Crystalline Silicon Photovoltaic Cells, Whether or Not Partially or Fully Assembled Into Other Products

Investigation No. TA-201-75 (Extension)

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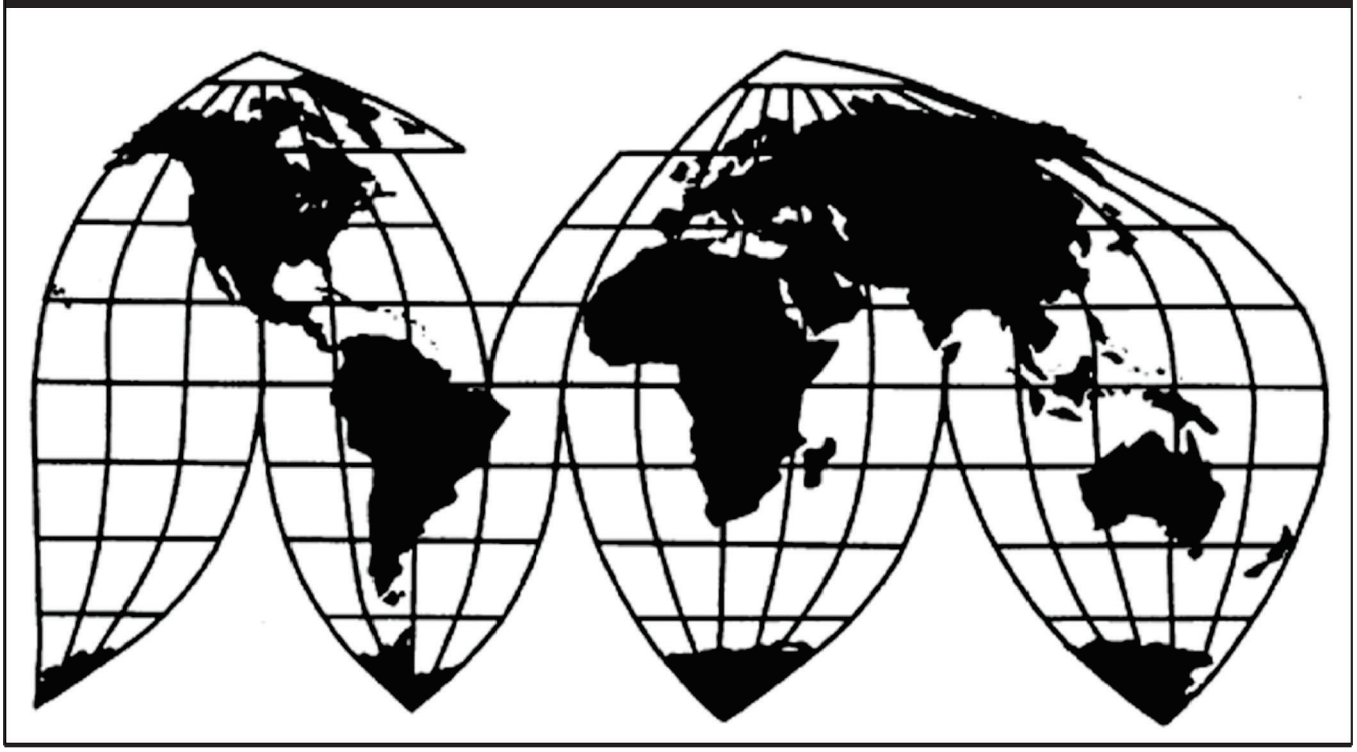
U.S. International Trade Commission



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UNITED STATES INTERNATIONAL TRADE COMMISSION

Investigation No. TA-201-075 (Extension)

Crystalline Silicon Photovoltaic Cells, Whether or Not Partially or Fully Assembled Into Other Products: Extension of Action

DETERMINATION

On the basis of the information in this investigation, the United States International Trade Commission ("Commission") determines, pursuant to section 204(c) of the Trade Act of 1974 ("the Act") (19 U.S.C. 2254(c)), that action under section 203 of the Act with respect to imports of crystalline silicon photovoltaic cells whether or not partially or fully assembled into other products ("CSPV products"), continues to be necessary to prevent or remedy serious injury and that there is evidence that the domestic industry is making a positive adjustment to import competition.

BACKGROUND

Following receipt of a petition filed on behalf of Auxin Solar Inc. and Suniva, Inc., on August 2, 2021, including an amendment thereto filed on August 5, 2021, and a petition filed on August 4, 2021, on behalf of Hanwha Q CELLS USA, Inc., LG Electronics USA, Inc., and Mission Solar Energy, the Commission, effective August 6, 2021, instituted investigation No. TA-201-075 (Extension) under section 204(c) of the Act to determine whether the action taken by the President under section 203 of the Act with respect to CSPV products continues to be necessary to prevent or remedy serious injury and whether there is evidence that the domestic industry is making a positive adjustment to import competition.

Notice of the institution of the Commission's investigation and of a public hearing to be held in connection therewith was given by posting copies of the notice in the Office of the Secretary, U.S. International Trade Commission, Washington, D.C., and by publishing notice in the Federal Register on August 12, 2021 (86 FR 44403). In light of the restrictions on access to the Commission building due to the COVID-19 pandemic, the Commission conducted its hearing by video conference on November 3, 2021. All persons who requested the opportunity were permitted to participate.

Views of the Commission

I. Summary of Determination and Recommendations

Pursuant to section 204(c) of the Trade Act of 1974 (Trade Act) (19 U.S.C. § 2254(c)), the Commission makes an affirmative determination in this investigation. Specifically, the Commission determines that action under section 203 of the Trade Act with respect to imports of crystalline silicon photovoltaic cells, whether or not partially or fully assembled into other products ("CSPV products"), continues to be necessary to prevent or remedy serious injury and that there is evidence that the domestic CSPV products industry is making a positive adjustment to import competition.

Having made an affirmative determination, the Commission recommends that the President take the following action –

(1) extend the action for an additional four years;

(2) maintain the tariff-rate quota ("TRQ") on imports of CSPV cells, with an in-quota volume level of 2.5 gigawatts ("GW"), with no safeguard duty on goods entered within the in-quota quantity, and with the rate of duty on over-quota imports decreasing by 0.25 percentage points beginning February 7, 2022, and continuing to decrease by 0.25 percentage points on February 7 of each of the three succeeding years of the measure;

(3) administer the annual quota on imports of CSPV cells on a quarterly basis; and

(4) maintain the duty on imports of CSPV modules, but with the rate of duty decreasing by 0.25 percentage points beginning on February 7, 2022, and continuing to decrease by 0.25 percentage points on February 7 of each of the three succeeding years of the measure.[1]

[1] Commissioner Johanson recommends limited phasing down of the *ad valorem* tariff rates of the extended measure, consisting of a reduction of one percentage point per year in the above-quota tariff rate for imports of CSPV cells and one percentage point per year in the tariff rate for imports of CSPV modules.

II. Background

A. The Commission's Extension Investigation

The Commission instituted this investigation on August 6, 2021,[2] following receipt of two petitions under section 204(c) of the Trade Act from domestic producers of CSPV products, one filed on August 2, 2021 by Auxin Solar, Inc. ("Auxin Solar") and Suniva, Inc. ("Suniva"), and the other on August 4, 2021 by Hanwha Q CELLS USA, Inc. ("Hanwha"), LG Electronics USA, Inc. ("LG"), and Mission Solar Energy ("Mission Solar").[3] Both petitioning groups requested that the Commission determine that there is evidence that the domestic industry is making a positive adjustment to import competition, and that action under section 203 of the Trade Act continues to be necessary to prevent or remedy serious injury to the domestic CSPV products industry.[4] Auxin Solar and Suniva requested that the Commission recommend that the President continue the safeguard measure on imports of CSPV cells and modules for up to four additional years, with only minimal liberalization of the additional rates of duty in the current safeguard measure applicable to CSPV modules and out-of-quota CSPV cells, and maintain the in-quota volume level for CSPV cells in the current safeguard measure.[5] Hanwha, LG, and Mission Solar requested that the Commission recommend extension of the safeguard measures for an additional four years, at the "highest possible duty rates" on imports of CSPV modules and out-of-quota CSPV cells, as follows: Year 1 of extension: tariff rate of 17 percent *ad*

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[2] *Crystalline Silicon Photovoltaic Cells, Whether Or Not Partially Or Fully Assembled Into Other Products: Extension of Action*, 86 Fed. Reg. 44403 (Aug. 12, 2021).

[3] Auxin Solar and Suniva filed an amendment to their petition on August 5, 2021.

[4] August 2, 2021 Petition of Auxin Solar and Suniva at 14; August 4, 2021 Petition of Hanwha, LG, and Mission Solar at 1.

[5] August 2, 2021 Petition of Auxin Solar and Suniva at 14.

valorem; Year 2 of extension: tariff rate of 16 percent *ad valorem*; Year 3 of extension: tariff rate of 15 percent *ad valorem*; Year 4 of extension: tariff rate of 14 percent *ad valorem.*[6] Hanwha, LG, and Mission Solar also requested that the Commission recommend increasing the TRQ in-quota volume level for imports of CSPV cells.[7]

The Commission held a public hearing virtually on November 3, 2021, and all persons who requested the opportunity were permitted to participate (virtually) in person or by counsel.[8] Suniva, Auxin Solar, Hanwha, Mission Solar, and LG appeared and supported an extension of relief. Appearing in opposition to extension of relief were the governments of Indonesia, the Socialist Republic of Vietnam, and Malaysia, as well as the Solar Energy Industries Association ("SEIA"), REC Americas LLC, NextEra Energy Inc. ("NextEra"), American Clean Power Association ("ACP"), Clearway Energy Group LLC, China Chamber of Commerce for Import and Export of Machinery and Electronic Products ("CCCME"), LONGi Green Energy Technology Co., Ltd.; Risen Energy Co., Ltd; and GCL System Integration Technology Co. Ltd. In addition, the government of Canada, Canadian Solar Solutions Inc. ("Canadian Solar"), Silfab Solar WA Inc., Silfab Solar USA Inc (collectively "Silfab"), Heliene USA Inc., and Heliene Inc. (collectively "Heliene") appeared at the hearing and argued that the Commission should

[6] August 4, 2021 Petition of Hanwha, LG, and Mission Solar at 14.

[7] August 4, 2021 Petition of Hanwha, LG, and Mission Solar at 15.

[8] In light of the restrictions on access to the Commission building due to the COVID-19 pandemic, the Commission conducted its hearing in this investigation through videoconference as set forth in procedures provided to the parties. *Crystalline Silicon Photovoltaic Cells, Whether or Not Partially or Fully Assembled Into Other Product: Extension of Action*, 86 Fed. Reg. 44403 (Aug. 12, 2021); October 27, 2021 letter regarding hearing procedures from Commission Secretary Barton to Counsel (EDIS Document ("Doc.") No. 755191).

recommend that imports of CSPV products from Canada be excluded from the safeguard measure, but took no position as to whether the measure should be extended.[9]

B. Current Status of CSPV Safeguard Measure

The safeguard action currently in effect is the result of a proclamation issued by the President on January 23, 2018, following a unanimous determination by the Commission under section 202(b) of the Trade Act that CSPV products were being imported into the United States in such increased quantities as to be a substantial cause of serious injury to the domestic industry.[10] In the proclamation, the President imposed a safeguard measure on imports of CSPV products, effective February 7, 2018, for a period of four years.[11] The measure imposed (1) a TRQ on imports of CSPV cells not partially or fully assembled into other products and (2) an increase in duties on imports of CSPV modules. The TRQ portion of the safeguard measure imposed additional tariffs on imports of CSPV cells in excess of 2.5 gigawatts annually of 30 percent *ad valorem* in the first year of the measure, 25 percent *ad valorem* in the second year,

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[9] *See, e.g.,* Revised and Corrected Hearing Transcript ("Hearing Tr.") (EDIS Doc. No. 75980) at 253, 274 (Stoel).

[10] *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products),* Inv. No. TA-201-75, USITC Pub. 4739, Vol. 1 at 1 (Nov. 2017) ("Original Safeguard Determination"); Confidential Views, *Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products)*, Inv. No. TA-201-075, EDIS Doc. No. 754890, Vol. I at 1 ("Confidential Original Safeguard Determination"). The Commission instituted the original safeguard investigation, effective May 17, 2017, in response to a petition, as amended and properly filed on May 17, 2017, by Suniva. On May 25, 2017, SolarWorld publicly stated its support for the petition as a co-petitioner. Original Safeguard Determination at 6; Confidential Original Safeguard Determination at 7.

[11] *To Facilitate Positive Adjustment to Competition From Imports of Certain Crystalline Silicon Photovoltaic Cells (Whether or Not Partially or Fully Assembled Into Other Products) and for Other Purposes,* Proclamation 9693, 83 Fed. Reg. 3541 (Jan. 25, 2018). The safeguard measure excludes imports from WTO Member developing countries (as long as imports from a developing country do not exceed 3 percent of total imports and imports from all developing countries with an import share of less than 3 percent do not collectively exceed 9 percent of total imports). *Id.*

20 percent *ad valorem* in the third year, and 15 percent *ad valorem* in the fourth year. The TRQ contained no individual country allocations, and the in-quota quantity reset annually. In the proclamation, the President also imposed additional tariffs on imports of CSPV modules of 30 percent *ad valorem* in the first year of the measure, 25 percent *ad valorem* in the second year, 20 percent *ad valorem* in the third year, and 15 percent *ad valorem* in the fourth year.[12]

Pursuant to authority delegated by the President, the U.S. Trade Representative ("USTR") determined on two occasions (September 2018 and June 2019) that certain CSPV products should be excluded from the safeguard measure.[13] The second of these determinations resulted in, *inter alia,* imports of bifacial modules being excluded from the measure on June 23, 2019.[14] In October 2019 and April 2020, USTR attempted to withdraw the exclusion on bifacial solar panels, but enforcement of these withdrawals was enjoined by the U.S. Court of International Trade ("CIT") following legal challenges from importers.[15] On

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[12] *To Facilitate Positive Adjustment to Competition From Imports of Certain Crystalline Silicon Photovoltaic Cells (Whether or Not Partially or Fully Assembled Into Other Products) and for Other Purposes,* Proclamation 9693, 83 Fed. Reg. 3541 (Jan. 25, 2018).

[13] *See Exclusion of Particular Products From the Solar Products Safeguard Measure*, 83 Fed. Reg. 47393 (USTR Sept. 19, 2018); *Exclusion of Particular Products From the Solar Products Safeguard Measure,* 84 Fed. Reg. 27684 (USTR June 13, 2019).

[14] *Exclusion of Particular Products From the Solar Products Safeguard Measure*, 84 Fed. Reg. 27684, 27685 (USTR June 13, 2019) (determination to grant exclusion for imports of bifacial solar panels).

[15] *Withdrawal of Bifacial Solar Panels Exclusion to the Solar Products Safeguard Measure,* 84 Fed. Reg. 54244 (USTR Oct. 9, 2019); *Determination on the Exclusion of Bifacial Solar Panels From the Safeguard Measure on Solar Products,* 85 Fed. Reg. 21497 (USTR Apr. 17, 2020); *Invenergy Renewables LLC v. United States,* 422 F. Supp. 3d 1255 (CIT 2019); *Invenergy Renewables LLC v. United States*, 476 F. Supp. 3d 1323 (CIT 2020); *see Invenergy Renewables LLC v. United States*, Slip Op. 21-155 (Ct. Int'l Trade Nov. 17, 2021).

October 10, 2020, following receipt of the Commission's monitoring and modification reports,[16] the President issued a proclamation (effective October 25, 2020) revoking the exclusion of imports of bifacial panels from the safeguard measure and re-imposing the safeguard tariff on such imports, and adjusting the duty rate of the safeguard tariff on imports of CSPV modules and out-of-quota CSPV cells for the fourth year of the measure from 15 percent *ad valorem* to 18 percent *ad valorem*.[17]

On November 16, 2021, the CIT issued a decision and order enjoining enforcement of the October 10, 2020 proclamation modifying the safeguard measure on CSPV products.[18] As the immediately effective result of the CIT's ruling, imports of bifacial modules again became excluded from the safeguard measure, and the duty rate on imports of CSPV modules and out-of-quota CSPV cells in the fourth year of the measure was reduced from 18 percent *ad valorem* back down to 15 percent *ad valorem*.

C. WTO Dispute Settlement Proceedings

On August 14, 2018, China requested consultations with the United States pursuant to the World Trade Organization ("WTO") dispute settlement understanding concerning imposition of the U.S. safeguard measure on imports of CSPV products.[19] China asserted that

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[16] *Crystalline Silicon Photovoltaic Cells, Whether or Not Partially or Fully Assembled Into Other Products: Monitoring Developments in the Domestic Industry*, Inv. No. 201-TA-075 (Monitoring), USITC Pub. 5021 (Feb. 2020); *Crystalline Silicon Photovoltaic Cells, Whether or Not Partially or Fully Assembled Into Other Products: Advice on the Probable Economic Effect of Certain Modifications to the Safeguard Measure*, Inv. No. 201-TA-075 (Modification), USITC Pub. 5032 (March 2020).

[17] *To Further Facilitate Positive Adjustment to Competition From Imports of Certain Crystalline Silicon Photovoltaic Cells (Whether or Not Partially or Fully Assembled Into Other Products),* Proclamation 10101, 85 Fed. Reg. 65639 (Oct. 16, 2020).

[18] *Solar Energy Industries Association v. United States*, Slip Op. 21-154 (Ct. Int'l Trade Nov. 16, 2021).

[19] WT/DS562/1: *United States – Safeguard Measure on Imports of Crystalline Silicon Photovoltaic Products*, Request for Consultations by China (16 August 2018).

the measure was inconsistent with certain provisions of the Agreement on Safeguards and the GATT 1994.[20] On July 11, 2019, China requested the establishment of a panel, and the WTO Dispute Settlement Body established a panel at its meeting on August 15, 2019.[21] On September 2, 2021, the WTO panel circulated its final report in this dispute, rejecting China's claims and upholding the Commission's serious injury determination in its safeguard investigation of imports of CSPV products.[22] The WTO Dispute Settlement Body has not adopted the Panel's report, however, because China appealed the Panel's findings to the WTO Appellate Body.[23]

D. Safeguard Monitoring and Modification Proceedings

As required by section 204(a)(1) of the Trade Act, the Commission has monitored developments with respect to the domestic industry since the action first took effect. As part of this effort, the Commission monitored the progress and specific efforts made by workers and firms in the domestic industry to make a positive adjustment to import competition. As required by section 204(a)(2) of the Trade Act, the Commission completed a mid-term review of the safeguard measure on CSPV products and, in February 2020, issued a report on the results

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[20] WT/DS562/1: *United States – Safeguard Measure on Imports of Crystalline Silicon Photovoltaic Products,* Request for Consultations by China (16 August 2018).

[21] WT/DS562/8: *United States – Safeguard Measure on Imports of Crystalline Silicon Photovoltaic Products*, Request for the Establishment of a Panel by China (12 July 2019).

[22] WT/DS562/R: U*nited States – Safeguard Measure on Imports of Crystalline Silicon Photovoltaic Products*, Report of the Panel (2 September 2021).

[23] China notified the WTO Dispute Settlement Body on September 16, 2021 that it intends to appeal to the WTO Appellate Body certain issues in the panel report, while noting that there is currently no division of the Appellate Body that can be established to hear the appeal. WT/DS562/12: *United States – Safeguard Measure on Imports of Crystalline Silicon Photovoltaic Products* (20 September 2021).

of its monitoring of developments in the domestic industry producing CSPV products.[24] In March 2020, in response to a request by the USTR, the Commission completed a report providing advice regarding the probable economic effect on the domestic CSPV industry of certain modifications to the safeguard measure on CSPV products.[25]

E. Antidumping and Countervailing Duty Orders

In addition to the safeguard measure, imports of CSPV products from China and Taiwan are subject to U.S. antidumping duty and/or countervailing duty orders. The U.S. Department of Commerce ("Commerce") issued antidumping and countervailing duty orders on imports of CSPV cells and certain CSPV modules from China effective December 7, 2012.[26] Commerce issued a continuation of these antidumping and countervailing duty orders on imports of CSPV cells and modules from China, effective March 20, 2019.[27]

Effective February 18, 2015, Commerce also issued antidumping and countervailing duty orders on certain other imports of CSPV modules from China and an antidumping duty order on

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[24] *Crystalline Silicon Photovoltaic Cells, Whether or Not Partially or Fully Assembled Into Other Products: Monitoring Developments in the Domestic Industry*, Inv. No. 201-TA-075 (Monitoring), USITC Pub. 5021 (Feb. 2020) ("Commission Monitoring Report").

[25] *Crystalline Silicon Photovoltaic Cells, Whether or Not Partially or Fully Assembled Into Other Products: Advice on the Probable Economic Effect of Certain Modifications to the Safeguard Measure*, Inv. No. 201-TA-075 (Modification), USITC Pub. 5032 (March 2020) ("Commission Modification Report").

[26] Confidential Report ("CR") at I-4 to I-5; Public Report ("PR") at I-4 to I-5; 77 Fed. Reg. 73017 (Dec. 7, 2012); 77 Fed. Reg. 73018 (Dec. 7, 2012). Commerce determined that the country of origin of CSPV modules subject to the orders was the country of manufacture of the CSPV cells, including CSPV modules assembled outside of China using CSPV cells manufactured in China, but not including CSPV modules assembled in China from CSPV cells made in a county other than China. *Id.*

[27] CR/PR at I-5; 84 Fed. Reg. 10299 (Mar. 20, 2019); 84 Fed. Reg. 10300 (Mar. 20, 2019). Commerce issued the continuation of the orders following a determination by the Commission on March 1, 2019 that revocation of the orders would be likely to lead to continuation or recurrence of material injury to an industry in the United States with a reasonably foreseeable time. 84 Fed. Reg. 8342 (Mar. 7, 2019).

imports of certain CSPV cells and modules from Taiwan.[28] Commerce issued a continuation of these antidumping and countervailing duty orders on imports of CSPV cells and modules from China, and of the antidumping duty order on imports of CSPV cells and modules from Taiwan, effective September 11, 2020.[29]

Furthermore, imports of CSPV cells and modules from China, as well as imports from China of various components used in CSPV module production (*e.g.,* ethylene vinyl acetate encapsulants, tempered glass, and backsheets), are subject to an additional 25-percent *ad valorem* duty under section 301 of the Trade Act of 1974.[30] Certain aluminum inputs into CSPV module production are also subject to an additional 10-percent *ad valorem* duty under section 232 of the Trade Expansion Act of 1962.[31]

III. The Nature of the Determination Required

Section 204(c)(1) of the Trade Act requires the Commission, upon the request of the President or the concerned industry, to "investigate to determine" –

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[28] CR/PR at I-5 to I-6; 80 Fed. Reg. 8592 (Feb. 18, 2015) (China); 80 Fed. Reg. 8596 (Feb.18, 2015) (Taiwan). In its final determinations, Commerce defined the merchandise from China subject to these orders to include U.S. imports of the following: (1) CSPV modules assembled in China from CSPV cells made in Taiwan and (2) CSPV modules assembled in China from CSPV cells made in third countries. Commerce defined the merchandise from Taiwan subject to the antidumping duty order to include U.S. imports of: (1) CSPV cells made in Taiwan; (2) CSPV modules assembled in Taiwan from CSPV cells made in Taiwan; and (3) CSPV modules assembled in third countries other than China from CSPV cells made in Taiwan. *Id.*

[29] CR/PR at I-7; 85 Fed. Reg. 56215 (Sept. 11, 2020). Commerce issued the continuation of the orders following a determination by the Commission on August 31, 2020 that revocation of the orders would be likely to lead to continuation or recurrence of material injury to an industry in the United States within a reasonably foreseeable time. 85 Fed. Reg. 55319 (Sept. 4, 2020).

[30] CR/PR at I-9. Certain small and low-wattage products are exempt from the section 301 duties, as are certain types of tempered glass used in CSPV module production. *Id.* at I-9 to I-10, Table I-4.

[31] CR/PR at I-8 to I-9. Aluminum is used as an input in CSPV module production. In addition, both steel and aluminum are used in balance of systems components (such as tracking systems on which modules are mounted) for solar installations. *Id.* at I-7 to I-9.

> whether action under {section 203 of the Trade Act} continues to be necessary to prevent or remedy serious injury and whether there is evidence that the industry is making a positive adjustment to import competition.[32]

Neither the statute nor the legislative history of the Uruguay Round Agreements Act ("URAA") further describes the nature of the determination the Commission must make under section 204(c), or sets out factors to be considered in making that determination.[33]

However, the term "positive adjustment" is defined in section 201(b) of the Trade Act. A positive adjustment to import competition is considered to have occurred when –

> (A) the domestic industry –
> (i) is able to compete successfully with imports after actions taken under {section 204 of the Trade Act} terminate, or
> (ii) the domestic industry experiences an orderly transfer of resources to other productive pursuits; and
> (B) dislocated workers in the industry experience an orderly transition to productive pursuits.[34]

The statute further provides that the domestic industry may be considered to have made a positive adjustment "even though the industry is not of the same size and composition" as the industry at the time the investigation was instituted under section 202(b).[35]

IV. Basis for Affirmative Determination

In making its affirmative determination, the Commission considered import volumes and prices under the remedy action, the domestic industry's performance during the remedy

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[32] 19 U.S.C. § 2254(c)(1).

[33] *See* Statement of Administrative Action for the URAA, H.R. Rep. No. 103-316, vol. I at 293 (1994) ("SAA"). This investigation marks the third time the Commission has been requested to make a determination under section 204(c) of the Trade Act of 1974. 19 U.S.C. § 2254(c). The Commission's prior determinations under section 204(c) of the Trade Act were in *Wheat Gluten* and *Large Residential Washers*. *See Wheat Gluten: Extension of Action*, Inv. No. TA-204-4, USITC Pub. 3407 (Apr. 2001); *Large Residential Washers: Extension of Action*, Inv. No. TA-201-076 (Extension), USITC Pub. 5144 (Dec. 2020).

[34] 19 U.S.C. § 2251(b)(1).

[35] 19 U.S.C. § 2251(b)(2).

period beginning on February 7, 2018, foreign industry developments, and evidence concerning the extent to which the industry has been able to make a positive adjustment to import competition. The Commission also considered the basis for its affirmative serious injury determination in 2017, the commitments submitted by domestic producers that year, and the Commission's report on the results of its monitoring of developments in the domestic industry producing CSPV products, as well as the Commission's report containing advice on the probable economic effect of certain modifications to the safeguard measure. Based on all the evidence on the record of this investigation, we find that that there is evidence that the domestic industry is making a positive adjustment to import competition, and that the safeguard measure on imports of CSPV products continues to be necessary to prevent or remedy serious injury.

A. Product Description

CSPV cells use crystalline silicon to convert sunlight to electricity and are the basic elements of CSPV modules (also commonly referred to as panels). The two main types of CSPV cells are monocrystalline and multicrystalline (or polycrystalline) silicon. In addition, CSPV cells can be either monofacial or bifacial. Bifacial CSPV cells convert light that hits both the front and back of the CSPV cell into electricity.[36] CSPV laminates consist of CSPV cells that are connected, encapsulated, and covered with a glass front layer and a back sheet or rear glass. CSPV laminates can use full cells or cells cut in smaller pieces, such as half-cut cells, whereby a standard 60-cell CSPV module would instead have 120 half cells.[37]

[36] CR/PR at I-57 to I-60.
[37] CR/PR at I-61.

CSPV modules typically consist of the laminate that is usually framed in aluminum and then attached to one or more junction boxes. CSPV modules can be used in both ground-mounted and rooftop-mounted systems and in both the off-grid market segment and the three on-grid market segments—residential, nonresidential, and utility. The most common on-grid CSPV modules have 60 cells (or 120 half-cut cells) or 72 cells (or 144 half-cut cells). Off-grid applications of CSPV modules include power generation in remote locations, mobile power solutions, telecommunications power and lighting systems, and portable consumer goods.[38]

B. The Commission's Original Serious Injury Determination

In the original investigation in 2017, the Commission determined that CSPV products were being imported in such increased quantities as to be a substantial cause of serious injury to the domestic CSPV products industry.[39] The Commission defined a single domestic like product corresponding to the imported products within the scope of the investigation consisting of all forms of CSPV cells, whether or not partially or fully assembled into other products. The Commission found that CSPV modules are not "like" CSPV cells, but found that the facts in the investigation indicated that they are "directly competitive" within the meaning of the statute and that there are no clear lines differentiating them.[40] The Commission defined the domestic industry as all U.S. producers of CSPV cells (whether or not partially or fully

[38] CR/PR at I-65.

[39] Original Safeguard Determination, USITC Pub. 4739 at 1; Confidential Original Safeguard Determination at 1.

[40] Original Safeguard Determination, USITC Pub. 4739 at 13-16; Confidential Original Safeguard Determination at 15-20. The Commission noted that the petitioners had advocated this definition, while no party in its comments on the draft questionnaires asked the Commission to collect data pursuant to any alternative definition of the domestic like product. Original Safeguard Determination, USITC Pub. 4739 at 16 n.61; Confidential Original Safeguard Determination at 20 n.61.

assembled into other products), including integrated producers of CSPV cells and modules, and independent module producers.[41]

The Commission found that imports of CSPV products increased by 492.4 percent between 2012 and 2016, and increased each year, from 2.1 million kW in 2012 to 3.1 million kW in 2013, 4.6 million kW in 2014, 8.4 million kW in 2015, and 12.8 million kW in 2016. The Commission further found that imports as a ratio to domestic production increased overall and in each year, from 733.9 percent in 2012 to 948.4 percent in 2013, 1,141.0 percent in 2014, 1,593.5 percent in 2015, and 2,276.2 percent in 2016. Consequently, the Commission found that imports of CSPV products increased both actually and relative to domestic production.[42]

The Commission found that the domestic industry was seriously injured. It found a significant idling of domestic productive facilities for CSPV products between 2012 and 2016 and significant unemployment and underemployment within the domestic industry. It found that a significant number of firms were unable to carry out domestic production operations at a reasonable level of profit, and that a significant number of domestic producers were unable to generate adequate capital to finance the modernization of their domestic plants and equipment or to maintain existing levels of expenditures for research and development. The Commission noted that the domestic industry's sales and market share declined significantly, and that inventories were high and growing during this period of adverse price conditions. The

[41] Original Safeguard Determination, USITC Pub. 4739 at 16-18; Confidential Original Safeguard Determination at 20-22. In our analysis in this extension investigation, we continue to define the domestic like product and the domestic industry in the same way that the Commission defined them in the original safeguard investigation.

[42] Original Safeguard Determination, USITC Pub. 4739 at 19-22; Confidential Original Safeguard Determination at 24-27.

Commission observed that the domestic industry's performance indicators particularly declined between 2015 and 2016 and continued to deteriorate into 2017 despite explosive demand growth. Based on this evidence and the status of the U.S. market as a focal point for exports, the Commission found a significant overall impairment in the domestic industry's position and consequently found that the domestic industry was seriously injured.[43]

The Commission found that increased imports were a substantial cause of serious injury to the domestic industry. It found that during a period of substantial and growing volumes of low-priced imports, prices of imported CSPV products declined by 45.7 to 51.0 percent and prices of U.S.-manufactured products declined by 48.5 to 73.2 percent between January 2012 and December 2016. The domestic industry reported reducing prices and/or rolling back announced price increases to compete with imported CSPV products, and its prices fell steadily as imports from additional sources entered the U.S. market at high volumes.[44]

Accordingly, the Commission found that the domestic industry's financial condition was poor and deteriorating in 2016, as imports peaked in volume and market share. Domestic producers were thus unable to generate adequate capital for investments and research and development, which impaired the domestic industry's ability to develop new products in this highly capital-intensive and technologically sophisticated market. Additionally, the domestic industry's capacity utilization levels remained low and declining as imports reached their peak during the original safeguard investigation, and a substantial number of domestic CSPV cell and

[43] Original Safeguard Determination, USITC Pub. 4739 at 43; Confidential Original Safeguard Determination at 59-60.

[44] Original Safeguard Determination, USITC Pub. 4739 at 43-46; Confidential Original Safeguard Determination at 60-64.

CSPV module facilities closed. Thus, the domestic industry was unable to take advantage of a market in which apparent U.S. consumption increased nearly five-fold in five years, while imports increased their share of apparent U.S. consumption from *** percent in 2012 to *** percent in 2016. Consequently, the Commission found that increased imports were a substantial cause of serious injury to the domestic industry manufacturing CSPV products based on a "clear causal link between them."[45]

The Commission also addressed arguments by respondents that causes other than imports -- alleged "missteps" by the domestic industry, and non-import pricing pressures that led to declines in domestic prices -- were more important and explained any injury to the domestic industry. The Commission found that the record did not support respondents' contentions that the domestic industry was unable to provide quality products, failed to serve certain segments of the market, or suffered widespread delivery and service issues. Respondents also argued that factors other than imports, such as declining government incentive programs, declining polysilicon raw material costs, and the need to meet grid parity with other sources of electricity, explained any declines in prices of CSPV products and the condition of the domestic industry. The Commission concluded that these asserted alternative causes did not explain domestic price declines and could not individually or collectively explain the serious injury to the domestic industry, particularly the declining market share, low capacity-utilization levels, facility closures, and abysmal financial performance. Accordingly, the

[45] Original Safeguard Determination, USITC Pub. 4739 at 47-50; Confidential Original Safeguard Determination at 65-69.

Commission found that increased imports were a substantial cause of serious injury to the domestic industry manufacturing CSPV products that was not less than any other cause.[46]

The facts and analysis from the original investigation form the background for our consideration of the current petitions for the extension of relief.

C. Domestic Producers' 2017 Commitments

In the original safeguard investigation in 2017, the Commission did not receive any adjustment plans within the 120-day time frame specified in section 202(a)(4) of the Trade Act.[47] However, each of the two petitioners submitted commitments regarding actions it intended to take to facilitate positive adjustment to import competition. SolarWorld America, Inc. ("SolarWorld") included company-specific commitments in its posthearing remedy brief,[48] while Suniva submitted a "prospective forward-action plan," indicating that the plan depended on a successful agreement of a reorganization plan in its Chapter 11 bankruptcy proceeding.[49]

In April 2017, Suniva filed for bankruptcy protection and ceased production of CSPV cells and modules. Suniva completed a reorganization and exited bankruptcy with a court-approved restructuring plan in April 2019. While Suniva retains its CSPV cell production facility and equipment in Norcross, Georgia, as of November 2021 it has not resumed production of CSPV products.[50] As discussed below, however, Suniva's ability to make additional progress on its

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[46] Original Safeguard Determination, USITC Pub. 4739 at 50-65; Confidential Original Safeguard Determination at 69-90.

[47] Original Safeguard Determination, USITC Pub. 4739 at 93 (Views on Remedy of Commissioners Johanson and Williamson); Confidential Original Safeguard Determination at 131.

[48] *See* CR/PR at VIII-1 to VIII-7.

[49] Original Safeguard Determination, USITC Pub. 4739 at 93-94 (Views on Remedy of Commissioners Johanson and Williamson); Confidential Original Safeguard Determination at 132.

[50] CR/PR at III-4 to III-5.

action plan was hindered significantly by the lack of effective relief afforded to CSPV cells under the safeguard measure.

From 2010 to 2018, SolarWorld had an integrated plant in Hillsboro, Oregon producing both CSPV cells and modules. In 2018, SunPower Corporation acquired SolarWorld's Hillsboro plant, and subsequently retired the CSPV cell production line at Hillsboro, while continuing production of CSPV modules. In 2021, Convalt Energy purchased the CSPV module production equipment at the Hillsboro facility from SunPower and shipped the equipment to a plant that Convalt intends to open in New York State.[51] Thus, SolarWorld is no longer a producer of CSPV cells or modules. As discussed below, however, there have been significant investments as well as new entrants in CSPV module production in the United States.

[51] CR/PR at Table III-5 to III-6.

D. Evidence that the Industry Is Making a Positive Adjustment to Import Competition

We find that there is evidence that the domestic CSPV products industry is making a positive adjustment to import competition. In making this determination, we again note that the operative statute provides that the domestic industry may be considered to have made a positive adjustment "even though the industry is not of the same size and composition" as the industry at the time the investigation was instituted under section 202(b).[52]

The domestic industry's CSPV module capacity, production, and capacity utilization all increased substantially during the remedy period. The domestic industry's CSPV module capacity more than tripled between 2018 and 2020, increasing by 241.6 percent. CSPV module capacity increased from 1.1 million kilowatts ("kW") in 2018 to 3.7 million kW in 2019 and 3.8 million kW in 2020; it was 1.9 million kW in January-June ("interim") 2020 and 1.8 million kW in interim 2021.[53] The industry's CSPV module production was over four times as high in 2020 as it was in 2018, increasing by 371.8 percent. CSPV module production increased from 469,829 kW in 2018 to 2.1 million kW in 2019 and 2.2 million kW in 2020; it was 1.2 million kW in interim 2020 and 1.1 million kW in interim 2021.[54] These capacity and production increases were accompanied by an increase in capacity utilization. The industry's CSPV module capacity utilization increased by 16.0 percentage points between 2018 and 2020. Capacity utilization increased from 41.9 percent in 2018 to 56.1 percent in 2019 and 57.9 percent in 2020; it was 61.1 percent in interim 2020 and 63.2 percent in interim 2021.[55]

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[52] *See* 19 U.S.C. § 2251(b)(2).
[53] CR/PR at Tables III-4, C-2. One million kW is the equivalent of 1 GW.
[54] CR/PR at Tables III-4, C-2.
[55] CR/PR at Tables III-4, C-2.

The principal contributors to the large increase in the industry's CSPV module capacity were the opening of new CSPV module plants by Hanwha, LG, and Jinko Solar (U.S.) Industries Inc. ("Jinko").[56] Hanwha began production at its $157 million CSPV module assembly plant in Dalton, Georgia in February 2019; the plant had an announced annual module production capacity of 1.7 GW.[57] LG began commercial production of CSPV modules at its new $*** Huntsville facility in February 2019, with an announced annual module production capacity of 500 megawatts ("MW").[58] Jinko began commercial production of CSPV modules at its $50.5 million facility in Jacksonville, Florida in early 2019; the plant has an announced module production capacity of 400 MW.[59] In addition, several domestic producers reported expansions of their CSPV module facilities, including Mission Solar, Silfab, Heliene, and ***.[60]

The domestic industry's employment indicators for production of CSPV modules, including employment, hours worked, wages paid, and productivity, all increased during the remedy period.[61] Employment for production of CSPV modules increased from 1,097 production and related workers (PRWs) in 2018 to 2,644 PRWs in 2019 and then declined to 2,583 PRWs in 2020; employment was 2,489 PRWs in interim 2020, and 2,305 PRWs in interim

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[56] CR/PR at III-15.

[57] CR/PR at III-2; Hearing Tr. at 63 (Munro). A representative of Hanwha testified at the Commission hearing that the capacity of the Dalton facility has increased from 1.7 GW to 1.9 GW. Hearing Tr. at 173 (Moskowitz).

[58] CR/PR at III-3, Table III-1; Hearing Tr. at 55 (Lynch). One thousand kW is the equivalent of 1 MW.

[59] CR/PR at III-3.

[60] CR/PR at III-15, Table III-1; Hearing Tr. at 59-60 (Mutchler, Mission Solar); 234-235 Maccario, SIlfab); 235-236 (Pochtaruk, Heliene). In addition to the module capacity already added since 2018, several other firms have taken concrete actions to prepare to commence production of modules in 2021 or 2022. CR/PR at Table I-11.

[61] CR/PR at Table III-17.

2021.[62] The domestic industry's overall employment (including employment for production of both CSPV cells and modules) increased from *** PRWs in 2018 to *** PRWs on 2019, and then fell to *** PRWs in 2020; overall employment was *** PRWs in interim 2020 and lower, at *** PRWs, in interim 2021.[63]

The domestic industry's U.S. shipments of CSPV modules also increased substantially during the remedy period, while its market share for CSPV modules increased somewhat. U.S. producers' U.S. shipments of CSPV modules rose by 369.2 percent from 2018 to 2020, increasing from 456,839 kW in 2018 to 1.9 million kW in 2019 and 2.1 million kW in 2020; they were 1.1 million kW in both interim 2020 and interim 2021.[64] The domestic industry's share of apparent U.S. consumption of CSPV modules increased overall by 1.7 percentage points between 2018 and 2020, rising from 8.5 percent in 2018 to 14.2 percent in 2019, before declining to 10.2 percent in 2020; it was 10.3 percent in interim 2020 and 9.6 percent in interim 2021.[65]

[62] CR/PR at Table III-17. Hanwha representatives testified that it has employed over 700 people at its Dalton, Georgia plant since May 2019. Hearing Tr. at 62 (Nash), 62-63 (Munro)

[63] CR/PR at Table III-18.

[64] CR/PR at Tables III-9, C-2.

[65] CR/PR at Tables V-21, C-2.

As with the period the Commission examined during the 2017 investigation, the domestic industry continued to ship CSPV modules to all segments of the U.S. market.[66] Contrary to respondents' assertions that domestic producers largely ignore the utility segment of the market,[67] domestic producers' shipments to the utility segment increased in recent years and account for an increasing share of the domestic industry's total shipments. In 2020, *** percent of the industry's shipments of CSPV modules went to the utility segment, *** percent to the residential segment, *** percent to the commercial segment, and *** percent to distributors.[68] The share of the industry's shipments of CSPV modules going to the utility segment increased from *** percent in 2018 to *** percent in 2019 and *** percent in 2020; it was *** percent in interim 2020, and higher, at *** percent, in interim 2021.[69] As a result of this increase, a plurality of the domestic industry's reported shipments of CSPV modules went to the utility segment in 2020 and interim 2021.[70]

In addition to increasing production, U.S. shipments, and employment since imposition of the safeguard measure, domestic producers of CSPV modules have made substantial efforts to produce new and improved products, such as adapting production lines to be compatible with larger wafer sizes by using higher cell form factors to produce CSPV modules,[71] using

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[66] Original Safeguard Determination, USITC Pub. 4739 at 28, 58-59; Confidential Original Safeguard Determination at 36, 80-81; CR/PR at Table II-1.

[67] SEIA's Prehearing Brief at 12-28; ACP's Prehearing Brief at 17-19; NextEra's Prehearing Brief at 6-9; SEIA's Posthearing Brief, Appendix A, Response to Commission Questions, at 42-44.

[68] CR/PR at Table II-1.

[69] CR/PR at Table II-1.

[70] CR/PR at II-2, Table II-1.

[71] *See* CR/PR at Table III-8; Joint Prehearing Brief of Hanwha, LG, and Mission Solar at 36 (identifying domestic producers making such efforts).

advanced cell technologies such as mono PERC cells and n-type cells,[72] and increasing production of bifacial modules.[73]

The domestic industry has made less progress with respect to production and shipments of CSPV cells than with respect to production and shipments of CSPV modules. Several CSPV cell production facilities closed.[74] While three domestic firms reported usable capacity and production data for CSPV cells during the remedy period, by 2020 only one domestic firm *** reported production of CSPV cells. But after the closing of *** cell production facilities in June 2020, reported domestic CSPV cell capacity and production in January-June 2021 were zero.[75]

[72] *See* CR/PR at Table III-7; Joint Prehearing Brief of Hanwha, LG, and Mission Solar at 36-37 (identifying domestic producers using advanced cell technologies).

[73] The domestic industry's production of CSPV modules using bifacial cells increased from *** kW in 2018 to *** kW in 2019 and *** kW in 2020; it was *** kW in interim 2020 and higher, at *** kW, in interim 2021. CR/PR at Table III-6; *see* Joint Prehearing Brief of Hanwha, LG, and Mission Solar at 37 (identifying domestic producers making bifacial modules).

[74] Publicly available information indicates the closing of CSPV cell production facilities during the remedy period by Panasonic, SunPower (the former SolarWorld plant), and Yingli. CR/PR at Table I-8.

[75] CR/PR at III-11 to III-12.

Thus, unlike the increases for domestic CSPV modules, the domestic industry's CSPV cell capacity, production, capacity utilization, U.S. shipments, and market share all declined between 2018 and 2020. Cell capacity declined from *** kW in 2018 to *** kW in 2019 and then increased to *** kW in 2020; it was *** kW in interim 2020 and *** kW in interim 2021.[76] The industry's CSPV cell production fell from *** kW in 2018 to *** kW in 2019 and *** kW in 2020; it was *** kW in interim 2020 and *** in interim 2021.[77] The industry's CSPV cell capacity utilization increased from *** percent in 2018 to *** percent in 2019, and then declined to *** percent in 2020; it was *** percent in interim 2020.[78] U.S. producers' U.S. shipments of CSPV cells declined from *** kW in 2018 to *** kW in 2019 and *** kW in 2020; they were *** kW in interim 2020 and interim 2021.[79] The domestic industry's share of apparent U.S. consumption of CSPV cells fell from *** percent in 2018 to *** percent in 2019, and was *** in 2020, interim 2020, and interim 2021.[80] The domestic industry's employment for production of CSPV cells declined from *** PRWs in 2018 to *** PRWs in 2019 and 2020; it was *** PRWs in interim 2020, and lower, at *** PRWs, in interim 2021.[81]

[76] CR/PR at Tables III-2, C-1.
[77] CR/PR at Tables III-2, C-1.
[78] CR/PR at Tables III-2, C-1.
[79] CR/PR at Tables III-11, C-1.
[80] CR/PR at Tables V-19, C-1.
[81] CR/PR at Table III-16.

Nonetheless, we find evidence of positive adjustment by the domestic industry with respect to U.S. CSPV cell production. Suniva emerged from bankruptcy in 2019, and reports that it has made investments of over $*** to reorganize the company and of $*** to keep its factory ready to upgrade and restart production at short notice, actions that it attributes to the existing safeguard relief.[82] Suniva states that its new owner *** that would permit it to resume production before the end of 2022, ***, if the safeguard relief is extended.[83] In addition, Auxin Solar reported that it ***.[84] Moreover, ***.[85] Several other firms (Maxeon Solar, Ubiquity Solar, and Violet Power) have publicly indicated plans to open new U.S. plants to produce CSPV cells.[86]

[82] Suniva's Posthearing Brief, Response to Commission Questions, at 1-2.

[83] CR/PR at III-4 to III-5; Hearing Tr. at 42-44, 81, 103-104, 143 (Card); Suniva's Posthearing Brief, Response to Commission Questions, at 1-4 and Exh.1 (Affidavit of Cristiano Amoruso).

[84] CR/PR at III-2. Auxin Solar asserts that ***. *Id*.

[85] Joint Prehearing Brief of Heliene, Silfab, and Canadian Solar at 23 and Exh. *** at Paragraph *** (Declaration of ***); Commission staff notes of virtual plant tour of ***, at 9 (EDIS Doc. No. 756120).

[86] CR/PR at I-24 to I-25; Table I-8.

The petitioning firms cited a number of factors that have impaired the effectiveness of the safeguard remedy and the domestic industry's ability to make a positive adjustment to import competition, some of which the Commission had described in its February 2020 Monitoring Report.[87] Hanwha, LG, and Mission Solar described four such factors: the exclusion of imports of bifacial modules from the measure between June 2019 and October 2020; stockpiling of imports prior to the implementation of the safeguard measure in February 2018, and further stockpiling in 2019 and 2020 to take advantage of investment tax credit incentives; the COVID-19 pandemic, which affected demand in the residential and commercial CSPV markets and caused some factory shutdowns and supply-chain issues; and high input costs for module producers, due to various duties (section 301, section 232, and antidumping and countervailing duties) on U.S. imports of certain module components made in China, as well as fluctuating raw material prices, partly due to power curtailments and energy shortages in China.[88] Suniva and Auxin Solar likewise cited the bifacial exclusion, stockpiling of imports, and the COVID-19 pandemic as factors impeding the domestic industry's positive adjustment to import competition.[89] In addition, they further asserted that the remedy has been undermined by the persistent underselling by imports of CSPV products and by circumvention of the measure.[90] Suniva also argued that the size (2.5 GW) of the TRQ on imports of CSPV cells was

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[87] Commission Monitoring Report, USITC Pub. 5021 at 7.

[88] Joint Prehearing Brief of Hanwha, LG, and Mission Solar at 48-63.

[89] *See, e.g.*, Auxin Solar's Prehearing Brief at 27-35; Suniva's Prehearing Brief at 23-30. Suniva reported that ***. CR/PR at III-10, Table III-1.

[90] Suniva and Auxin Solar contend that imports from certain developing countries that are currently excluded from the safeguard measure under Presidential Proclamation 9693, particularly Cambodia, have increased during the remedy period, and argue that this increase reflects Chinese investment and support in developing Cambodia's CSPV products industry in an effort to circumvent the safeguard remedy. Suniva's Prehearing Brief at 27-28; Auxin Solar's Prehearing Brief at 35-38; Hearing Tr. at 165-166 (Beline).

"excessive" and "eviscerated" the remedy for producers of CSPV cells, given that the quota has not been filled thus far and tariffs have not been collected on any imports of CSPV cells under the safeguard measure.[91] [92]

[91] Suniva's Prehearing Brief at 21-23; see Auxin Solar's Prehearing Brief at 40.

[92] The Commission's February 2020 Monitoring Report contained a similar list of factors that some U.S. producers had argued were hindering their adjustment efforts. That pre-pandemic list did not include the COVID-19 pandemic, but also included exporter tariff cost absorption. Commission Monitoring Report, USITC Pub. 5021 at 7.

In the Commission's March 2020 Modification Report, it analyzed some of the effects that the exclusion of imports of bifacial modules from the measure would have if it remained in place. The Commission found that bifacial modules can substitute for monofacial products in all market segments, and can be produced at virtually the same cost as monofacial modules. The Commission further found that lower-priced bifacial modules would likely reduce demand for and production of U.S. modules, and that imports of bifacial modules exempt from the safeguard tariffs would "put significant price pressure on U.S. module producers," and would likely "drive down U.S. market prices for modules."[93] These findings remain relevant to our analysis in this extension investigation. Given the substitutability between monofacial and bifacial modules, the small but increasing domestic production of bifacial modules at the time the bifacial exclusion went into effect,[94] and the huge volume of imports of bifacial modules that entered free of tariffs between June 2019 and October 2020,[95] the record indicates that the bifacial exclusion was an impediment to the domestic industry's positive adjustment to import competition during the remedy period.[96]

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[93] Commission Modification Report, USITC Pub. 5032 at III-4 to III-5.

[94] The domestic industry's production of CSPV modules using bifacial cells increased from *** kW in 2018 to *** kW in 2019 and *** kW in 2020. CR/PR at Table III-6.

[95] Imports of CSPV products using bifacial cells increased from *** kW in 2018 to *** kW in 2019 and *** kW in 2020. CR/PR at Tables V-9, V-10.

[96] In the proclamation announcing the revocation of the bifacial exclusion, the President determined that "the exclusion of bifacial panels from application of the safeguard measure has impaired and is likely to continue to impair the effectiveness" of the safeguard action, citing the findings of the Commission Modification Report. *To Further Facilitate Positive Adjustment to Competition From Imports of Certain Crystalline Silicon Photovoltaic Cells (Whether or Not Partially or Fully Assembled Into Other Products),* Proclamation 10101 at Paragraphs 6, 9(a), 85 Fed. Reg. 65639 (Oct. 16, 2020).

As Suniva and Auxin Solar have noted, imports of CSPV cells have not reached the 2.5 GW in-quota amount under the TRQ in any of the first three years of the safeguard measure,[97] and accordingly to date all imports of CSPV cells have entered under the zero duty in-quota rate. Consequently, no duties have been paid for above-quota imports of CSPV cells, and domestic CSPV cell producers have not received effective tariff relief to date.[98]

SEIA argues that the domestic industry is not making a positive adjustment to import competition and specifically notes that a majority of responding purchasers reported that U.S. producers had not taken certain steps during the remedy period to make positive adjustments to import competition, such as introducing new or innovative products, improving product quality, expanding marketing efforts, and/or improving customer service, while a minority of responding purchasers reported that the domestic industry had taken such steps.[99] However, as explained above, the record contains evidence of substantial efforts made by domestic producers of CSPV modules to produce new and improved products, and also contains evidence of efforts by domestic producers, including Hanwha and LG, to improve marketing efforts and customer service.[100]

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[97] The TRQ fill rate was 25.3 percent for the first year of the measure (ending on February 6, 2019), 92.5 percent for the second year of the measure (ending on February 6, 2020), and 83.9 percent for the third year of the measure (ending on February 6, 2021). For the fourth year of the measure, which is to end on February 6, 2022, the fill rate as of November 15, 2021 was 81.9 percent. CR/PR at Table H-8.

[98] We note that in the original safeguard investigation, three Commissioners recommended the TRQ in-quota volume level in the first year of the measure at 1.0 GW or less. *See* Original Safeguard Determination, USITC Pub. 4739 at 2-3; Confidential Original Safeguard Determination at 2-3 (Commissioner Schmidtlein recommended an in-quota volume level in the first year of 0.5 GW, while Commissioners Johanson and Williamson recommended an in-quota volume level in the first year of 1.0 GW).

[99] CR/PR at II-21, Table VIII-8; *see* SEIA's Prehearing Brief at 11.

[100] *See* Joint Prehearing Brief of Hanwha, LG, and Mission Solar at 39-40.

In the original safeguard investigation, the Commission found that, as a result of competition from low-priced imports, the domestic industry had an "inability to generate adequate capital for investments and research and development," which impaired its "ability to develop next-generation products in this highly capital-intensive and technologically sophisticated market."[101] During the remedy period, the domestic industry's poor financial performance as a result of competition by low-priced imports has likewise adversely affected its ability to make capital expenditures and fund research and development expenditures, both of which declined during the remedy period, as discussed in section IV.E.2 below. Thus, while there is evidence that the domestic industry is making efforts to introduce new and innovative products and to improve product quality, it is not surprising that there have been limits to its success in these efforts.

[101] Original Safeguard Determination, USITC Pub. 4739 at 47; Confidential Original Safeguard Determination at 65-66.

We note that the statutory standard is whether there is "evidence" that the domestic industry "is making" a positive adjustment to import competition, not that it "has made" a positive adjustment. Thus, the existence of evidence of aspects in which the domestic industry has not as yet "made" a full positive adjustment to import competition does not negate the ample evidence in this investigation of the domestic industry's progress in making a positive adjustment, and does not warrant a negative extension determination, contrary to SEIA's assertions.[102] Indeed, in order to meet both criteria necessary for an affirmative extension determination, the Commission must also determine that the safeguard measure continues to be necessary to prevent or remedy serious injury. Respondents' argument overlooks that the "necessity" criterion suggests that the domestic industry may not yet have completed its positive adjustment to import competition; in fact, a fully-adjusted industry would no longer need relief.

[102] SEIA's Prehearing Brief at 25-26, 39.

Moreover, the statute states that a complete positive adjustment by the domestic industry means that it has the ability to compete successfully with imports *after* the safeguard measure *terminates.*[103] Thus, contrary to respondent's arguments, there is no requirement that the domestic industry be fully capable of competing successfully with imports in all respects at the time an extension is requested.[104] Nor does the statute contain a requirement, as suggested by respondents, that at the time of an extension request the domestic industry must have the capacity to fulfill all of domestic demand or reach any specific level of market share.[105] As noted above, the domestic industry has increased production and U.S. shipments, including its U.S. shipments serving the utility sector.

Thus, the record shows that during the nearly four years that the safeguard measure has been in place, the domestic industry has upgraded and expanded its production capacity to produce CSPV modules, increased production, U.S. shipments, and employment, regained some market share, and improved its capacity utilization. However, the domestic industry's weak financial performance during the remedy period (which we discuss more fully below in addressing the necessity of continuation of the measure), coupled with the bifacial exclusion and the COVID-19 pandemic,[106] prevented the industry from making additional adjustments. While the absence of effective tariff relief on imports of CSPV cells prevented the domestic

[103] 19 U.S.C. § 2251(b)(1)(A)(i).

[104] *See* NextEra's Posthearing Brief at 6-7; ACP's Posthearing Brief at 10-15.

[105] *See* SEIA's Posthearing Brief at 13-14.

[106] *See, e.g.*, CR/PR at II-7, II-19, III-10, IV-13 to IV-18; Joint Prehearing Brief of Hanwha, LG, and Mission Solar at 56-58 (explaining that COVID-19 and the related lockdowns caused declines in demand for residential and commercial installations, caused production delays for domestic producers, and led to increased production costs). Suniva's Prehearing Brief at 28-29 (stating that the pandemic ***).

industry from upgrading its production capacity to produce CSPV cells, Suniva has emerged from bankruptcy and it and others plan to begin domestic cell production if safeguard relief is extended. Accordingly, we find that there is evidence that the domestic industry is making a positive adjustment to import competition, but also find that the industry's adjustment remains incomplete.

E. Whether Action Continues to be Necessary to Prevent or Remedy Serious Injury

In making its determination, the Commission considered the volume and prices of imports since the safeguard action was taken; the current condition of the domestic industry and changes in the various indicators of the industry's health since the action was taken; and developments in foreign industries and markets. Based on our evaluation of these and other factors, we find that action continues to be necessary to prevent or remedy serious injury to the domestic CSPV products industry.

1. Imports Under the Safeguard Remedy

The volume of imports of CSPV products continued to increase during the remedy period. Total imports of CSPV products, including both CSPV cells and CSPV modules combined, increased by 270.9 percent from 2018 to 2020.[107] Imports of CSPV cells increased by 187.7 percent between 2018 and 2020,[108] while imports of CSPV modules increased by 283.7 percent between 2018 and 2020.[109]

Total imports of CSPV products, including both CSPV cells and CSPV modules, increased from 5.7 million kW in 2018 to 13.9 million kW in 2019 and 21.1 kW million in 2020; total

[107] CR/PR at V-16.
[108] CR/PR at V-1.
[109] CR/PR at V-8.

imports of CSPV products were 11.0 million kW in interim 2020 and 11.6 million kW in interim 2021.[110] Imports of CSPV cells increased during the remedy period from 754,939 kW in 2018 to 2.2 million kW in 2019 and 2020; they were 1.3 million kW in interim 2020 and 1.1 million kW in interim 2021.[111] Imports' share of apparent U.S. consumption of CSPV cells increased from *** percent in 2018 to *** percent in 2019, 2020, and interim 2021.[112] Imports of CSPV modules increased from 4.9 million kW in 2018 to 11.7 million kW in 2019 and 18.9 million kW in 2020; they were 9.7 million kW in interim 2020 and 10.5 million kW in interim 2021.[113] Imports' share of apparent U.S. consumption of CSPV modules decreased from 91.5 percent in 2018 to 85.8 percent in 2019, before increasing to 89.8 percent in 2020.[114] Imports' share of

[110] CR/PR at Table V-8.

[111] CR/PR at Table V-1. The leading suppliers of CSPV cells to the U.S. market had large increases in U.S. imports in both absolute terms and in percentage increase terms. U.S. imports of CSPV cells from Korea increased from *** kW in 2018 to *** kW in 2020, a *** percent increase. CR/PR at Table C-1. U.S. imports of CSPV cells from China increased from *** kW in 2018 to *** kW in 2020, a *** percent increase. *Id.* U.S. imports of CSPV cells from Malaysia increased from *** kW in 2018 to *** kW in 2020, a *** percent increase. *Id.*

[112] CR/PR at Tables V-19, C-1.

[113] CR/PR at Table V-5. The leading suppliers of CSPV modules to the U.S. market had large increases in U.S. imports in both absolute terms and in percentage increase terms. U.S. imports of CSPV modules from Malaysia increased from *** kW in 2018 to *** kW in 2020, a *** percent increase. CR/PR at Table C-2. U.S. imports of CSPV modules from Vietnam increased from *** kW in 2018 to *** kW in 2020, a *** percent increase. *Id.* U.S. imports of CSPV modules from Thailand increased from *** kW in 2018 to *** kW in 2020, a *** percent increase. *Id.*

[114] CR/PR at Tables V-21, C-2.

apparent U.S. consumption of CSPV modules was 89.7 percent in interim 2020 and higher, at 90.4 percent, in interim 2021.[115] [116]

As noted previously, imports of bifacial modules were excluded from the safeguard measure between June 2019 and October 2020.[117] Imports of CSPV products using bifacial cells increased dramatically from *** kW in 2018 to *** kW in 2019 and *** kW in 2020; they were *** kW in interim 2020 and *** kW in interim 2021.[118] CSPV products using bifacial cells increased from *** percent of total U.S. imports in 2018 to *** percent in 2019 and *** percent in 2020; they were *** percent of all imports in interim 2020, and higher and a majority, at *** percent, in interim 2021.[119] While the monthly import data indicate that the large increase in imports of modules using bifacial cells began after imports of bifacial modules were excluded from the safeguard duties in June 2019, they also indicate that imports of modules using bifacial cells continued to increase after the

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[115] CR/PR at Tables V-21, C-2.

[116] Respondents highlight that domestic CSPV module producers, including petitioners in these proceedings, imported CSPV products during the remedy period, and assert that these producers chose to import rather than produce the products domestically, thus leaving domestic capacity idle. SEIA's Prehearing Brief at 64-67; Hearing Tr. at 33, 280 (Nicely); 231 (Dougan). The record confirms that several domestic producers, including Hanwha and LG, are also importers of CSPV products. CR/PR at Table I-15. However, Hanwha explained that it has limited capacity to produce utility-scale modules at its facility in Georgia, and thus it supplements its available U.S. production with imports from its foreign affiliates to serve its customers in the utility market (including NextEra), but this does not reflect a choice to leave domestic capacity idle. Hanwha's Posthearing Brief, Response to Commission Questions, at 54; Hearing Tr. at 243 (Reagan). A Hanwha representative testified that it does not supply CSPV modules from one factory or another based on the market price it could receive for the modules, but rather "we're supplying it based on when it's available where we can deliver." Hearing Tr. at 114 (Moskowitz). In addition, LG explained that it is operating at projected levels in terms of CSPV modules, but the modules it is currently producing are smaller, and so it is not showing full capacity utilization. Hearing Tr. at 106-107 (Lynch). In any event, we do not find that such importation by domestic producers indicates that the safeguard measure is not necessary to prevent or remedy serious injury.

[117] As a result of the November 16, 2021 CIT decision, imports of bifacial modules are now again excluded from the safeguard measure.

[118] CR/PR at Table V-9.

[119] CR/PR at Table V-9.

exclusion was revoked by the President in October 2020.[120] The continued rapid growth in the U.S. market of use of bifacial modules even after the revocation of the bifacial exclusion indicates that this growth is not solely a result of the exclusion. As the Commission stated in its March 2020 Modification Report, "bifacial modules are projected to gain a large share of total demand over the next several years due to the power-generation advantage of bifacial technology and their relative cost competitiveness with monofacial modules."[121]

We have also examined the prices of imports during the remedy period. We received usable quarterly net U.S. f.o.b. selling price data for six CSPV module products from nine domestic producers and 21 importers, although not all firms reported pricing for all products for all quarters.[122] Reported pricing data accounted for *** percent of U.S. producers' U.S. commercial shipments of CSPV products and *** percent of U.S. commercial shipments of imported CSPV products in 2020.[123] In the original investigation, the Commission found that imported CSPV products were highly substitutable with domestically produced CSPV products and that price was an important factor in purchasing decisions in this industry.[124] Nothing on the record of this investigation indicates that these conditions of competition have fundamentally changed.[125]

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[120] CR/PR at Table V-10.

[121] Commission Modification Report, USITC Pub. 5032 at ES-5.

[122] CR/PR at VII-5 to VII-6.

[123] CR/PR at VII-6. Some firms (both domestic producers and importers) reported quantities of CSPV modules in their pricing data that exceeded the quantities of CSPV modules that they reported in their commercial shipments, in some cases due to transfers to related entities made at commercial prices. *Id.* at VII-6 n.9.

[124] Original Safeguard Determination, USITC Pub. 4739 at 29-30, 41; Confidential Original Safeguard Determination at 38-39, 56.

[125] *See generally* CR/PR at II-19 to II-21.

The pricing data on the record of this investigation show that imported CSPV modules continued to be priced lower than domestically produced CSPV modules after imposition of the safeguard measure. In the original safeguard investigation, prior to imposition of the safeguard measure, the Commission found that imported CSPV products were priced lower than domestically produced products in 33 of 52 quarterly comparisons (*** kW), and were priced higher in 19 quarterly comparisons (*** kW).[126] After imposition of the measure, during the January 2018-June 2021 period, imports of CSPV modules continued to be priced lower than domestically produced CSPV modules in 59 of 64 quarterly comparisons, or 92.2 percent of quarterly comparisons.[127] There were 28.9 GW of imported CSPV modules in quarterly comparisons in which imports were priced lower than domestic CSPV modules during the remedy period, equivalent to 96.4 percent of the reported sales of the imported CSPV module pricing products during the period.[128] Furthermore, the record shows that prices of both domestically produced CSPV modules and imported CSPV modules declined during the period for all pricing products for which there were data.[129]

The record shows that imports of CSPV products, particularly CSPV modules, have remained at very high levels during the remedy period and continued to increase after the safeguard measure was imposed. Moreover, imported CSPV modules have remained lower-

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[126] CR/PR at VII-21; Original Safeguard Determination, USITC Pub. 4739 at 48; Confidential Original Safeguard Determination at 57. In the Commission's monitoring investigation, prices for imported modules were below those for domestically produced modules in 32 of 43 instances. CR/PR at VII-21; Commission Monitoring Report, USITC Pub. 5021 at VI-28.

[127] CR/PR at Table VII-9.

[128] CR/PR at Table VII-9. There were 1.1 GW of imported CSPV modules in the five quarterly comparisons in which imports were priced higher than domestically produced modules. *Id*.

[129] CR/PR at VII-19. Domestic price declines ranged from *** percent to *** percent, while import price declines ranged between *** percent and *** percent. *Id.*

priced than domestically produced CSPV modules in the vast majority of quarterly comparisons, despite the 15 to 30 percent *ad valorem* duties imposed on imports of CSPV modules during the remedy period. Furthermore, respondents acknowledged at the hearing that if the safeguard measure were to expire, the volume of imports would increase and the prices of imports would decline.[130]

Thus, we find it likely that, after expiration of the measure, the domestic industry will confront intense competition from increasing volumes of imports sold at low and declining prices.

2. Developments with Respect to the Domestic Industry's Condition

We have also examined the various indicators of the industry's performance over the remedy period to determine whether relief continues to be necessary. These data show that the domestic industry's financial performance remained weak no matter how measured. Although the production, sales, and employment data with respect to CSPV modules improved, they declined with respect to CSPV cells. For the reasons discussed below, we find that the domestic industry considered as a whole does not currently exhibit the level of performance that would indicate that relief is no longer necessary.

Demand for CSPV cells as measured by apparent U.S. consumption increased from *** kW in 2018 to *** kW in 2019 and 2020; it was *** kW interim 2020 and lower, at *** kW, in interim 2021.[131] Demand for CSPV modules as measured by apparent U.S. consumption increased from 5.4 million kW in 2018 to 13.6 million kW in 2019

[130] Hearing Tr. at 254- 261 (Reagan, Prusa, Nicely, Dougan).
[131] CR/PR at Tables V-18.

and 21.0 million kW in 2020; it was 10.8 million kW in interim 2020 and 11.6 million kW in interim 2021.[132] Large majorities of responding U.S. producers, importers, and purchasers reported that U.S. demand for CSPV products had increased overall, and in each of the residential, commercial, and utility segments, since the safeguard remedy was imposed on February 7, 2018.[133]

As previously discussed in section IV.D, the domestic industry's capacity, production, capacity utilization, employment, U.S. shipments, and market share all increased during the remedy period with respect to CSPV modules, but declined with respect to CSPV cells.

The domestic industry's revenues for sales of CSPV modules increased from $*** in 2018 to $*** in 2019 and $*** in 2020; they were $*** in interim 2020, and lower, at $*** in interim 2021.[134] The industry's revenues for sales of CSPV cells increased from $*** in 2018 to $*** in 2019, and then fell to $*** in 2020; they were $*** in interim 2020, and lower, at $*** in interim 2021.[135]

For both CSPV cell and module producers, the domestic industry sustained operating and net losses throughout the remedy period. U.S. producers of CSPV cells incurred operating losses of $*** in 2018, $*** in 2019; and $*** in 2020; they incurred an operating loss of $*** in interim 2020 and $*** in interim 2021.[136] U.S. producers of CSPV cells incurred net losses of

[132] CR/PR at Table V-20.
[133] CR/PR at Table II-6.
[134] CR/PR at Table IV-3.
[135] CR/PR at Table IV-1.
[136] CR/PR at Table IV-1.

$*** in 2018, $*** in 2019; and $*** in 2020; they incurred a net loss of $*** in interim 2020 and $*** in interim 2021.[137]

U.S. producers of CSPV modules incurred operating losses of $*** in 2018, $*** in 2019; and $*** in 2020; they incurred an operating loss of $*** in interim 2020 and $*** in interim 2021.[138] U.S. producers of CSPV modules incurred net losses of $*** in 2018, $*** in 2019; and $*** in 2020; they incurred a net loss of $*** in interim 2020 and $*** in interim 2021.[139]

The domestic industry's overall capital expenditures declined from $*** in 2018 to $*** in 2019, and $*** in 2020; they were $*** in interim 2020 and lower, at $***, in interim 2021.[140] Capital expenditures by domestic producers of CSPV modules declined from $*** in 2018,to $*** in 2019 and $*** in 2020; they were $*** in interim 2020 and lower, at $***, in interim 2021.[141] Capital expenditures by domestic producers of CSPV cells were *** in 2018, and $*** in 2019, 2020, interim 2020, and interim 2021.[142]

The domestic industry's research and development (R&D) expenditures, made primarily by *** and secondarily by ***, decreased from $*** in 2018 to $***

[137] CR/PR at Table IV-1.
[138] CR/PR at Table IV-3.
[139] CR/PR at Table IV-3.
[140] CR/PR at Table IV-5.
[141] CR/PR at Table IV-5.
[142] CR/PR at Table IV-5.

*** in 2019 and $*** in 2020; they were $*** in interim 2020, and lower, at $***, in interim 2021.[143]

Based on the preceding analysis, we find that the weak financial performance of the domestic industry, which was impacted by the exclusion of bifacial modules, the COVID-19 pandemic, and the lack of an effective remedy for cell producers, materially hindered the industry's efforts to make a positive adjustment to import competition during the remedy period, and contributes to our finding below that action continues to be necessary to prevent or remedy serious injury.

Respondents argued that extension of the safeguard remedy is not necessary to prevent or remedy serious injury because domestic producers are not participating in the utility sector and there is a lack of cross-competition between the utility and residential sectors of the market, and specifically that the prices for 72-cell modules sold to the utility segment have no

[143] CR/PR at Table IV-7. *** of the domestic industry's reported R&D expenses were reported by U.S. producers of CSPV modules, as *** U.S. producer of CSPV cells reported R&D expenses. *Id.*

effect on prices for 60-cell modules sold to the residential segment and vice versa.[144] [145] These arguments are based on the faulty premise that there are minimal sales by the domestic industry to the utility segment and only minor sales of imported CSPV modules to the residential segment. In fact, as explained above, the record shows that a plurality (*** percent) of U.S. shipments of CSPV modules by the domestic industry went to the utility segment in 2020, while *** percent of the industry's shipments went to the residential segment, and *** percent went to the commercial segment.[146] While *** percent of U.S. imports of CSPV modules went to the utility segment, *** percent went to the commercial segment, and *** percent went to the residential segment.[147] While import shipments were more concentrated in the utility segment, the larger size of import volumes relative to U.S.

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[144] SEIA's Prehearing Brief at 12-28 and Appendix A (report of Dr. Thomas J. Prusa); ACP's Prehearing Brief at 17-19; NextEra's Prehearing Brief at 6-9; Hearing Tr. at 222-223 (Prusa).

[145] SEIA also argued that the safeguard measure is not necessary to prevent or remedy serious injury because the U.S. producer allegedly competing most directly with CSPV imports is performing well. SEIA's Prehearing Brief at 47-54; SEIA's Posthearing Brief, Appendix A, Response to Commission Questions, at 56-58. Specifically, SEIA highlights the performance of First Solar, a U.S. producer and importer of out-of-scope thin film products, which competes in the utility sector against CSPV modules and has performed well in recent years. SEIA's Prehearing Brief at 50 (emphasizing First Solar's gross profits and increased sales in its annual report). SEIA's argument ignores the fact that First Solar relies heavily on imports of thin film modules from its affiliates in Malaysia and Vietnam (*see* SEIA's Prehearing Brief at 53; CR/PR at I-88), which are not subject to the safeguard tariffs, and thus its profitability is not an indication of the strength of its U.S. production operations. CR/PR at Table I-27 (showing First Solar's imports exceeding its U.S. production by *** MW in 2019 and by *** MW in 2020). In addition, although the U.S. remains the largest market for First Solar's sales, its total net sales value in the United States declined substantially between 2019 and 2020, despite the fact that total photovoltaic ("PV") installations in the United States increased, which suggests that any increased profitability may be due to increased sales in other markets. CR/PR at Tables I-12, I-26.

[146] CR/PR at Table II-1.

[147] CR/PR at Table II-1.

production means that there were more shipments of imports than domestic product to every segment in every year, including the residential and commercial segments.[148]

With respect to cross-competition, the available information indicates that while CSPV modules with 60 cells are the most commonly used CSPV modules in residential systems (accounting for 69 percent of installations), CSPV modules with 72 cells are also used in residential systems (accounting for 7 percent of installations).[149] Furthermore, the record indicates that the domestic industry sells 72-cell CSPV modules (including bifacial modules) to the residential market as well as 60-cell CSPV modules.[150] Thus, the record indicates that the domestic industry and imports compete in all segments of the CSPV module market, and that 60-cell and 72-cell CSPV modules both compete in the residential market. For these reasons, we reject respondents' argument regarding the lack of price effects across products, which is premised on a lack of competition in the U.S. market.

3. Foreign Industry Developments

[148] Derived from data submitted in response to Commission questionnaires. *E.g.,* in 2020 U.S. import shipments to the residential segment were approximately *** kW, and U.S. import shipments to the commercial segment were approximately *** kW. *Id*. Domestic producers' U.S. shipments in 2020 to the residential segment were approximately *** kW, and roughly *** kW to the commercial segment. *Id.*

[149] CR/PR at I-66 to I-67.

[150] *See* Hearing Tr. at 49 (Rashid); CR/PR at Tables I-21, I-22; EDIS Doc. No. 757068 (indicating that domestic producers Auxin Solar and Mission Solar, among others, produce 72-cell modules going to the residential segment).

Foreign producers of CSPV cells and modules have very large capacity and excess capacity, and have added substantial capacity during the remedy period.[151] In the original safeguard investigation, the Commission found that "{t}he foreign industries' excess capacity, which grew between 2014 and 2016, consistently exceeded the size of the entire U.S. market."[152] In this extension investigation, data compiled from Commission questionnaires for all foreign CSPV products industries combined show that aggregate unused capacity (capacity less production) for CSPV cells was 8.5 million kW in 2018, 13.2 million kW in 2019, and 21.7 million kW in 2020,[153] while aggregate unused cell capacity is projected to be 16.6 million kW in 2021, 18.1 million kW in 2022, and 15.6 million kW in 2023.[154] For CSPV modules, aggregate unused capacity was 9.7 million kW in 2018, 11.2 million kW in 2019, and 17.3 million kW in 2020,[155] while aggregate unused module capacity is projected to be 48.8 million kW in 2021, 55.1 million kW in 2022, and 59.9 million kW in 2023.[156] Information available in the record indicates that unused global PV cell capacity (including for out-of-scope thin film) was *** GW in 2020, while unused global PV module capacity (including for out-of-scope thin film) was *** GW in 2020.[157] Given apparent U.S. consumption in 2020 of *** kW for CSPV cells and

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[151] Given that many foreign producers did not submit questionnaire responses, the data derived from Commission questionnaires likely substantially understate the amount of capacity and excess capacity in many of the foreign CSPV industries. *See, e.g.,* CR/PR at VI-17 (usable questionnaire responses received from nine producers of CSPV products in China, accounting for approximately 31 percent of CSPV cell capacity and 30 percent of CSPV module capacity in China in 2020). We have accordingly considered other available information on the record relating to the capacity and excess capacity of foreign CSPV industries in our analysis.

[152] Original Safeguard Determination, USITC Pub. 4739 at 38; Confidential Original Safeguard Determination at 52.

[153] CR/PR at Table VI-87.

[154] Derived from CR/PR at Table VI-89.

[155] Derived from CR/PR at Table VI-90.

[156] Derived from CR/PR at Table VI-92.

[157] Derived from CR/PR at I-17, I-19 to I-20.

21.0 million kW for CSPV modules,[158] the unused capacity of the foreign industries continues to exceed apparent U.S. consumption.

China and other large global producers of CSPV products have had substantial and rapidly growing capacity since 2018.[159] Moreover, foreign producers of CSPV products project that they will continue to add substantial additional capacity. Questionnaire data in this investigation show that aggregate capacity for CSPV modules from all foreign CSPV products industries combined was 1.7 million kW in 2020, was projected to be 1.4 million kW in 2021, and then was projected to increase to 2.5 million kW in 2022 and 3.6 million kW in 2023.[160] The fastest growing foreign producers of CSPV cells and modules project substantial additional capacity in 2021-2023. While CSPV cell capacity in China was reported as 62.0 million kW in 2020, it is projected to increase to 88.2 million kW in 2021, 112.9 million kW in 2022, and 125.0 million kW in 2023.[161] Similarly, while CSPV module capacity in China was reported as 71.9 million kW in 2020, it is projected to increase to 125.3 million kW in 2021, 154.2 million kW in 2022, and 176.8 million kW in 2023.[162] In Malaysia, CSPV cell capacity, reported as 10.0 million kW in 2020, is projected to reach 17.3 million kW in 2023,[163] while CSPV module capacity, reported as 5.5 million kW in 2020, is projected to reach 6.5 million kW in 2022 and be 6.2

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[158] CR/PR Tables C-1, C-2.

[159] Reported CSPV cell capacity and module capacity in China both more than doubled between 2018 and 2020, with CSPV cell capacity increasing from 29.6 million kW in 2018 to 62.0 million kW in 2020, and CSPV module capacity increasing from 32.5 million kW in 2018 to 71.9 million kW in 2020. CR/PR at Tables VI-17, VI-20. Reported CSPV cell and module capacity in Thailand likewise *** between 2018 and 2020. CR/PR at Tables VI-57, VI-60. The CSPV products industries in Malaysia and Vietnam also reported substantial increases in capacity for both CSPV cells and CSPV modules. CR/PR at Tables IV-37, IV-40, VI-67, VI-70.

[160] CR/PR at Tables VI-80, VI-82.

[161] CR/PR at Tables VI-17, VI-19.

[162] CR/PR at Tables VI-20, VI-22.

[163] CR/PR at Tables VI-37, VI-39.

million kW in 2023.[164] In Vietnam, CSPV cell capacity, reported as 5.5 million kW in 2020, is projected to reach 8.9 million kW in 2023,[165] while CSPV module capacity, reported as *** kW in 2020, is projected to reach *** kW in 2022 and remain at that level in 2023.[166]

Many of the largest foreign industries producing CSPV cells and modules – China, Korea, Malaysia, Thailand, and Vietnam – are heavily export oriented, particularly with respect to CSPV modules. In 2020, 54.8 percent of reported production of CSPV modules in China was exported,[167] *** percent of reported production of CSPV modules in Korea was exported,[168] *** percent of reported production of CSPV modules in Malaysia was exported,[169] *** percent of reported production of CSPV modules in Thailand was exported,[170] and *** percent of reported production of CSPV modules in Vietnam was exported.[171]

The United States remains a large and attractive market for foreign exporters of CSPV products. The available data indicate that the United States is the world's second-largest market, following China, for PV system installations, and is projected to continue to be in the 2021-2024 period.[172] Foreign producers of CSPV products are heavily reliant upon exports to the U.S. market. In 2020, *** percent of reported production of CSPV modules in Korea was

[164] CR/PR at Tables VI-40, VI-42.
[165] CR/PR at Tables VI-67; VI-69.
[166] CR/PR at Tables VI-70, VI-72.
[167] CR/PR at Table VI-20.
[168] CR/PR at Table VI-30.
[169] CR/PR at Table VI-40.
[170] CR/PR at Table VI-60.
[171] CR/PR at Table VI-70.
[172] CR/PR at I-11 to I-12. PV system installations include installations of out-of-scope thin film, in addition to CSPV products. *Id.* at I-11.

exported to the U.S. market,[173] *** percent of reported production of CSPV modules in Malaysia was exported to the U.S. market,[174] *** percent of reported production of CSPV modules in Thailand was exported to the U.S. market,[175] and *** percent of reported production of CSPV modules in Vietnam was exported to the U.S. market.[176] By contrast, in light of the antidumping and countervailing duty orders and section 301 tariffs on imports of CSPV cells and modules from China, *** percent of reported production of CSPV modules in China was exported to the U.S. market in 2020.[177]

CCCME argues that despite the very large capacity and excess capacity of the CSPV products industry in China, there is little likelihood that this capacity will be directed toward the United States if the safeguard measure were terminated, citing the *** market share of CSPV cells and modules from China in the U.S. market during the remedy period, the antidumping and countervailing duty orders on imports of CSPV cells and modules from China, and the development of other markets, including the European Union, by the CSPV industry in China.[178] However, the data show that China was the second largest supplier of CSPV cells to the U.S. market in 2020, and that U.S. imports of CSPV cells from China increased by *** percent between 2018 and 2020.[179] Moreover, the fact that the Chinese CSPV industry has other export markets would not prevent it from diverting shipments from those markets to the

[173] CR/PR at Table VI-30.
[174] CR/PR at Table VI-40.
[175] CR/PR at Table VI-60.
[176] CR/PR at Table VI-70.
[177] CR/PR at Table VI-20.
[178] CCCME's Posthearing Brief at 4-8.
[179] CR/PR at V-1, Tables V-1, C-1.

large and attractive U.S. market if the safeguard measure were removed, given the Chinese industry's demonstrated ability to rapidly increase shipments to the U.S. market.

Thus, the record indicates that foreign industries producing CSPV products maintain the ability to increase their exports of CSPV products to the United States substantially by utilizing existing excess capacity and by rapidly adding additional capacity. Given this, we find that the domestic industry is likely to face even more intense import competition after expiration of the measure.

In conclusion, based our analysis of the volume and price of imports under the safeguard remedy, the condition of the domestic industry, and foreign industry developments, we find it likely that large and rapidly increasing volumes of low-priced imports are likely to compete aggressively in the U.S. market and continue to challenge the domestic industry's efforts to complete a positive adjustment to import competition. As discussed above, with the safeguard remedy in place, evidence shows that the domestic industry is making a positive adjustment to import competition, but that adjustment remains incomplete. Accordingly, we find that action continues to be necessary to prevent or remedy serious injury.

V. Recommendations

Duration of extension. After considering the information on the record of this investigation and the arguments of the parties, we recommend that the President extend the relief action for four additional years. We believe that the domestic industry needs this additional time to continue its positive adjustment to import competition. In making this recommendation to extend the safeguard, the Commission has taken into consideration the extent to which the domestic industry has completed its positive adjustment to import

competition, the condition of the domestic industry, and the likelihood that large volumes of low-priced imports will continue.

Given the industry's already poor financial condition, as well as the impediments that the domestic industry has faced to its adjustment efforts, such as the bifacial exclusion and the COVID-19 pandemic, an extension of less than four years would not appear to be sufficient for the industry's efforts to adjust to import competition. All domestic petitioning firms support an extension of four years.[180] Moreover, the start-up of domestic CSPV cell production requires a greater long-term investment and longer time frame than does domestic CSPV module production, particularly given the current state of U.S. CSPV cell production, and a four-year extension period would send a clearer message to the capital markets, as well as to foreign producers of CSPV products, about the commitment to domestic CSPV production than would a shorter extension period.

For all of these reasons, we recommend that the safeguard measure be extended for four additional years.

Amount of relief. With respect to CSPV cells, we recommend that the President maintain the TRQ on imports of CSPV cells with an in-quota volume level of 2.5 gigawatts, as it is under the original measure. We recommend that the President continue to phase down the action by decreasing the *ad valorem* tariff on out-of-quota imports by 0.25 percentage points *ad valorem* from the rate in effect at the end of the fourth year of the measure on February 6, 2022, and continuing to decrease the *ad valorem* out-of-quota tariff rate by 0.25 percentage

[180] August 2, 2021 Petition of Auxin Solar and Suniva at 14; August 4, 2021 Petition of Hanwha, LG, and Mission Solar at 14.

points in each succeeding year of the measure. No additional tariff would apply to goods within the in-quota quantity, as under the original measure.

With respect to CSPV modules, we recommend that the President continue to phase down the action by decreasing the *ad valorem* tariff rate by 0.25 percentage points from the rate in effect at the at the end of the fourth year of the measure on February 6, 2022, and continuing to decrease the *ad valorem* tariff rate by 0.25 percentage points in each succeeding year of the measure.[181]

The statute requires that a safeguard measure being extended must continue to be "phased down at regular intervals."[182] The statute does not indicate that any specific level of phasing down is required.[183] In light of the many substantial factors hindering the domestic industry's positive adjustment to import competition during the remedy period, including the exclusion of bifacial modules from the safeguard measure, the COVID-19 pandemic, the significant levels of low-priced imports that have persisted in the market, and the lack of any tariff relief for domestic producers of CSPV cells to date, we are recommending a minimal level of phasing down consisting of a reduction each year of 0.25 percentage points *ad valorem* in

[181] Pursuant to the requirement that an extended safeguard measure continue to be phased down at regular intervals, 19 U.S.C. § 2253(e)(5), and in light of the factors hindering the domestic industry's positive adjustment to import competition during the remedy period, including the exclusion of bifacial modules from the safeguard measure and the COVID-19 pandemic, Commissioner Johanson recommends a limited reduction of the *ad valorem* tariff rates of the extended measure, consisting of a reduction of one percentage point per year in the above-quota tariff rate for imports of CSPV cells and one percentage point per year in the tariff rate for imports of CSPV modules. He otherwise joins the majority recommendations except as noted below.

[182] 19 U.S.C. § 2253(e)(5).

[183] We note that the SAA states that the President "will retain the discretion to determine the appropriate 'regular intervals' and the amount by which the relief is phased down at those intervals." SAA, H.R. Rep. No. 103-316, vol. I at 293 (1994).

the above-quota tariff rate for imports of CSPV cells and in the tariff rate for imports of CSPV modules.[184]

We recognize the arguments of Hanwha, LG, and Mission Solar for an increase in the TRQ quota level on imports of CSPV cells,[185] but we decline to recommend such an increase. The domestic industry is defined to include producers of both CSPV cells and CSPV modules, and we have considered the adjustment needs of both kinds of producers. CSPV module producers have benefited from the tariffs on imported modules during the remedy period and made substantial progress in adjusting to import competition at the current TRQ quota level for imports of CSPV cells. However, CSPV cell producers have received less benefit to date from the safeguard measure on imports of CSPV cells, as the 2.5 GW TRQ quota level on cell imports has not yet been reached in any year and hence no duties on imports of cells have been applied under the safeguard measure.

An increase in the TRQ quota from the current level of 2.5 GW would allow additional volume of CSPV cells to enter under the zero duty in-quota rate and extend the period for which CSPV cell producers have not benefitted from tariff relief under the safeguard. Imports of CSPV cells are anticipated to exceed the 2.5 GW in-quota amount, possibly as soon as the

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[184] We acknowledge the recent CIT ruling of November 16, 2021, only eight days before the Commission's vote in this investigation, which reinstated the exclusion on bifacial modules and reduced the tariff rate in the fourth year of the measure. There is no information on whether this ruling will be appealed or how this issue may be resolved other than that there is presently a final CIT order as discussed above.

[185] Joint Prehearing Brief of Hanwha, LG, and Mission Solar at 94-113. These producers argue that the TRQ on imports of CSPV cells at the current quota level will increase costs for domestic producers of CSPV modules given the current absence of domestic CSPV cell production, and that planned future domestic CSPV cell production from *** will not be technologically compatible with some domestic producers' CSPV modules. *Id*.

fourth year of the safeguard by February 6, 2022,[186] and thus – if the safeguard is extended and the in-quota amount remains unchanged – domestic producers would begin to see the benefit of duties under the TRQ as of that time.[187] Under our recommendation, domestic CSPV module producers will continue to benefit from the tariff on imports of CSPV modules.[188]

Given the increased likelihood that imports of CSPV cells may exceed the annual 2.5 GW in-quota limit in any extension period of the measure,[189] and the possibility that U.S. importers would accordingly attempt to "front-end load" their imports of CSPV cells in the early months of each 12-month period, we recommend that the annual quota on imports of CSPV cells be administered on a quarterly basis, instead of an annual basis, as was done by the President in making such an amendment to the TRQ in the *Large Residential Washers* safeguard measure.[190]

Other considerations. Several witnesses for both petitioners and respondents in this proceeding emphasized the importance of government policies that incentivize domestic production of CSPV cells and modules, rather than strictly focused on consumption of CSPV products, in order to further bolster investments in the domestic industry and aid in the

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[186] *See* Joint Prehearing Brief of Hanwha, LG, and Mission Solar at 105 ("Given the rate at which solar cells are being imported in the United States for use in module production, {these petitioners} are legitimately concerned that the TRQ will foreseeably exceed its limit before the end of the fourth year of the safeguard").

[187] Joint Prehearing Brief of Hanwha, LG, and Mission Solar at 105.

[188] We note that the existing duty-free in-quota volume of CSPV cell imports under the existing TRQ level will continue to be sufficient to satisfy *** of anticipated domestic production of CSPV modules in the next two years. *See* Joint Prehearing Brief of Hanwha, LG, and Mission Solar at 97-98 (showing projected domestic CSPV module production of *** GW in 2022 and *** GW in 2023).

[189] We note that in the fourth year of the measure, which ends on February 6, 2022, imports of CSPV cells as of November 15, 2021 were 2.05 GW, resulting in a "fill rate" as of that date of 81.9 percent of the 2.5 GW in-quota limit. CR/PR at Table H-8.

[190] *To Further Facilitate Positive Adjustment to Competition From Imports of Large Residential Washers,* Proclamation 9979, 85 Fed. Reg. 5125 (Jan. 28, 2020).

industry's longer-term competitiveness.[191] Domestic producers emphasized that such policies should be considered as a supplement, not a substitute, for the extension of the safeguard measure.[192] Most of the parties also recognized the importance of assuring a complete domestic supply chain of solar products – including polysilicon and wafers, as well as CSPV cells and modules. Some witnesses additionally noted the risks to U.S. energy policy of relying completely on foreign sources for these vital elements.[193] [194] While we agree that the President may wish to consider policies that will incentive domestic production, and not merely consumption, of CSPV cells and modules, we view such policies as a supplement, not a substitute, for the extension of the safeguard measure. Therefore, in addition to extension of the safeguard measure as described above, policies that incentivize domestic production of CSPV cells and modules would further benefit the industry.

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[191] *See* Hearing Tr. at 101-103, 138, 157-158 (Moskowitz); 109 (Porter); 203-204 (Reagan); 277-278 (Granger).

[192] *See, e.g.*, Suniva's Posthearing Brief, Response to Commission Questions, at 13-14; Hearing Tr. at 136-137 (Drake).

[193] *See* Hearing Tr. at 52-53, 84-85, 134 (Rashid); 133, 146-147, 176-177 (Moskowitz); 157 (Card); 197-198 (Hopper); 240-242 (Reagan); 320-324 (Granger, Regan, Hall, Hershman). In addition, some industry representatives noted the high input costs for CSPV module producers due to section 301 and section 232 duties on products without alternative sourcing. *See* Joint Prehearing Brief of Hanwha, LG, and Mission Solar at 58-63.

[194] Commissioner Johanson joins in highlighting these additional issues that parties raised during the course of this investigation for the President's consideration as the President analyzes this extension request. He does not join the remainder of the Views.

Part I: Introduction and overview

Background

On May 17, 2017, a petition, as amended, was properly filed under section 202(a) of the Trade Act of 1974 ("The Trade Act") (19 U.S.C. § 2552(a)) by counsel for Suniva Inc. ("Suniva"). The petition alleged that certain crystalline silicon photovoltaic cells, whether or not partially or fully assembled into other products ("CSPV products"), were being imported into the United States in such increased quantities as to be a substantial cause of serious injury, or threat thereof, to the domestic industry producing an article like or directly competitive with the imported article.[1] The Commission conducted an investigation under section 202(b)(1)(A) of the Act. Following receipt of the report from the U.S. International Trade Commission ("USITC" or "Commission") in November 2017 under section 202 of the Act (19 U.S.C. § 2252) containing an affirmative serious injury determination and remedy recommendations, the President, on January 23, 2018, pursuant to section 203 of the Act (19 U.S.C. § 2253), issued Proclamation 9693, imposing a safeguard measure in the form of (a) a tariff-rate quota ("TRQ") on imports of CSPV (or "solar") cells not partially or fully assembled into other products and (b) an increase in duties on imports of CSPV modules for a period of four years, effective February 7, 2018.[2] [3]

On July 25, 2019,[4] the Commission instituted a proceeding for the purpose of preparing a report to the President and the Congress required by section 204(a)(2) of the Trade Act of 1974 ("the Act")[5] on the results of its monitoring of developments with respect to the domestic industry producing CSPV products since the imposition of the TRQ on imports of CSPV cells and the increase in duties on imports of CSPV modules. On February 7, 2020, the Commission issued its report of its monitoring of developments with respect to the domestic CSPV products industry.[6] Additionally, in response to a request by the U.S. Trade Representative ("USTR") in a

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[1] On May 25, 2017, SolarWorld Americas, Inc. ("SolarWorld") and Suniva notified the Commission that SolarWorld was joining Suniva as co-petitioner in the investigation.

[2] 83 FR 3541, January 25, 2018.

[3] See the sections entitled "Scope of the safeguard remedy" and "Tariff treatment" in Part I of this report for a complete description of the merchandise subject to the safeguard measure.

[4] 84 FR 37674, August 1, 2019.

[5] 19 U.S.C. § 2254(a)(2).

[6] Crystalline Silicon Photovoltaic Cells, Whether or Not Partially or Fully Assembled Into Other Products: Monitoring Developments in the Domestic Industry, Investigation No. TA-201-075 (Monitoring), Publication 5021, February 2020 ("Monitoring publication").

letter dated December 6, 2019,[7] the Commission analyzed the effect of increasing the level of the TRQ covering CSPV cells from 2.5 gigawatts ("GW") to 4.0, 5.0, or 6.0 GW, without other changes to the remedy.[8] Following receipt of the monitoring and modification reports, the President issued Proclamation 10101, effective October 10, 2020, revoking the exclusion previously applied to bifacial modules and increasing the duty on cells entered in excess of the TRQ, and the duty on modules, from 15 percent to 18 percent in the fourth year of the safeguard action.[9] On November 16, 2021, the Court of International Trade ("CIT") issued a decision setting aside Proclamation 10101 as null and void, on the grounds that it was outside the President's delegated statutory authority.[10]

The Commission instituted this investigation on August 6, 2021, following receipt of petitions filed by Auxin Solar Inc. ("Auxin") and Suniva on August 2, 2021 and amended on August 5, 2021, and filed by Hanwha Q CELLS USA, Inc. ("Hanwha"), LG Electronics USA, Inc. ("LG"), and Mission Solar Energy LLC ("Mission") on August 4, 2021, requesting extension of the relief action currently in place on imports of CSPV products.[11] The purpose of this investigation is to determine whether the action taken by the President under section 203 of the Act with respect to CSPV products, described in Proclamation 9693 of January 23, 2018, as modified by Proclamation 10101 of October 10, 2020, continues to be necessary to prevent or remedy serious injury and whether there is evidence that the domestic industry is making a positive

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[7] USTR's request for probable economic effect advice was made pursuant to section 204(a)(4) of the Trade Act of 1974 (19 U.S.C. § 2254(a)(4)) (Trade Act). Section 204(a)(4) of the Trade Act requires the Commission, upon request of the President, to advise the President of its judgment as to the probable economic effect on the industry concerned of any reduction, modification, or termination of the action taken under section 203 of the Trade Act (a safeguard measure) that is under consideration. The President has delegated certain authority to the USTR for this purpose.

[8] Crystalline Silicon Photovoltaic Cells, Whether or Not Partially or Fully Assembled Into Other Products: Advice on the Probable Economic Effect of Certain Modifications to the Safeguard Measure, Investigation No. TA-201-075 (Modification), Publication 5032, March 2020 ("Modification Report").

[9] *To Further Facilitate Positive Adjustment to Competition From Imports of Certain Crystalline Silicon Photovoltaic Cells (Whether or Not Partially or Fully Assembled Into Other Products),* Proclamation 10101, 85 FR 65639, October 16, 2020. The sections "Scope of the safeguard remedy" and "The safeguard measure" in this Part contain additional information on the safeguard measure and excluded products.

[10] *Solar Energy Industry Associations v. United States*, Slip Op. 21-154 (Ct. Int'l Trade Nov. 16, 2021.

[11] *Crystalline Silicon Photovoltaic Cells, Whether or Not Partially or Fully Assembled Into Other Products: Extension of Action*, 86 FR 44403, August 12, 2021. The Commission exercised its authority under section 603(a) of the Act (19 U.S.C. 2482(a)) to consolidate the proceedings.

adjustment to import competition. Table I-1 provides information relating to the background and schedule of this proceeding.[12] [13]

Table I-1
CSPV products: Information relating to the background and schedule of this proceeding

Effective date	Action
August 6, 2021	Institution of Commission's investigation (86 FR 44403 August 12, 2021)
November 3, 2021	Commission's hearing
November 24, 2021	Scheduled date for Commission's vote
December 8, 2021	Scheduled date for Commission's determination and report to the President

WTO proceedings

On May 14, 2018, Korea requested consultations with the United States concerning imposition of the safeguard measure on imports of CSPV products pursuant to the World Trade Organization ("WTO") dispute settlement understanding. On May 24, 2018, China requested to join the consultations and on May 25, 2018, the European Union ("EU"), Malaysia, and Thailand requested the same. Subsequently, the United States informed the Dispute Settlement Body ("DSB") that it accepted the requests of China, the EU, Malaysia, and Thailand to join the consultations. On August 14, 2018, Korea requested the establishment of a panel and at its meeting on September 26, 2018, the DSB established a panel.[14]

On August 14, 2018, China also requested consultations with the United States concerning imposition of the safeguard measure on imports of CSPV products pursuant to the WTO dispute settlement understanding. The EU and Thailand requested to join the consultations on August 23, 2018 and August 27, 2018, respectively. Subsequently, the United States informed the DSB that it accepted both requests to join the consultations. On July 11, 2019, China requested the establishment of a panel and at its meeting on August 15, 2019, the DSB established a panel.[15] After the United States and China were unable to agree on panelists, the Director-General determined the composition of the panel on October 24, 2019, at China's

[12] Pertinent *Federal Register* notices are referenced in appendix A, and may be found at the Commission's website (www.usitc.gov).

[13] Appendix B presents a list of witnesses who appeared at the hearing.

[14] WTO, "DS545: United States – Safeguard Measure on Imports of Crystalline Silicon Photovoltaic Products."

[15] WTO, "DS562: United States – Safeguard Measure on Imports of Crystalline Silicon Photovoltaic Products."

request. On September 2, 2021, the WTO panel circulated its final report in this dispute, rejecting China's claims and upholding in all respects the Commission's serious injury determination in its safeguard investigation of imports of CSPV products.[16] China notified the WTO Dispute Settlement Body on September 16, 2021 that it intended to appeal to the WTO Appellate Body certain issues in the panel report, while noting that there is currently no division of the Appellate Body that can be established to hear the appeal.[17]

Previous and related investigations

Antidumping and countervailing duty investigations on CSPV cells and modules from China (Inv. Nos. 701-TA-481 and 731-TA-1190) ("CSPV 1")

The antidumping and countervailing duty investigations on CSPV cells and modules from China (Inv. Nos. 701-TA-481 and 731-TA-1190) (hereinafter referred to as "CSPV 1") resulted from petitions filed by SolarWorld Industries America, Inc. on October 19, 2011.[18] On October 12, 2012, the U.S. Department of Commerce ("Commerce") announced its final affirmative determinations in its antidumping and countervailing duty investigations on CSPV cells and modules from China. The countervailable subsidy margins ranged from 14.78 percent to 15.97 percent[19] and the estimated weighted-average dumping margins ranged from 18.32 percent to 249.96 percent.[20] In November 2012, the Commission determined that an industry in the United States was materially injured by reason of imports of CSPV cells and modules from China that Commerce found were sold at less than fair value ("LTFV") in the U.S. market and subsidized by the Government of China.[21] Effective December 7, 2012, Commerce issued

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[16] WTO, "WT/DS562/R: United States – Safeguard Measure on Imports of Crystalline Silicon Photovoltaic Products, Report of the Panel (2 September 2021)."

[17] WTO, "WT/DS562/12: United States – Safeguard Measure on Imports of Crystalline Silicon Photovoltaic Products (20 September 2021)."

[18] Crystalline Silicon Photovoltaic Cells and Modules from China, Inv. Nos. 701-TA-481 and 731-TA-1190 (Final), USITC Publication 4360, November 2012 ("CSPV 1 original publication"), p. I-1. Effective October 1, 2014, SolarWorld Industries America, Inc. changed its name to SolarWorld Americas, Inc. Certain Crystalline Silicon Photovoltaic Products from China and Taiwan, Inv. Nos. 701-TA-511 and 731-TA-1246-1247 (Final), USITC Publication 4519, February 2015 ("CSPV 2 original publication"), p. I-1.

[19] 77 FR 63788, October 17, 2012.

[20] 77 FR 63791, October 17, 2012. On August 4, 2015, the U.S. Trade Representative ("USTR") instructed Commerce to implement its determinations under Section 129 of the Uruguay Round Agreements Act ("URAA") regarding the antidumping duty investigation of CSPV cells and modules from China. Accordingly, Commerce revised the antidumping cash deposit rates to account for double remedies, reflecting rates ranging from 6.68 percent to 238.88 percent. 80 FR 48812, August 14, 2015.

[21] CSPV 1 original publication, p. 1 (all six Commissioners reached affirmative determinations).

antidumping and countervailing duty orders on those imports.[22] In CSPV 1, Commerce determined that the country of origin of subject CSPV modules was the country of manufacture of the CSPV cells, including modules assembled outside of China using Chinese CSPV cells. Therefore, the scope of the CSPV 1 orders did not include U.S. imports of CSPV modules assembled in China from CSPV cells made in a country other than China.[23]

On November 1, 2017, the Commission gave notice, pursuant to Section 751(c) of the Tariff Act of 1930, as amended,[24] that it had instituted first five-year reviews of the CSPV 1 orders[25] and on February 5, 2018, the Commission determined that it would conduct full reviews.[26] On the basis of the record developed in the first five-year reviews of the CSPV 1 orders, the Commission determined on March 1, 2019, pursuant to the Tariff Act of 1930, that revocation of the antidumping and countervailing duty orders on CSPV cells and modules from China would be likely to lead to continuation or recurrence of material injury to an industry in the United States within a reasonably foreseeable time.[27] Commerce issued a continuation of the antidumping and countervailing duty orders on imports of CSPV cells and modules from China, effective March 20, 2019.[28] [29]

Antidumping and countervailing duty investigations on CSPV cells and modules from China and Taiwan (Inv. Nos. 701-TA-511 and 731-TA-1246-1247) ("CSPV 2")

The antidumping and countervailing duty investigations on CSPV cells and modules from China and Taiwan (Inv. Nos. 701-TA-511 and 731-TA-1246-1247) (hereinafter referred to as "CSPV 2") resulted from petitions filed by SolarWorld on December 31, 2013.[30] On December 16, 2014, Commerce announced its final affirmative determinations in its antidumping duty

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[22] 77 FR 73017, December 7, 2012; 77 FR 73018, December 7, 2012.

[23] CSPV 2 original publication, pp. 3-4.

[24] 19 U.S.C. 1675(c).

[25] 82 FR 50681 and 50612, November 1, 2017.

[26] 83 FR 8296, February 26, 2018.

[27] 84 FR 8342, March 7, 2019.

[28] 84 FR 10299 and 10300, March 20, 2019.

[29] On August 16, 2021, the American Solar Manufacturers Against Chinese Circumvention ("A-SMACC") filed requests with Commerce to investigate imports from certain producers of CSPV cells and modules from China that are completed in Malaysia, Thailand, and Vietnam which they alleged to have circumvented the antidumping and countervailing duty orders on imports of CSPV products from China. On November 10, 2021, Commerce rejected these requests, citing the refusal of A-SMACC members to publicly identify themselves. Letter from Commerce to Timothy Brightbill, Wiley Rein LLP, Re: Crystalline Silicon Photovoltaic Cells, Whether or Not Assembled into Modules, from the People's Republic of China: Requests for Circumvention Inquiries, November 10, 2021.

[30] CSPV 2 original publication, p. I-1.

investigations on CSPV cells and modules from China and Taiwan and its countervailing duty investigation on CSPV cells and modules from China. The countervailable subsidy margins ranged from 27.64 percent to 49.79 percent for China.[31] The estimated weighted-average dumping margins (in percent ad valorem), as reported by Commerce ranged from 26.71 percent to 165.04 percent for China and 11.45 percent to 27.55 percent for Taiwan.[32] In February 2015, the Commission determined that an industry in the United States was materially injured by reason of imports of certain CSPV cells and modules from Taiwan that Commerce found were sold in the U.S. market at LTFV and imports from China that Commerce found were sold at LTFV and subsidized by the Government of China.[33] Effective February 18, 2015, Commerce issued antidumping and countervailing duty orders on those imports from China and an antidumping duty order on those imports Taiwan.[34] The first five-year reviews of the CSPV 2 orders were initiated by Commerce and instituted by the Commission on January 2, 2020.[35]

In its final CSPV 2 determinations, Commerce defined the subject merchandise from China to include U.S. imports of the following: (1) CSPV modules assembled in China from CSPV cells made in Taiwan and (2) CSPV modules assembled in China from CSPV cells made in third countries. Commerce defined the subject merchandise from Taiwan to include U.S. imports of: (1) CSPV cells made in Taiwan; (2) CSPV modules assembled in Taiwan from CSPV cells made in Taiwan; and (3) CSPV modules assembled in third countries other than China from CSPV cells made in Taiwan. Therefore, the module assembly location determined the country of origin for U.S. imports of modules from China, except for modules covered by the prior CSPV 1 orders (which were considered nonsubject merchandise from China in the CSPV 2 investigations); the cell manufacture location determined the country of origin for U.S. imports of cells and modules from Taiwan.[36]

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[31] 79 FR 76962, December 23, 2014.

[32] 79 FR 76970, December 23, 2014; 79 FR 76966, December 23, 2014.

[33] Chairman Schmidtlein, Vice Chairman Johanson, and Commissioners Williamson and Pinkert voted in the affirmative. Commissioner Broadbent voted in the affirmative with respect to CSPV modules from China and Taiwan and in the negative with respect to CSPV cells from Taiwan (CSPV cells from China were not included in the scope as they were already covered by the CSPV 1 orders). Commissioner Kieff did not participate in the CSPV 2 investigations). 80 FR 7495, February 10, 2015.

[34] 80 FR 8592 and 8596, February 18, 2015.

[35] 85 FR 67, January 2, 2020; 85 FR 120, January 2, 2020.

[36] 79 FR 76962 and 76970, December 23, 2014; *see also* CSPV 2 original publication, pp. 3-4 and 6. The CIT affirmed Commerce's scope determinations, as further explained by the agency on remand. *See SunPower Corp. v. United States*, 253 F.Supp. 3d 1275 (Ct. Int'l Trade 2017); *Kyocera Solar, Inc. v. United States*, 253 F.Supp. 3d 1294 (Ct. Int'l Trade 2017).

On January 2, 2020, the Commission gave notice, pursuant to Section 751(c) of the Tariff Act of 1930, as amended,[37] that it had instituted first five-year reviews of the CSPV 2 orders[38] and on April 6, 2020, the Commission determined that it would conduct expedited reviews.[39] On the basis of the record developed in the first five-year reviews of the CSPV 2 orders, the Commission determined on August 31, 2020, pursuant to the Tariff Act of 1930, that revocation of the antidumping and countervailing duty orders on CSPV cells and modules from China, and revocation of the antidumping duty order on CSPV cells and modules from Taiwan, would be likely to lead to continuation or recurrence of material injury to an industry in the United States within a reasonably foreseeable time.[40] Commerce issued a continuation of the antidumping and countervailing duty orders on imports of CSPV cells and modules from China, and of the antidumping duty orders on imports of CSPV cells and modules from Taiwan, effective September 11, 2020.[41]

Antidumping and countervailing duty investigations on primary raw materials

There are no antidumping or countervailing duty orders currently in effect on U.S. imports of polysilicon, the primary raw material in the production of CSPV cells.

Section 232 investigations (Commerce)[42]

Steel

The relevant HTS subheadings within the scope of this safeguard remedy, 8541.40.60, 8501.31.80, 8501.32.60, 8501.61.00, and 8507.20.80, were not included in the enumeration of certain steel products subject to the additional 25-percent *ad valorem* duties under Section 232 of the Trade Expansion Act of 1962, as amended.[43] Steel is also generally not a major input into CSPV cells and modules, but may be used in balance of systems components (such as tracking

[37] 19 U.S.C. 1675(c).
[38] 85 FR 120, January 2, 2020.
[39] 85 FR 42430, July 14, 2020.
[40] 85 FR 55319, September 4, 2020.
[41] 85 FR 56215, September 11, 2020.
[42] See appendix E for additional details.
[43] 83 FR 11625, March 15, 2018.

systems on which modules are mounted) for solar installations.[44] [45] Table I-2 presents a summary of Section 232 tariffs on U.S. imports of steel, by country.

Table I-2
Steel mill articles: Section 232 tariffs summary

n.a.=not applicable

Country	Effective date	Ad valorem duty rate	Absolute quotas
Argentina	May 31, 2018	Exempt	180,000 metric tons (198,416 short tons)
Australia	May 31, 2018	Exempt	Exempt
Brazil	May 31, 2018	Exempt	4,193,157 metric tons (4,622,159 short tons)
Canada	May 20, 2019	Exempt	Exempt
European Union	May 31, 2018	25%	n.a.
Korea	April 30, 2018	Exempt	2,631,012 metric tons (2,900,190 short tons)
Mexico	May 20, 2019	Exempt	Exempt
Turkey	May 21, 2019	25%	n.a.
All other countries	March 8, 2018	25%	n.a.

Source: U.S. Customs and Border Protection ("CBP"), "Information on Trade Remedy Questions and Resources, Section 232 Trade Remedies on Aluminum and Steel, Guidance," https://www.cbp.gov/trade/programs-administration/trade-remedies, retrieved October 8, 2021.

Aluminum

The relevant HTS subheadings within the scope of this safeguard remedy, 8541.40.60, 8501.31.80, 8501.32.60, 8501.61.00, and 8507.20.80, were not included in the enumeration of aluminum products that are subject to the additional 10-percent ad valorem national-security duties under Section 232 of the Trade Expansion Act of 1962, as amended.[46] However, aluminum is used as an input in CSPV module production, as discussed below, and in balance of system components such as racking and mounting systems.[47] [48] Table I-3 presents a summary of Section 232 tariffs on U.S. imports of aluminum, by country.

[44] NEXTracker Webpage, https://www.nextracker.com/product-services/solar-storage/nx-horizon/, retrieved October 22, 2019.

[45] See U.S. notes 16(a) and 16(b), subchapter III of chapter 99.

[46] 83 FR 11619, March 15, 2018.

[47] Energysage, "What is Solar Racking?" August 22, 2019, https://news.energysage.com/solar-racking-overview/, retrieved October 22, 2019.

[48] See U.S. notes 19(a), 19(b), 19(c), 19(d), and 19(e), subchapter III of chapter 99.

Table I-3
Aluminum products: Section 232 tariffs summary

n.a.=not applicable

Country	Effective date	Ad valorem duty rate	Absolute quotas
Argentina	May 31, 2018	Exempt	180,00 metric tons (199,450 short tons)
Australia	May 31, 2018	Exempt	Exempt
Canada	May 20, 2019	Exempt	Exempt
Mexico	May 20, 2019	Exempt	Exempt
All other countries	March 8, 2018	10%	n.a.

Source: U.S. Customs and Border Protection ("CBP") "Information on Trade Remedy Questions and Resources, Section 232 Trade Remedies on Aluminum and Steel, Guidance," https://www.cbp.gov/trade/programs-administration/trade-remedies, retrieved October 8, 2021.

Section 301 proceeding[49]

CSPV cells and modules imported from China, as well as various components used in CSPV module production such as ethylene vinyl acetate (EVA) encapsulants, tempered glass, and backsheets, are subject to additional 25-percent ad valorem duties under Section 301 of the Trade Act of 1974.[50] HTS subheadings 3920.10.00, 3920.62.00, 8501.31.80, 8501.32.60, and 8541.40.60 were included in the August 23, 2019 (List 2) tariff action.[51] HTS subheadings 7007.19.00 and 8507.20.80 were included among the September 24, 2019 (List 3) tariff action.[52] Certain small and low wattage products, however, are exempt from the duties as is

[49] See appendix E for additional details.

[50] Roselund, Christian, "Trump Ratchets up Tariffs on Chinese Products Including Batteries," *PV Magazine*, August 26, 2019, https://pv-magazine-usa.com/2019/08/26/trump-ratchets-up-tariffs-chinese-products-including-batteries/, retrieved November 3, 2019; Sun, Xiaojing, "Look to the Solar Industry for Answers About the Trade War's Impact," *Greentech Media*, August 8, 2019, https://www.greentechmedia.com/articles/read/look-to-the-solar-industry-for-answers-about-trade-wars-impact, retrieved November 3, 2019.

[51] See U.S. notes 20(c) and 20(d), subchapter III of HTS chapter 99 which discuses articles and products from China. For HTS subheading 9903.88.02, the ad valorem duty is 25.0-percent and included in the August 23, 2019 (List 2) $16 Billion Tariff Action. HTS 8541.40.60 includes out-of-scope thin film products. USTR, *Notice of Modification of Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 83 FR 40823, August 16, 2018. HTSUS (2021) Revision 8, USITC Publication 5225, October 2021, pp. 99-III-20 - 99-III-23.

[52] See U.S. notes 20(e) and 20(f), subchapter III of chapter 99 which discuses articles and products from China. For HTS subheading 9903.88.03, the ad valorem duty is 25.0-percent and included in the September 24, 2019 (List 3) $200 Billion Tariff Action. USTR, *Notice of Modification of Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 83 FR 47974, September 21, 2018. HTSUS (2021) Revision 8, USITC Publication 5225, October 2021, pp. 99-III-24 - 99-III-46. USTR published a notice on March 26, 2020 that retroactively (continued...)

certain types of tempered glass used in module production.[53] Table I-4 presents information on section 301 tariffs on select inputs into cell and module production.

Table I-4
CSPV products: Section 301 tariffs on CSPV products and select inputs

Item	Associated HTS subheading	List
CSPV cells and modules	8541.40.60	(List 2) $16 Billion Tariff Action Effective on August 23, 2019
DC photovoltaic generators of an output not exceeding 750 W	8501.31.80	(List 2) $16 Billion Tariff Action Effective on August 23, 2019
DC photovoltaic generators of an output exceeding 750 W but not exceeding 75 kW:	8501.32.60	(List 2) $16 Billion Tariff Action Effective on August 23, 2019
AC photovoltaic generators of an output not exceeding 75 kVA	8501.61.00	(List 3) $200 Billion Tariff Action Effective on September 24, 2019
Other lead-acid storage batteries of a kind described in subheading 9903.45.25	8507.20.80	(List 3) $200 Billion Tariff Action Effective on September 24, 2019
Backsheets	3920.62.00	(List 2) $16 Billion Tariff Action Effective on August 23, 2019
EVA encapsulants	3920.10.00	(List 2) $16 Billion Tariff Action Effective on August 23, 2019
Module frames	8541.90.00	(List 1) $34 billion Tariff Action Effective on July 6, 2018
Tempered low iron glass	7007.19.00	(List 3) $200 Billion Tariff Action Effective on September 24, 2019
Wafers	3818.00.00	(List 3) $200 Billion Tariff Action Effective on September 24, 2019

Source: Compiled from staff research.

Note: Certain small and low wattage products, however, are exempt from the duties as is certain types of tempered glass used in module production. USTR published a notice on March 26, 2020 that retroactively excluded sheets of tempered safety glass, coated with silicone oxide, having a surface area of less than 2.5 m^2, designed to be placed over solar cell panels for protection from external damage (described in statistical reporting number 7007.19.0000) from September 24, 2018, the effective date of the $200 billion action, to August 7, 2020.

(…continued)

excluded tempered glass from September 24, 2018, the effective date of the $200 billion action, to August 7, 2020. USTR, *Notice of Product Exclusions: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 85 FR 17158, March 26, 2020.

[53] See Appendix E.

Global developments

Global installations

Global photovoltaic ("PV") system installations (including out-of-scope thin film), according to the International Energy Agency ("IEA"), increased from 104.4 GW[54] in 2018 to 139.4 GW in 2020 (table I-5).[55] The largest markets in 2020 were China (48.2 GW, 35 percent of installations), the United States (19.2 GW, 14 percent), Vietnam (11.1 GW, 8 percent), and Japan (8.2 GW, 6 percent).[56] In 2019, Vietnam and Egypt were new entrants, installing 4.8 GW and 2.5 GW respectively.[57]

[54] This report discusses data in terms of watts ("W"), kilowatts ("kW" (equal to 1,000 watts)), megawatts ("MW" (1,000 kW)), and gigawatts ("GW" (1,000 MW)).

[55] The latest version of data from IEA includes revisions to 2018-20 installation totals. IEA PVPS, *Trends 2020 in Photovoltaic Applications*, IEA-PVPS T1-38:2020, pp. 12 https://iea-pvps.org/wp-content/uploads/2020/11/IEA_PVPS_Trends_Report_2020-1.pdf, retrieved September 25, 2021; IEA PVPS, *Snapshot of Global PV Markets*, IEA-PVPS T1-39:2021, p. 8 https://iea-pvps.org/wp-content/uploads/2021/04/IEA_PVPS_Snapshot_2021-V3.pdf, retrieved October 4, 2021.

[56] IEA PVPS, *Snapshot of Global PV Markets*, IEA-PVPS T1-39:2021, p. 10 https://iea-pvps.org/wp-content/uploads/2021/04/IEA_PVPS_Snapshot_2021-V3.pdf, retrieved October 4, 2021.

[57] IEA PVPS, *Trends 2020 in Photovoltaic Applications*, IEA-PVPS T1-38:2020, pp. 4 and 13 https://iea-pvps.org/wp-content/uploads/2020/11/IEA_PVPS_Trends_Report_2020-1.pdf, retrieved September 25, 2021 and IEA PVPS, *Trends 2019 in Photovoltaic Applications*, IEA PVPS T1-36:2019, pp. 30 https://iea-pvps.org/wp-content/uploads/2020/02/5319-iea-pvps-report-2019-08-lr.pdf, retrieved September 25, 2021;

Table I-5
CSPV products: Global PV (including out-of-scope thin film) installations, by country and period

Installations in GW

Country	2018	2019	2020
China	44.3	30.1	48.2
United States	10.7	13.3	19.2
Vietnam	0	4.8	11.1
Japan	6.7	7.0	8.2
Germany	2.9	3.8	4.9
India	10.8	10.1	4.4
Australia	4.4	4.8	4.1
Korea	2.3	3.1	4.1
Brazil	2.3	4.5	3.1
Netherlands	1.6	2.4	3.0
Rest of World	18.5	27.7	29.1
Total	104.4	111.6	139.4

Source: IEA PVPS, *Trends 2019 in Photovoltaic Applications*, IEA PVPS T1-36:2019, p. 42 https://iea-pvps.org/wp-content/uploads/2020/02/5319-iea-pvps-report-2019-08-lr.pdf, retrieved September 25, 2021; IEA PVPS, *Trends 2020 in Photovoltaic Applications*, IEA-PVPS T1-38:2020, pp. 4, 12-14 and 85 https://iea-pvps.org/wp-content/uploads/2020/11/IEA_PVPS_Trends_Report_2020-1.pdf, retrieved September 25, 2021; and IEA PVPS, *Snapshot of Global PV Markets*, IEA-PVPS T1-39:2021, pp. 8 and 10 https://iea-pvps.org/wp-content/uploads/2021/04/IEA_PVPS_Snapshot_2021-V3.pdf, retrieved October 4, 2021.

Note: Top ten countries in installed capacity in 2020.

Global installations are forecasted to total approximately 163.2 GW in 2021, 203 GW in 2022, 205 GW in 2023, and 239 GW in 2024 (table I-6).[58] China, the United States, and India are expected to remain the top three markets for PV installation from 2021-24.[59] Australia, Germany, Japan, Netherlands, South Korea, Spain, and Vietnam are expected to be in the top ten over the same period. Throughout 2021-24, global and Chinese demand are expected to

[58] Solar Power Europe notes that the estimate for solar PV installation is conservative and pointed out that for 2021, IHS Market revised its forecast down to 171 GW from 182 GW and BloombergNEF revised its forecast to 182 GW from 184 GW. Solar Power Europe, Global Market Outlook for Solar Power, 2021–2025, 2021, p. 24, retrieved October 1, 2021.

[59] National Renewable Energy Laboratory (NREL) projects growth annual global PV installation as well as growth in China, United States, Europe, and India in 2022 and 2023. China 2021 forecast varied widely across analysts: 57 GW (HIS Market), 60 GW (China PV Industry Association), and 65 GW (BNEF). The United States 2021 PV installation forecast is 23.8 GW by the US Solar Energy Industries Association (SEIA) and Wood Mackenzie, published in their June Q2 market update. National Renewable Energy Laboratory, H1 Solar Industry Update, June 22, 2021, p. 4, https://www.nrel.gov/docs/fy21osti/80427.pdf, retrieved October 1, 2021 and Solar Power Europe, *Global Market Outlook for Solar Power, 2021–2025*, 2021, p. 30, retrieved October 1, 2021.

grow continuously, India's demand will remain relatively constant, while U.S. demand is expected to peak in 2023. Overall, global demand is expected to grow from 2021-24.[60]

Table I-6
CSPV products: Global PV installations (including out-of-scope thin film), projected installations, by period

Installations in GW

Country	2021	2022	2023	2024
Total	163	203	225	239

Source: Solar Power Europe, *Global Market Outlook for Solar Power, 2021–2025*, 2021, pp. 24–30, retrieved October 1, 2021.

Note: Solar Power Europe medium case scenario forecast for the annual solar PV market 2021-2024.

Global industry

Global CSPV supply chain

Polysilicon

Global polysilicon production (including for semiconductors) increased from 480,000 metric tons in 2018 to more than 550,000 metric tons in 2020.[61] Production is primarily for the solar industry, with production of polysilicon for CSPV cells increasing from 446,000 metric tons in 2018 to 469,000 metric tons in 2019.[62] China is the largest global polysilicon producer, accounting for 68 percent of global production in 2019.[63] The China Photovoltaic Industry

[60] Solar Power Europe, *Global Market Outlook for Solar Power, 2021–2025*, 2021, pp. 24–30, retrieved October 1, 2021.

[61] While the IEA has not yet reported production totals for 2020, China reported production to the IEA of 396,000 metric tons in 2020. In addition, global imports, excluding from China, totaled about 160,000 metric tons in 2020. This likely understates production as it doesn't include non-China production consumed domestically. IEA PVPS, *Trends in Photovoltaic Applications 2019*, p. 59, https://iea-pvps.org/trends-reports/, retrieved September 14, 2021; IEA PVPS, *National Survey Report of PV Power Applications in China 2020*, 2021, p. 22, https://iea-pvps.org/national-survey-reports/, retrieved September 10, 2020; IHS Markit, Global Trade Atlas Database, https://connect.ihsmarkit.com, retrieved September 14, 2021.

[62] Polysilicon production increases at a different rate than CSPV cell production due to annual declines in the volume of polysilicon per watt of output. For example, CSPV cell polysilicon usage declined from 3.9 grams per watt in 2018 to 3.2 grams per watt in 2019. IEA PVPS, *Trends in Photovoltaic Applications 2020*, p. 39, https://iea-pvps.org/trends-reports/, retrieved September 14, 2021.

[63] IEA PVPS, *Trends in Photovoltaic Applications 2020*, IEA-PVPS T1-38:2020, p. 40, https://iea-pvps.org/trends-reports/, retrieved September 14, 2021.

Association estimates that China accounted for 76 percent of global production in 2020.[64] The four large producers with facilities in Xinjiang accounted for 65 percent of Chinese production in 2020, though one of the four producers also has a plant outside of Xinjiang, so this may slightly overstate the region's share of production.[65] Other large producers in 2019 included Germany (11 percent of production), South Korea (10 percent), and the United States (6 percent).[66]

Global polysilicon production capacity increased from 639,000 metric tons per year in 2018 to 712,000 metric tons per year in 2019, according to IEA data.[67] In 2020, polysilicon production capacity declined to *** metric tons as companies outside of China *** their production plants.[68] Accidents and flooding at polysilicon plants in China further constrained supply in the second half of 2020.[69] In September and the first half of October 2021, additional constraints on production in China occurred due to high coal prices and government mandated energy use restrictions that led to a reduction in operations at some plants producing polysilicon and silicon metal, an input into polysilicon production.[70]

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[64] IEA PVPS, *National Survey Report of PV Power Applications in China 2020*, 2021, p. 22, https://iea-pvps.org/national-survey-reports/, retrieved September 10, 2020.

[65] IEA PVPS, *National Survey Report of PV Power Applications in China 2020*, 2021, p. 22, https://iea-pvps.org/national-survey-reports/, retrieved September 10, 2020; Bernreuter, Johannes, "Polysilicon Manufacturers," n.d., https://www.bernreuter.com/polysilicon/manufacturers/#GCL-Poly-Energy-bold-capacity-expansion-late-adaption-to-high-purity, retrieved September 14, 2021.

[66] IEA PVPS, *Trends in Photovoltaic Applications 2020*, p. 40, https://iea-pvps.org/trends-reports/, retrieved September 14, 2021.

[67] IEA PVPS, *Trends in Photovoltaic Applications 2020*, p. 39, https://iea-pvps.org/trends-reports/, retrieved September 14, 2021.

[68] ***.

[69] Bernreuter, Johannes, "Lessons from the Polysilicon Plant Accidents at Daqo and GCL," Bernreuter Research, July 24, 2020, https://www.bernreuter.com/newsroom/polysilicon-news/article/lessons-from-the-polysilicon-plant-accidents-at-daqo-and-gcl/, retrieved October 6, 2021; Reuters, "China Flood Forces Tongwei to Cut Polysilicon Capacity by a Quarter," August 18, 2020, https://www.reuters.com/article/us-china-solar-floods/china-flood-forces-tongwei-to-cut-polysilicon-capacity-by-a-quarter-idUSKCN25E0T1, retrieved October 6, 2021.

[70] These energy use restrictions also impacted production in other segments of the CSPV value chain in China. Adler, Maxwell, Dan Murtaugh, and Krystal Chia, "Solar Power May Be the Next Victim of China's Coal Shortage," Bloomberg, September 29, 2021, https://www.yahoo.com/now/solar-power-may-next-victim-224858556.html, retrieved October 18, 2021; Rai-Roche, Sean, "Polysilicon Price Jumps 9% In a Week as Energy Crisis Hits China," *PV Tech*, September 30, 2021, https://www.pv-tech.org/polysilicon-price-jumps-9-in-a-week-as-energy-crisis-hits-china/, retrieved October 18, 2021; Lin, Corrine, "PV Manufacturers Call to Action amid Challenges Brought by China's Power Rationing," InfoLink, October 1, 2021, https://www.infolink-group.com/en/solar/analysis-trends/PV-manufacturers-call-to-action-amid-challenges-brought-by-China%E2%80%99s-power-rationing, retrieved October 18, 2021; Shaw, Vincent, "Silicon Metal and Aluminum Industries Hit by China Power Shortages," *PV*
(continued...)

Production capacity is expected to significantly increase at the end of 2021. Annualized production capacity in September 2021 was ***metric tons, but annualized capacity is expected to reach *** metric tons by the end of the year. Capacity is expected to reach *** metric tons by the end of 2022. China's share of global production capacity increased from *** percent in 2018 to *** percent in 2020 and is forecast to exceed *** percent in 2023. Xinjiang's share of global production capacity increased from *** percent in 2018 to *** percent in 2020.[71]

Global polysilicon spot prices declined *** percent from January 2018 to June 2020, while contract prices decreased *** percent. Global spot prices increased *** percent from June to December 2020, while contract prices increased *** percent. From January to June 2021, spot prices increased *** percent and contract prices increased *** percent. Spot and contracts prices in July and August were ***. Spot prices increased *** percent from August to October 2021 (based on the average price in the first half of the October), while contract prices increased *** percent.[72]

Wafers

Global wafer production increased from 115 GW in 2018 to 142 GW in 2019, while wafer production capacity increased from 156 GW in 2018 to 185 GW in 2019. Capacity utilization increased slightly from 74 percent in 2018 to 77 percent in 2019.[73] China was the largest producer, accounting for 96 percent of wafer production capacity in 2019.[74] China's wafer production increased from 107 GW in 2018 to 161 GW in 2020, while its production capacity increased from 146 GW in 2018 to 240 GW in 2020.[75]

A few Chinese companies account for most global wafer production capacity. The two largest companies (Longi and Zhonghuan) accounted for 62 percent of global production

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(…continued)

Magazine, October 6, 2021, https://www.pv-magazine-india.com/2021/10/06/silicon-metal-and-aluminum-industries-hit-by-china-power-shortages/, retrieved October 18, 2021.

[71] ***.

[72] See Part VII for additional discussion of polysilicon prices. ***.

[73] IEA PVPS, *Trends in Photovoltaic Applications 2020*, p. 41, https://iea-pvps.org/trends-reports/, retrieved September 14, 2021.

[74] IEA PVPS, *Trends in Photovoltaic Applications 2020*, Report IEA-PVPS T1-38:2020, p. 41, https://iea-pvps.org/trends-reports/, retrieved September 14, 2021.

[75] IEA PVPS, *National Survey Report of PV Power Applications in China 2020*, 2021, p. 22, https://iea-pvps.org/national-survey-reports/, retrieved September 10, 2021; IEA PVPS, *National Survey Report of PV Power Applications in China 2018*, 2019, p. 19, https://iea-pvps.org/wp-content/uploads/2020/01/NSR_China_2018.pdf retrieved September 10, 2021.

capacity in 2020, according to EnergyTrend, while the top six companies (Longi, Zhonghuan, Jinko, JA Solar, Shangli, and JYT) accounted for 88 percent of global production capacity. These six companies also account for most planned capacity additions in 2021.[76]

There was a significant shift in wafer sizes during 2018–20. In 2018, M2 (156.75 x 156.75 mm) wafers accounted for about 90 percent of the global monocrystalline wafer production, with M0 (156.0 x 156.0 mm) wafers accounting for most of the remaining production.[77] In 2019, M2 wafers accounted for slightly less than 70 percent of production and G1 (158.75 x 158.75) wafers for more than 20 percent of production. M4 (161.7 x 161.7 mm) wafers accounted for more than 5 percent of production.[78] By 2020, the industry had mostly shifted away from wafers smaller than G1. In 2020, G1 wafers accounted for slightly more than 50 percent of production. The remainder of the market was accounted for by larger sizes, with M10 and large wafers accounting for more than 15 percent of production.[79]

Glass

Global PV glass production totaled 542 million square meters in 2019, with China accounting for 86 percent of production.[80] The top two firms in global production capacity in 2020 were Xinyi Solar (32 percent) and Flat Glass Group (20 percent).[81] There was a shortage of PV glass and a significant increase in global prices in the second half of 2020, with prices rising

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[76] EnergyTrend, "TrendForce: Large-Sized Tendency Expedites Differentiation in Wafer Prices as M10 and G12 Exceed 50% in Market Shares during 2022," January 13, 2021, https://www.energytrend.com/research/20210113-20674.html, retrieved September 15, 2021.

[77] ITRPV, *Results 2018 Including Maturity Report 2019*, p. 43, https://itrpv.vdma.org, retrieved September 28, 2021.

[78] In 2016, M0 monocrystalline wafers accounted for more than half of the market and M2 wafers for more than 40 percent of the market. M4 wafers were introduced in 2016. ITRPV, *Results 2019 Including Maturity Report 2020*, p. 17, https://itrpv.vdma.org, retrieved September 29, 2021; ITRPV, *2016 Results*, March 2017, p. 33; Pickerel, Kelly, "Big-Wafer Solar Panels Aren't Quite Ready for Their Residential Debut," *Solar Power World*, August 31, 2020, https://www.solarpowerworldonline.com/2020/08/big-wafer-solar-panels-arent-quite-ready-for-their-residential-debut/.

[79] ITRPV, *2020 Results,* p. 14, https://itrpv.vdma.org, retrieved September 28, 2021.

[80] Taiyang News, "471 New PV Glass Companies Registered In China In 2020," May 21, 2021, http://taiyangnews.info/business/471-new-pv-glass-companies-registered-in-china-in-2020/, retrieved September 17, 2021.

[81] Orient Securities (Hong Kong) Limited, "Morning Notes," January 29, 2021, p. 2, https://www.dfzq.com.hk/ueditor/jsp/upload/file/20210129/1611883473007092281.pdf, retrieved September 17, 2021.

73 percent from July to December 2020.[82] Global spot prices dropped 30 to 32 percent, depending on the type of glass, the last week in March 2021 to return to more typical price levels.[83]

Global CSPV cell production and shipments

Global PV cell production (including out-of-scope thin film products) increased from 116 GW in 2018 to *** GW in 2020.[84] Global PV cell production capacity increased from 172 GW in 2018 to *** GW in 2020.[85] *** projects that production capacity will reach *** GW by the end of 2021.[86] Capacity utilization was 67 percent in 2018 and *** percent in 2020.[87] The leading global CSPV cell producers in 2020, as measured by the volume of shipments, were ***.[88]

China was the leading global PV cell producer in 2018, accounting for 74 percent of production, followed by Taiwan (7 percent of production), Malaysia, (6 percent), and South Korea (5 percent).[89] In 2020, China's cell production totaled 135 GW, accounting for ***

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[82] Xiao, Carrie, "Solar Glass Provider Profits Topped Us$1.25 Billion in 2020, but Sudden Price Falls Loom," *PV Tech*, April 6, 2021, https://www.pv-tech.org/solar-glass-provider-profits-topped-us1-25-billion-in-2020-but-sudden-price-falls-loom/, retrieved September 17, 2021; Bloomberg, "Glass Shortage Threatens Solar Panels Needed for Climate Fix," November 4, 2020, https://www.bloomberg.com/news/articles/2020-11-05/a-glass-shortage-is-threatening-china-s-solar-power-ambitions, retrieved September 17, 2021.

[83] PV InfoLink, "Module Utilization Rates Dropped Further, Driving Up BOM Inventory Pressures," March 31, 2021, https://www.infolink-group.com/en/solar/spot-price?page=5, retrieved September 17, 2021.

[84] References to "PV" in this section include out-of-scope thin film products. IEA PVPS, *Trends in Photovoltaic Applications 2019*, Report IEA-PVPS T1-36:2019, p. 62, https://iea-pvps.org/trends-reports/, retrieved September 14, 2021; ***.

[85] IEA PVPS, *Trends in Photovoltaic Applications 2019*, Report IEA-PVPS T1-36:2019, p. 62, https://iea-pvps.org/trends-reports/, retrieved September 14, 2021; ***.

[86] ***.

[87] IEA PVPS, *Trends in Photovoltaic Applications 2019*, Report IEA-PVPS T1-36:2019, p. 62, https://iea-pvps.org/trends-reports/, retrieved September 14, 2021; ***.

[88] ***.

[89] IEA PVPS, *Trends in Photovoltaic Applications 2019*, Report IEA-PVPS T1-36:2019, p. 63, https://iea-pvps.org/trends-reports/, retrieved September 14, 2021.

percent of global production.[90] *** projects that China will account for *** percent of year end 2021 PV cell production capacity, Southeast Asia for *** percent, and the rest of the world for *** percent.[91]

The size of global cell production plants has significantly increased over time. Plants with a production capacity of 2 GW or less accounted for more than 50 percent of cell plants in 2018 and those greater than 2 GW for more than 40 percent. In 2020, plants with less than 2 GW in annual production capacity accounted for slightly more than 30 percent of the market, 2 to 5 GW plants for almost 50 percent, and plants with more than 5 GW for slightly less than 20 percent.[92]

There was a significant shift in CSPV cell shipments by technology type during 2018–the first half of 2021. Multicrystalline cells declined from *** percent of CSPV cell shipments in 2018 to *** percent in 2020, while monocrystalline cells increased from *** percent of shipments in 2018 to *** percent in 2020 (figure I-1).[93] PERC cells *** monocrystalline and multicrystalline cell technologies shipped in 2020. However, n-type CSPV cell shipments increased, from around 5 percent of the market in 2018 to *** percent of shipments in 2020.[94] In the first half of 2021, n-type cell shipments increased to more than *** percent of CSPV cell shipments.[95]

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[90] IEA PVPS, *National Survey Report of PV Power Applications in China 2020*, 2021, p. 23, https://iea-pvps.org/national-survey-reports/, retrieved September 10, 2020; ***.

[91] ***.

[92] The ITRPV report does not specify if this is by number of plants or weighted by annual production capacity. ITRPV, *Results 2018 Including Maturity Report 2019*, p. 53, https://itrpv.vdma.org, retrieved September 28, 2021; ITRPV, *2020 Results,* p. 32, https://itrpv.vdma.org, retrieved September 28, 2021.

[93] ***.

[94] ITRPV, *Results 2018 Including Maturity Report 2019*, p. 42, https://itrpv.vdma.org, retrieved September 28, 2021; ***.

[95] ***.

Figure I-1
CSPV cells: Global shipments by technology, 2020 and first half 2021

* * * * * * *

Source: ***.

Note: ***.

Global CSPV module production

Global CSPV module production increased from 112 GW in 2018 to *** GW in 2020. Shipments were *** production in 2020, with PV module (including out-of-scope thin film) production totaling *** and shipments totaling *** GW. Global production capacity (including out-of-scope thin film products) increased from 184 GW in 2018

to *** in 2020. Global PV capacity utilization declined from 63 percent in 2018 to *** percent in 2020.[96] China was the leading global module producer in 2020, accounting for *** percent of global PV module production.[97]

The largest module producers, in terms of annual production capacity at the end of 2020, were ***. The firms with the largest increases in production capacity during 2018–20 were ***. Firms are undertaking significant production capacity additions in 2021, with the leading firms in capacity expansions in 2021 expected to be ***.[98]

Module facilities with less than 500 MW in annual production capacity accounted for about 10 percent of plants in 2018, those with 500 MW to 2 GW for about 30 percent, and those with more than 2 GW for about 60 percent. In 2020, facilities with 1 GW or less in annual production capacity accounted for more than 20 percent of plants, those with 1 GW to 5 GW in annual capacity for more than 60 percent, and those with more than 5 GW in capacity for more than 10 percent.[99]

The global market share of select module technologies is shown in figure I-2. Half cut cells were about 80 percent of the global market in 2020, with modules with 120 half cut cells accounting for slightly less than 40 percent of the market and modules with 144 half cut cells for slightly less than 60 percent. Bifacial modules accounted for more than 15 percent of the global market and monofacial for more than 80 percent.[100]

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[96] IEA PVPS, *Trends in Photovoltaic Applications 2019*, Report IEA-PVPS T1-36:2019, pp. 64, 67, https://iea-pvps.org/trends-reports/, retrieved September 14, 2021; ***.

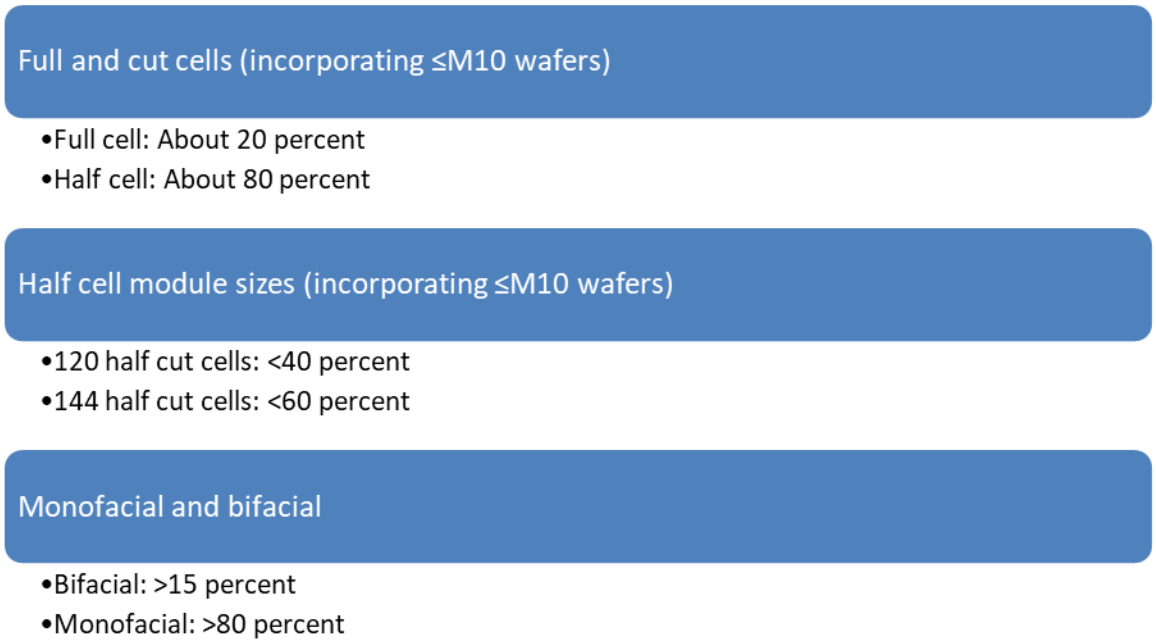
[97] ***.

[98] ***.

[99] The ITRPV report does not specify if this is by number of plants or weighted by annual production capacity. ITRPV, *Results 2018 Including Maturity Report 2019*, p. 54, https://itrpv.vdma.org, retrieved September 28, 2021; ITRPV, *2020 Results,* p. 42, https://itrpv.vdma.org, retrieved September 28, 2021.

[100] ITRPV, *2020 Results*, pp. 46–49, https://itrpv.vdma.org, retrieved September 28, 2021.

Figure I-2
CSPV modules: Global market share by technology type, 2020



Source: ITRPV, 2020 Results, pp. 46–49, https://itrpv.vdma.org, retrieved September 28, 2021.

Note: Technologies with a small share of the market for which data could not be discerned in the report are not included here.

Third-country market import restraints

Table I-7 provides information on third-country market import restraints on CSPV modules and their components.

Table I-7
CSPV: Third-country market import restraints, 2016–21

Date	Third-country market import restraint
January 2016	Canada imposed AD/CVD duties on CSPV modules from China
January 2016	EU imposed antidumping (AD) duties on CSPV cells and modules from China.
January 2016	China imposed AD and countervailing (CVD) duties on polysilicon (HTS 2804.61) from the EU, Korea, and the United States.
February 2016	Conclusion of EU anti-circumvention investigation and extension of duties to certain companies in Malaysia and Taiwan.
October 2016	Australia terminated an AD investigation on module imports from China.
April 2017	Turkey imposed AD duties on modules from China, with rates ranging from $20 - $25 per square meter.
April 2017	Korea imposed AD duties on PET film (HTS 3920.90) from Chinese Taipei, Thailand, and the United Emirates.
August 2017	India imposed duties on glass for PV modules from China.
September 2017	EU announced that it would progressively reduce minimum import prices.
November 2017	China adjusts AD duties on polysilicon (HTS 2804.61) from Korea from 4.4 percent to 113.8 percent.
December 2017	Indonesia initiated a sunset review on biaxially oriented polypropylene (BOPP) (HTS 3920.20.10, 3920.20.91, 3920.20) from Thailand and Vietnam. Quota limits were placed on Biaxially Oriented Polypropylene from Thailand.
February 2018	Brazil initiated anti-dumping investigations on Polyethylene terephthalate films from the Kingdom of Bahrain and Peru. AD duties of $480.15/ton on imports from the Kingdom of Bahrain and $123.20/ton on imports from Peru were effective January 7, 2019.
March 2018	Indian Solar Manufacturers Association withdrew an AD petition.
April 2018	India initiated an AD investigation on ethyl vinyl acetate sheet for solar modules (HTS 3901, 3920, 3921) from China. Anti-dumping duties on China were enforced March 29, 2019.
May 2018	The EU initiated an AD investigation on solar glass (HTS 7007.19) from Malaysia.
June 2018	India initiated AD and CVD investigations on textured tempered coated and uncoated glass (7007.19) from Malaysia. On February 26, 2019, India imposed duties of $114.58 per MT.
July 2018	India imposed safeguard duties on solar cells and modules. Developing countries except China and Malaysia, were exempt. The duties include 25 percent in the first year, 20 percent for the first six months of the second year and 15 percent thereafter.
September 2018	EU terminated measures on cells and modules from China.
November 2018	China duties on polysilicon (HTS 2804.61) imports from the EU expired.

Table continued.

Table I-7 Continued
CSPV: Third-country market import restraints, 2016–21

Date	Third-country market import restraint
January 2019	China initiated a sunset review of polysilicon (HTS 2804.61) imports from Korea and the United States. AD/CVD measures against Korea and the United States were continued.
August 2019	Indonesia initiated AD investigations on BOPP (HTS 3920.20.10, 3920.20.91, 3920.20) from China and Malaysia.
January 2020	China imposed a 5-year extension on AD duties on imports of solar-grade polysilicon from Korea and the United States.
July 2020	India reviewed the safeguard duty on PV solar cells and modules and granted a one-year extension for products imported from China, Thailand, and Vietnam. Malaysian products were exempted from the safeguard duties.
March 2021	India announced that it would impose a basic customs duty of 25 percent on PV cells and 40 percent on PV modules, effective April 1, 2022.

Source: Crystalline Silicon Photovoltaic Cells and Modules from China, Inv. Nos. 701-TA-481 and 731-TA-1190 (Review), USITC Publication 4874, March 2019 ("CSPV 1 first review publication"), pp. IV-18–IV-25; IEA PVPS, Trends 2020 in Photovoltaic Applications, IEA-PVPS T1-38:2020, p. 50, https://iea-pvps.org/wp-content/uploads/2020/11/IEA_PVPS_Trends_Report_2020-1.pdf, retrieved September 25, 2020; and Crystalline Silicon Photovoltaic Cells, Whether or Not Partially or Fully Assembled Into Other Products: Monitoring Developments in the Domestic Industry, Investigation No. TA-201-075 (Monitoring), Publication 5021, February 2020, p. I-36; Information is collected from each country's semiannual reports from the WTO's committee on Anti-dumping Practices. Additional information can be found online at: "World Trade Organization's Anti-dumping Gateway," retrieved September 1, 2021; Government of India, Ministry of New and Renewable Energy, Imposition of Basic Customs Duty (BCD) on Solar PV Cells & Modules/ Panels, March 9, 2021, https://mnre.gov.in/public-information/current-notice, retrieved October 13, 2021.

U.S. developments

U.S. CSPV cell producers

A list of CSPV cell firm exits and announced new facilities are presented in tables I-8 to I-9.[101] U.S. CSPV cell producer exits during 2018 through September 2021 (from publicly available data sources) are reported in table I-8. Currently, there are no firms with domestic CSPV cell production. No CSPV cell manufacturing plants were opened during January 2018 through September 2021, however three CSPV cell manufacturing plants closed in that time.

[101] For additional details regarding industry events in the United States, see part III of this report.

Table I-8
CSPV cells: U.S. CSPV production facilities closing, January 2018–September 2021

n.a.=not applicable

Company	State	Opening year	Closing year	Notes
Panasonic	NY	2018	2020	n.a.
SunPower (former SolarWorld plant)	OR	Prior to 2018	2019	Closing year is the year that CSPV cell manufacturing equipment was put up for auction.
Yingli	TX	Not available	2019	Closing year is based on auction date for cell manufacturing equipment.

Source: Compiled from publicly available information and Monitoring publication, pp. I-37–I-39.

Note: This table is based on publicly available information. Information on producers of off-grid products, such as consumer electronic products or solar generators, is not included. In addition, it does not include changes in production capacity at existing plants. Solaria does not appear to do all steps in the CSPV cell production process internally, and is not listed in this table.

Three new U.S. CSPV cell plants have been publicly announced or are under consideration (table I-9). In September 2020, Violet Power announced that it would open a new CSPV cell and module manufacturing plant in Washington. The plant was expected to open by the second quarter of 2021 and produce 500 MW in 2021.[102] In January 2021, the company announced that it would build a facility instead of leasing a facility as originally planned, and stated that it expected to break ground by the end of the month.[103] As of April 2021, the firm indicated that it plans to start production by the end of 2021 and fully ramp an initial 1.4 GW in production capacity in 2022.[104] The firm plans to eventually increase production capacity to 5 GW.[105] In 2021, Maxeon Solar announced that it applied for a U.S. Department of Energy loan

[102] Featherstone, Charles H., "Company to Open Solar Plant in Moses Lake," *Columbia Basin Herald*, September 9, 2020, https://columbiabasinherald.com/news/2020/sep/09/company-build-solar-plant-moses-lake/, retrieved September 22, 2021.

[103] Featherstone, Charles H., "Violet Power to build at Port of Moses Lake," *Columbia Basin Herald*, January 4, 2021, https://columbiabasinherald.com/news/2021/jan/04/violet-power-build-port-moses-lake/, retrieved September 22, 2021.

[104] There have been no subsequent updates on the status of this plant. Featherstone, Charles H., "Violet Power Still Committed to Moses Lake Production," *Columbia Basin Herald*, April 13, 2021, https://columbiabasinherald.com/news/2021/apr/13/violet-power-still-committed-moses-lake-production/, retrieved September 22, 2021.

[105] Featherstone, Charles H., "Company to Open Solar Plant in Moses Lake," *Columbia Basin Herald*, September 9, 2020, https://columbiabasinherald.com/news/2020/sep/09/company-build-solar-plant-moses-lake/, retrieved September 22, 2021.

guarantee for a possible 3 GW U.S. CSPV cell and module plant.[106] The firm reports that "pending successful loan guarantee and enabling legislation" production would start in 2023 at the earliest.[107] In September 2021, Ubiquity Solar announced plans to open a plant in New York with 350 MW of annual production capacity. The plant is expected to be commissioned by the end of 2022.[108]

Table I-9
CSPV cells: New U.S. CSPV cell production facilities announced

n.a.=not available

Company	State	Planned start of production	Notes
Maxeon Solar	n.a.	2023 (earliest)	Submitted loan guarantee application to the U.S. Department of Energy to build a 3 GW U.S. CSPV cell and module plant.
Ubiquity Solar	NY	2022	Announced plans to build a 350 MW cell plant.
Violet Power	WA	2021	As of April 2021, planned to start production by the end of 2021 at a 1.4 GW cell and module plant. There have been no subsequent updates on the status of this plant.

Source: Featherstone, Charles H., "Violet Power Still Committed to Moses Lake Production," *Columbia Basin Herald*, April 13, 2021, https://columbiabasinherald.com/news/2021/apr/13/violet-power-still-committed-moses-lake-production/, retrieved September 22, 2021; Maxeon Solar, "Investor Presentation," August 2021, p. 24, https://corp.maxeon.com/static-files/616bda26-3d2f-430b-9a5b-9969c5d3183b, retrieved September 24, 2021; Governor of New York Press Office, "Governor Hochul Announces Plans for Ubiquity Solar to Establish U.S. Manufacturing Operations at Former IBM Huron Campus in Broome County," September 22, 2021, https://www.governor.ny.gov/news/governor-hochul-announces-plans-ubiquity-solar-establish-us-manufacturing-operations-former, retrieved September 22, 2021.

Note: This table is based on publicly available information as of September 30, 2021. Information on producers of off-grid products is not included.

[106] Maxeon Solar, "Investor Presentation," August 2021, p. 24, https://corp.maxeon.com/static-files/616bda26-3d2f-430b-9a5b-9969c5d3183b, retrieved September 24, 2021.

[107] Maxeon Solar, "Investor Presentation," August 2021, p. 24, https://corp.maxeon.com/static-files/616bda26-3d2f-430b-9a5b-9969c5d3183b, retrieved September 24, 2021.

[108] Governor of New York Press Office, "Governor Hochul Announces Plans for Ubiquity Solar to Establish U.S. Manufacturing Operations at Former IBM Huron Campus in Broome County," September 22, 2021, https://www.governor.ny.gov/news/governor-hochul-announces-plans-ubiquity-solar-establish-us-manufacturing-operations-former, retrieved September 22, 2021.

U.S. CSPV module producers

U.S. CSPV module producer entries and exits during 2018–September 2021 (from publicly available data sources) are reported in table I-10. Currently, there are about 20 U.S. CSPV module manufacturing plants. Seven plants closed during 2018–September 2021.[109]

[109] Compiled from publicly available information; Monitoring publication, pp. I-40–I-41; CSPV 2 first review publication, pp. I-41–I-42.

Table I-10
CSPV modules: U.S. CSPV production facilities opening and/or closing, January 1, 2018–September 30, 2021

n.a.=not applicable

Company	State	Start year	Year closed	Notes
Auxin Solar	CA	Prior to 2018	n.a.	n.a.
CBS Solar/Sonali Energees	MI	Prior to 2018	n.a.	n.a.
CHERP Solar Works/ Locally Grown Power	CA	2021	n.a.	n.a.
Crossroads Solar	IN	2021	n.a.	n.a.
Hanwha Q-Cells	GA	2019	n.a.	n.a.
Heliene	FL	Prior to 2018	n.a.	In August 2021, Heliene took over the plant from SolarTech Universal and planned to upgrade the production line before starting production of its own products at the plant.
Heliene	MN	Prior to 2018	n.a.	n.a.
Hightec Solar	IN	Prior to 2018	n.a.	n.a.
Jinko Solar	FL	2018	n.a.	n.a.
Merlin Solar	CA	Prior to 2018	n.a.	Majority stake acquired by Ayala Corporation in 2018.
Mission Solar	TX	Prior to 2018	n.a.	n.a.
LG	AL	2019	n.a.	n.a.
PowerFilm	IA	2018	n.a.	n.a.
SBM Solar	NC	Prior to 2018	n.a.	n.a.
Silfab Solar	WA	See note	n.a.	Bellingham plant. This plant was built in 2017 by Itek Energy, and replaced a smaller facility. In August 2018, Silfab purchased the plant from Itek.
Silfab Solar	WA	2021	n.a.	Burlington plant
Solar Electric America	VA	Around 2018	n.a.	n.a.
Solaria	CA	Prior to 2018	n.a.	n.a.
SunSpark Technology	CA	Prior to 2018	n.a.	n.a.
Tesla	NY	Prior to 2018	n.a.	n.a.

Table continued.

Table I-10 Continued
CSPV modules: U.S. CSPV production facilities opening and/or closing, January 1, 2018–September 30, 2021

Company	State	Start year	Year closed	Notes
Itek Energy	MN	Prior to 2018	2018	n.a.
Prism Solar	NY	Prior to 2018	2020	Closing date is the date when manufacturing equipment was sold.
PureSolar	WA	Prior to 2018	2018	n.a.
Seraphim Solar	MS	Prior to 2018	2018	n.a.
Solartec Energia	TX	Prior to 2018	2019	n.a.
Sunergy California	CA	2018	2021	n.a.
SunPower	OR	Prior to 2018	2021	Former SolarWorld plant acquired by SunPower on October 1, 2018.

Source: Compiled from publicly available information and Monitoring publication, pp. I-40–I-41; CSPV 2 first review publication, pp. I-41–I-42.

Note: This table is based on publicly available information as of October 15, 2021. Information on producers of off-grid products is not included. In addition, it does not include changes in production capacity at existing plants.

A number of additional investments in U.S. CSPV module manufacturing have been announced or are under consideration (table I-11). There are nine plants that have been publicly announced, which are at various stages of development. Of these plants, two are planning to start operation by the end of 2021, five are planning to start production in 2022, and one is planning to start production in 2023.[110]

[110] A start of production date was not available for REC solar.

Table I-11
CSPV modules: New CSPV module production facilities announced

n.a.=not available

Company	State	Planned start of production	Notes
Convalt Energy	NY	2022	Purchased SunPower manufacturing equipment and plans to open a module plant with an annual capacity of 700 MW.
GAF Energy	CA	2021	Leased facility and announced plans to open a 50 MW per year manufacturing plant for its solar roof product. The company imported solar manufacturing equipment in August 2021. In September 2021 the firm announced that they had completed building improvements and started moving into the new facility.
Heliene	MN	2022	Announced plans to open a new manufacturing plant adjacent to its current plant that will bring its total Minnesota production capacity, including its current plant, to 550 MW.
Maxeon Solar	n.a.	2023 (earliest)	Submitted loan guarantee application to the U.S. Department of Energy to build a 3 GW U.S. CSPV cell and module plant.
Meyer Burger	n.a.	2022	Announced plans in September 2021 to open a 400 MW U.S. module plant. The firm indicated that it was negotiating with states on the site selection and it expected to make a final decision by the end of 2021. The firm indicated that equipment purchases are taking place concurrently with the site selection and that it expects the plant to be online by the end of 2022. There will be the potential to expand to multiple gigawatts in the long term, according to the firm.
NanoPV	GA	2022	Plan to open a 250 MW plant, though there is no information confirming that the plant will be CSPV.
Philadelphia Solar	n.a.	2022	The company is reportedly in negotiations over sites for a U.S. manufacturing plant with an initial capacity of 530 MW and a plan to reach an annual capacity of 1 GW. (The firm currently manufactures in Jordan.)
REC Group	n.a.	n.a.	Reportedly plans to open a 1 GW plant, but no additional details are available.
Violet Power	WA	2021	As of April 2021, planned to start production by the end of 2021 at 1.4 GW cell and module plant. There have been no subsequent updates on the status of this plant.

Sources: Featherstone, Charles H., "Violet Power Still Committed to Moses Lake Production," *Columbia Basin Herald*, April 13, 2021, https://columbiabasinherald.com/news/2021/apr/13/violet-power-still-committed-moses-lake-production/, retrieved September 22, 2021; Maxeon Solar, "Investor Presentation," August 2021, p. 24, https://corp.maxeon.com/static-files/616bda26-3d2f-430b-9a5b-9969c5d3183b, retrieved September 24, 2021; Wagman, "Philadelphia Solar Plans to Build 1 GW Module Plant in the U.S.," PV Magazine, July 15, 2021, https://pv-magazine-usa.com/2021/07/15/philadelphia-solar-plans-to-build-1-gw-module-plant-in-the-u-s/, retrieved September 24, 2021; Pickerel, Kelly, "Heliene to Expand Minnesota Solar Panel Assembly Facility to 550 MW Total Capacity," *Solar Power World*, September 9, 2021, https://www.solarpowerworldonline.com/2021/09/heliene-to-expand-minnesota-solar-panel-assembly-facility-to-550-mw-total-capacity/, retrieved September 24, 2021; Pickerel, Kelly, "Convalt Energy to open 700-MW solar panel assembly facility in New York in 2022," *Solar Power World*, July 12, 2021, https://www.solarpowerworldonline.com/2021/07/convalt-energy-to-open-700-mw-solar-panel-assembly-facility-in-new-york-in-2022/, retrieved September 24, 2021; Panjiva Website, https://panjiva.com, retrieved September 24, 2021; Reuters, "U.S. Solar Company GAF Energy Moving Production Back Home from Asia," May 11, 2021, https://www.reuters.com/business/energy/us-solar-company-gaf-energy-moving-production-back-home-asia-2021-05-11/, retrieved September 24, 2021; Pickerel, Kelly, "GAF Energy Will Bring Manufacturing of Its Low-Profile Solar Roofing System to California," *Solar Power World*, May 11, 2021, https://www.solarpowerworldonline.com/2021/05/gaf-energy-will-bring-manufacturing-of-its-low-profile-solar-roofing-system-to-california/, retrieved September 24, 2021; Roofing Contractor, "GAF Energy Begins Hiring for New California Solar Roofing Manufacturing Facility," July 13, 2021, https://www.roofingcontractor.com/articles/95872-gaf-energy-begins-hiring-for-new-california-solar-roofing-manufacturing-facility, retrieved September 24, 2021; GAF Energy, "GAF Energy Completes Build Out Of First U.S. Solar R&D And Manufacturing Facility," News release, https://finance.yahoo.com/news/gaf-energy-completes-build-first-130000638.html, retrieved September 28, 2021: Meyer Burger, "Meyer Burger to Develop 400 MW High-performance Solar Module Manufacturing Facility in the U.S.," News release, September 28, 2021, https://www.meyerburger.com/en/newsroom/artikel/meyer-burger-to-develop-400-mw-high-performance-solar-module-manufacturing-facility-in-the-us, retrieved September 29, 2021; Office of the Governor, State of Georgia, "Gov. Kemp: Solar Tech Company NanoPV to Open Manufacturing, Distribution Operations in Sumter County, Create Over 500 Jobs," News release, October 7, 2021, https://gov.georgia.gov/press-releases/2021-10-07/gov-kemp-solar-tech-company-nanopv-open-manufacturing-distribution, retrieved October 13, 2021; Associated Press, "Solar Panel Maker Plans $36M Georgia factory, Hiring 500," October 7, 2021, https://apnews.com/article/technology-business-americus-georgia-daf05d0b3dd7e4e7a2b6b7566c695d92, retrieved October 13, 2021; Sumter County Development Authority, "NanoPV Solar to Become the Largest Solar Panel Manufacturer in U.S. at the Ted Baldwin Business and Technology Park, Sumter County, Georgia, Creating 500 Jobs," News release, October 7, 2021, https://www.selectsumter.com/nanopv, retrieved October 13, 2021; Pickerel, Kelly, "After Company Acquisition, REC Now Has Backing to Open 1-GW Module Assembly Facility in USA," *Solar Power World*, October 12, 2021, https://www.solarpowerworldonline.com/2021/10/after-company-acquisition-rec-now-has-backing-to-open-1-gw-module-assembly-facility-in-usa/, retrieved October 12, 2021.

Note: This table is based on publicly available information as of October 15, 2021. Information on producers of off-grid products is not included.

U.S. policies[111]

There were changes during 2018–20 to two of the major federal policies that promote solar energy: the Investment Tax Credit ("ITC") and the Public Utilities Regulatory Act ("PURPA"). The investment tax credit was established in 2005 and has been extended multiple

[111] See Part II for additional discussion of U.S. policies.

times thereafter. The most recent extension of the investment tax credit was in the Consolidated Appropriation Act in 2020. It allows a 26 percent tax credit for projects that begin construction through 2022. The credits decline to 22 percent in 2023. The projects must be completed by December 31, 2025 to qualify for these rates. For projects that start construction after 2023, the tax credit is 10 percent for commercial and utility projects. There is no tax credit for residential projects that start construction after 2023.[112]

In 2020 and 2021, the IRS extended, due to COVID-19 related disruptions, previous ITC deadlines. In May 2020, the IRS added an extra year to the four year "Continuity Safe Harbor" deadline to complete projects started in 2016 and 2017. In June 2021, the IRS extended it to six years for projects that started construction during 2016–19 and to five years for projects that started construction in 2020.[113]

PURPA mandates certain utilities purchase solar-generated electric power from qualifying facilities (for solar, those of a certain size) at the utility's avoided cost.[114] On July 16, 2020, the Federal Energy Regulatory Commission ("FERC") modified the PURPA rules by adjusting qualifying facility rates (the rules were effective 120 days after publication in the Federal Register).[115] In addition, the net capacity for most qualifying facilities (including all solar facilities) was lowered from at or below 20 megawatts ("MW") down to 5 MW and the new rules made it more challenging for facilities in close proximity to qualify as separate facilities.

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[112] The legislation was signed by the President on December 27, 2020. KPMG, "Favorable Tax Provisions for Renewable Energy Industry Enacted," December 30, 2020, https://home.kpmg/us/en/home/insights/2020/12/tnf-favorable-tax-provisions-renewable-energy-industry-enacted.html, retrieved September 30, 2021.

[113] In 2020, the IRS also provided a 3½ Month Safe Harbor for property and services. IRS, "Treasury, IRS Provide Safe Harbor for Taxpayers That Develop Renewable Energy Projects," May 27, 2020, https://www.irs.gov/newsroom/treasury-irs-provide-safe-harbor-for-taxpayers-that-develop-renewable-energy-projects, retrieved November 18, 2021; IRS, "Treasury, IRS Extend Safe Harbor for Renewable Energy Projects," June 29, 2021, https://www.irs.gov/newsroom/treasury-irs-extend-safe-harbor-for-renewable-energy-projects, retrieved June 29, 2021.

[114] 85 FR 86656

[115] The rule changes grant states three main flexibilities: (1) the ability to require that energy rates (but not capacity rates) in qualifying facility power sales contracts and other legally enforceable obligations vary in accordance with changes in the purchasing utility's avoided costs at the time the energy is delivered; (2) the ability to allow qualifying facilities to retain their rights to fixed energy rates (which could be based on the contract term's projected energy prices); and (3) the ability to set "as available" qualifying facilities energy rates for selling to electric utilities located in organized wholesale power markets at the locational marginal price ("LMP") in those markets (subjected to rebuttable presumption that the LMP represents the as-available avoided costs of utilities located in those markets), at competitive prices from liquid market hubs, or from a formula based on natural-gas prices indices and heat rates.

At the state level, there are many policies established to advance the growth of solar energy, including:

- Renewable Portfolio Standards ("RPS"): At the state level, 30 states plus the District of Columbia and 2 territories had RPS[116] in 2020.[117] According to an August 2021 summary, since 2018, 15 states and 2 territories had passed legislation to increase or expand their renewable or clean-energy targets. However, seven states and one territory have allowed their RPS targets to expire, and four states have RPS targes that will expire in 2021. [118]
- Net Metering:[119] The number of states with mandatory net metering rules declined from 44 and the District of Columbia in 2015 to 39 and the District of Columbia as of October 2019, with 5 of these states in the process of transitioning to other policies.[120] The landscape was largely the same as of August 2021, with the exception that New York added net metering rules for large customer-generators.[121]
- Virtual Net Metering was developed for customers who can own a share of an offsite solar energy project and receive compensation for their share of the energy it produces.[122]

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[116] An RPS is a regulatory mandate that requires entities that supply electricity, such as utility companies, to generate or buy a portion of their retail electricity sales from renewable energy sources, including solar.

[117] RPS are often "accompanied by a tradable renewable energy certificate (REC) program to facilitate compliance." Barbose, Galen, "U.S. Renewables Portfolio Standards 2021 Status Update: Early Release," February 2021, p. 9, https://eta-publications.lbl.gov/sites/default/files/rps_status_update-2021_early_release.pdf, retrieved November 18,2021.

[118] National Conference of State Legislatures ("NCSL"), "State Renewable Portfolio Standards and Goals, August 13, 2021, https://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx, retrieved September 15, 2021.

[119] Net metering allows residential and commercial customers that generate their own electricity from solar to receive credit for excess electricity fed into the grid. Residential and commercial customers can use this credit to offset the cost of grid electricity used when their CSPV system does not generate enough electricity to cover their needs.

[120] DSIRE, "Net Metering," October 2019, https://s3.amazonaws.com/ncsolarcen-prod/wp-content/uploads/2019/10/DSIRE_Net_Metering_Oct2019.pdf, retrieved November 11, 2019; DSIRE, "Net Metering," March 2015, https://s3.amazonaws.com/ncsolarcen-prod/wp-content/uploads/2015/04/Net-Metering-Policies.pptx, retrieved November 11, 2019.

[121] DSIRE, "Net Metering," August 2021, https://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2021/08/DSIRE_Net_Metering_August2021.pdf, retrieved September 30, 2021.

[122] National Renewable Energy Laboratory ("NREL"), "State, Local, & Tribal Governments, Net Metering" https://www.nrel.gov/state-local-tribal/basics-net-metering.html, retrieved September 30, 2021.

- Third-Party Financing in the form of a power purchase agreement ("PPA") or solar leases: in a PPA, the solar project is financed by a third party and the guarantor agrees to pay a specific rate each month; by contrast a customer who signs a solar lease agrees to pay a monthly rate for the use of the PV system (the cost covers the system rather than electricity cost and the leases typically range from 10 to 20 years). As of August 2021, 29 states along with Washington, DC, and Puerto Rico allow for PPAs.[123]
- California Solar Roof Mandate: Starting in 2020, PV modules are required for all new residential buildings, with certain exceptions.[124]
- Clean Energy Funds ("CEF"): Funded by a small surcharge on electricity consumption, voluntary donations, and utility settlements. CEFs predominately provide funding for renewable energy projects, support rebate programs for renewable energy systems, and provide loan support.[125] For example, the Mass Solar Loan program in Massachusetts offers low-interest loans for solar installations.[126]

Several policy changes in June 2021 limit trade with firms that engage in forced labor. The U.S. Department of Labor added polysilicon to the list of goods made with forced labor on June 24, 2021.[127] On the same day, U.S. Customs and Border Protection issued a Withhold Release Order (WRO) against Hoshine Silicon Industry Co. Ltd. due to its use of forced labor. The WRO applies to "silica-based products made by Hoshine and its subsidiaries as well as to materials and goods (such as polysilicon) derived from or produced using those silica-based

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[123] DSIRE, "3rd Party Solar PV Power Purchase Agreement," August 2021, https://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2021/08/DSIRE_3rd-Party-PPA_Aug_2021.pdf, retrieved September 30, 2021; Solar Energy Industries Association ("SEIA"), "Third Party Solar Financing," https://www.seia.org/initiatives/third-party-solar-financing, retrieved October 7, 2021.

[124] Gheorghiu, Lulia, "New California Building Standards Integrate 2020 Rooftop Solar Mandate," *Utility Dive*, December 7, 2018, https://www.utilitydive.com/news/new-california-building-standards-integrate-2020-rooftop-solar-mandate/543803/, retrieved November 11, 2019.

[125] NREL, "Federal and State Structures to Support Financing Utility-Scale Solar Projects and the Business Models Designed to Utilize Them," April 2012, http://www.nrel.gov/docs/fy12osti/48685.pdf, retrieved October 7, 2021.

[126] MASS Solar Loan, Program Metrics, https://www.masssolarloan.com/program-metrics, retrieved September 21, 2021.

[127] U.S. Department of Labor, "US Department of Labor Adds Polysilicon from China to 'List of Goods Produced by Child Labor or Forced Labor,'" June 24, 2021, https://www.dol.gov/newsroom/releases/ILAB/ILAB20210624, retrieved October 8, 2021.

products."[128] Finally, on the same day the U.S. Department of Commerce, Bureau of Industry and Security added Xinjiang GCL New Energy Material Technology, Co. Ltd; Xinjiang Daqo New Energy, Co. Ltd; Xinjiang East Hope Nonferrous Metals Co. Ltd.; Hoshine Silicon Industry (Shanshan) Co., Ltd.; and Xinjiang Production and Construction Corps to the Entity List" due to their use of forced labor.[129] The "Entity List restrictions prohibit exports, re-exports and transfers of commodities, software and technology subject to the Export Administration Regulations (EAR) to listed entities without a license."[130]

U.S. installations[131]

U.S. PV installations, including out-of-scope thin film products, increased from 10.8 GW in 2018 to 19.2 GW in 2020, according to WoodMackenzie (WoodMac)/SEIA data (table I-12). The utility segment, according to WoodMac and SEIA, increased from 6.1 GW in 2018 to 14.0 GW in 2020 and rose from 57 percent to 73 percent of installations.[132] According to the U.S. Energy Information Administration (EIA), U.S. CSPV utility installations, excluding out-of-scope thin film products, decreased from 5.1 GW in 2018 to 4.9 GW in 2019, then increased to 10.4 GW in 2020.[133] The residential market segment, according to WoodMac/SEIA data, increased from 2.4 GW to 3.2 GW, though it declined from 23 percent of the market to 17 percent. The

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[128] This includes cells and modules using materials from Hoshine. U.S. Customs and Border Protection, "The Department of Homeland Security Issues Withhold Release Order on Silica-Based Products Made by Forced Labor in Xinjiang," News release, June 24, 2021, https://www.cbp.gov/newsroom/national-media-release/department-homeland-security-issues-withhold-release-order-silica, retrieved October 8, 2021. DLA Piper, "Impact on the US Solar, Silicon and Related Industries of New US Government Actions Aimed to Address Labor Practices in Xinjiang," July 6, 2021, https://www.dlapiper.com/en/us/insights/publications/2021/07/new-us-government-actions-on-forced-labor-in-xinjiang/, retrieved October 8, 2021.

[129] 86 FR 33119.

[130] DLA Piper, "Impact on the US Solar, Silicon and Related Industries of New US Government Actions Aimed to Address Labor Practices in Xinjiang," July 6, 2021, https://www.dlapiper.com/en/us/insights/publications/2021/07/new-us-government-actions-on-forced-labor-in-xinjiang/, retrieved October 8, 2021.

[131] U.S. installation are not a proxy for apparent consumption of modules due to differences in timing between when a module is shipped and when it is installed. See Modification report, p. D-4.

[132] WoodMac and SEIA data from Bolinger, Mark, Joachim Seel, Cody Warner, and Dana Robson, *Utility-Scale Solar, 2021 Edition*, Lawrence Berkeley National Laboratory, October 2021, data file, https://emp.lbl.gov/utility-scale-solar, retrieved October 6, 2021.

[133] U.S. Department of Energy, Energy Information Administration, 2020 Form EIA-860 Data - Schedule 3, 'Solar Technology Data' (Operable Units Only), 2020, https://www.eia.gov/electricity/data/eia860/, retrieved October 6, 2021.

nonresidential sector declined from 20 percent of the market to 17 percent of the market.[134] U.S. PV installation forecasts vary, but most forecasts project U.S. installations of more than 24 GW 2021 and an average of more than 25 GW in annual installations during 2022–25.[135]

Table I-12
CSPV products: U.S. PV installations, by period and sector

Installations in megawatts

Year	Residential	Nonresidential	Utility	Total
2018	2,436	2,200	6,119	10,755
2019	2,865	2,157	8,462	13,484
2020	3,194	2,074	13,953	19,221

Source: WoodMac and SEIA data from Bolinger, Mark, Joachim Seel, Cody Warner, and Dana Robson, *Utility-Scale Solar, 2021 Edition*, Lawrence Berkeley National Laboratory, October 2021, data file, https://emp.lbl.gov/utility-scale-solar, retrieved October 6, 2021.

Summary data

A summary of data collected on CSPV products in this proceeding is presented in appendix C. Except as noted, U.S. industry data are based on the questionnaire responses of 14 firms that are estimated to have accounted for all known U.S. capacity to produce CSPV cells and approximately 81.0 percent of known U.S. capacity to produce CSPV modules during 2020 and all known U.S. capacity to produce CSPV cells and 78.9 percent of U.S. capacity to produce CSPV modules during the first half of 2021.[136] U.S. import data and related information are

[134] WoodMac and SEIA data from Bolinger, Mark, Joachim Seel, Cody Warner, and Dana Robson, *Utility-Scale Solar, 2021 Edition*, Lawrence Berkeley National Laboratory, October 2021, data file, https://emp.lbl.gov/utility-scale-solar, retrieved October 6, 2021.

[135] WoodMac and SEIA data from Bolinger, Mark, Joachim Seel, Cody Warner, and Dana Robson, *Utility-Scale Solar, 2021 Edition*, Lawrence Berkeley National Laboratory, October 2021, data file, https://emp.lbl.gov/utility-scale-solar, retrieved October 6, 2021; U.S. Department of Energy, Energy Information Administration, Short Term Energy Outlook Data Browser, https://www.eia.gov/outlooks/steo/data/browser/#/?v=25&f=A&s=0&maptype=0&ctype=linechart, retrieved October 6, 2021; Eckhouse, Brian, "Renewables Buildout to Fall Short of Biden's Climate Goal," Bloomberg Green, April 9, 2021; EnergyTrend, "TrendForce: Global PV Demand Will Reach 158GW for 2021 as Many Regional Markets Rebound, but Risks Remain as Subsidies Drop," January 1, 2021, https://www.energytrend.com/research/20210121-20804.html, retrieved October 6, 2021; Chang, Mars, "Global PV installations to surpass 150 GW in 2021," PV Magazine, February 16, 2021, https://www.pv-magazine.com/2021/02/16/global-pv-installations-to-surpass-150-gw-in-2021/, retrieved October 6, 2021.

[136] Estimates are based on a comparison of U.S. producers' reported capacity to produce CSPV cells and modules during 2020 (*** MW (cells) and 3.8 GW (modules)) and the first six months of 2021 (*** MW (cells) and 1.8 GW (modules)) with the total estimated U.S. capacity to produce cells and modules during 2020 (*** MW (cells) and 4.69 GW (modules)) and the first six months of 2021 (*** MW (cells) (continued...)

based on the questionnaire responses of 50 firms that are estimated to have accounted for 66.5 percent of U.S. imports of CSPV cells and CSPV modules during 2020.[137]

U.S. market participants

U.S. producers[138]

The Commission sent U.S. producers' questionnaires to 64 firms identified by the Commission as possible U.S. producers of CSPV cells and/or modules. The Commission received usable responses from 14 firms reporting domestic production of CSPV products since January 1, 2018.[139]

Presented in table I-13 is a list of responding domestic producers and each company's position on the safeguard measures, production locations, and share of reported production of CSPV products during 2020. Additional information regarding U.S. producers' production, shipment, and employment is presented in Part III of this report.

(…continued)

and 2.28 GW (modules)), as calculated by Commission staff using publicly available capacity estimates for known non-responding U.S. producers.

[137] The estimate is based on a comparison of the total value of 2020 U.S. imports of CSPV cells and modules from all countries reported in the responses to the Commission's U.S. importer questionnaires ($6.1 billion) with total landed-duty paid value ($9.2 billion) of 2020 U.S. imports of CSPV cells and modules as reported by official Commerce import statistics (HTS 8541.40.6015, 8541.40.6020, 8541.40.6025, 8541.40.6030, 8541.40.6035, 8541.40.6045). Questionnaire data coverage presented may be slightly understated because the official Commerce statistics may include other products not within the scope of this proceeding, such as thin film solar products. Import data compiled from official U.S. import statistics using HTS statistical reporting numbers 8541.40.6015, 8541.40.6020, 8541.40.6025, 8541.40.6030, 8541.40.6035, and 8541.40.6045 are presented in appendix H.

[138] In the safeguard proceeding, the Commission defined the domestic industry as all U.S. producers of CSPV cells (whether or not partially or fully assembled into other products), including integrated producers of CSPV cells and modules and independent module producers. Crystalline Silicon Photovoltaic Cells (Whether or not Partially or Fully Assembled into Other Products), Inv. No. TA-201-75, USITC Publication 4739, November 2017, vol. I ("Safeguard publication"), p. 18.

[139] While separate U.S. producer questionnaires were submitted for SunPower (pre-acquisition) and SunPower (post-acquisition), they represent the same underlying facility and are, where applicable, counted as a single U.S. producer. Suniva is not currently producing CSPV products ***. However, in its petition it states that "…its productive assets still exist at the same facility in Norcross, Georgia and Suniva's investment plans will allow it to quickly resume production if the economic headwinds that have stifled these investment plans subside." Auxin and Suniva's petition, p. 2, fn. 2.

The following companies reported that they have not produced CSPV products in the United States since January 1, 2018: ***.

Table I-13
CSPV products: U.S. producers, their positions on the extension of the safeguard measures, locations of production, and share of reported production, 2020

Shares in percent

Firm	Position on extension	Production location(s)	Share of production of cells	Share of production of modules
Auxin	***	San Jose, CA	***	***
Hanwha	***	Dalton, GA	***	***
Heliene	***	Mountain Iron , MN Riviera Beach, FL	***	***
Jinko	***	Jacksonville, FL	***	***
LG	***	Huntsville, AL	***	***
Mission	***	San Antonio, TX	***	***
Panasonic	***	Buffalo, NY	***	***
PowerFilm	***	Ames, IA	***	***
SBM	***	Concord, NC	***	***
Silfab	***	Bellingham, WA Burlington, WA	***	***
Suniva	***	Norcross, GA	***	***
SunPower Pre-acquisition	***	Hillsboro, OR	***	***
SunPower Post-acquisition	***	Hillsboro, OR	***	***
Tesla	***	Buffalo, NY Fremont, CA	***	***
Yingli	***	San Antonio, TX	***	***
All firms	Various	Various	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Note: ***.

U.S. producers' ownership and related or affiliated firms

Table I-14 presents information on U.S. producers' ownership, related and/or affiliated firms. Seven U.S. producers (***) reported related foreign producers of CSPV products at some point since January 1, 2018 and all *** responding U.S. producers reported either related U.S. importers of CSPV products or were themselves direct importers of CSPV products. U.S. producers' direct imports of CSPV products are discussed in greater detail in Part III and appendix F.

Table I-14
CSPV products: U.S. producers' ownership and related and/or affiliated firms

Reporting firm	Relationship type and related firm	Details of relationship
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***

Reporting firm	Relationship type and related firm	Details of relationship
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***

Reporting firm	Relationship type and related firm	Details of relationship
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***

Reporting firm	Relationship type and related firm	Details of relationship
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***
***	***	***

Reporting firm	Relationship type and related firm	Details of relationship
***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: "N/A" indicates a response was not given for that element.

U.S. importers

The Commission sent U.S. importers' questionnaires to 264 firms identified by the Commission as possible U.S. importers of CSPV cells and/or modules.[140] Questionnaire responses containing usable data were received from 50 firms and are estimated to have accounted for 66.5 percent of U.S. imports of CSPV cells and CSPV modules during 2020.[141] U.S. import data were reported by U.S. importers in their questionnaire responses during January 2018-June 2021 from the following countries: Cambodia, Canada, China, Germany, India, Indonesia, Japan, Korea, Malaysia, Mexico, Netherlands, Philippines, Singapore, Taiwan, Thailand, Turkey, and Vietnam. Table I-15 lists all responding U.S. importers of CSPV products, their U.S. headquarters, and their share of the quantity of total U.S. imports during 2020.[142]

[140] The following firms reported that they have not imported CSPV products since January 1, 2018: ***.

[141] The estimate is based on a comparison of the total value of 2020 U.S. imports of CSPV cells and modules from all countries reported in the responses to the Commission's U.S. importer questionnaires ($6.1 billion) with total landed-duty paid value ($9.2 billion) of 2020 U.S. imports of cells and modules as reported by official Commerce import statistics (HTS 8541.40.6015, 8541.40.6020, 8541.40.6025, 8541.40.6030, 8541.40.6035, 8541.40.6045). Questionnaire data coverage presented may be slightly understated because the official Commerce statistics may include other products not within the scope of this proceeding, such as thin film solar products.

[142] Nineteen firms reported importing cells, and 41 firms reported importing modules. Eleven firms reported importing both cells and modules.

Table I-15
CSPV products: U.S. importers, their headquarters, and share of total imports from all sources, 2020

Shares in percent

Firm	Headquarters	CSPV cells	CSPV modules	CSPV products
Alps	Walnut, CA	***	***	***
Auxin	San Jose, CA	***	***	***
Axitec	Logan Township, NJ	***	***	***
BayWa	Irvine, CA	***	***	***
BYD	Los Angeles, CA	***	***	***
Cantex	Houston, TX	***	***	***
Canadian Solar	Walnut Creek, CA	***	***	***
Carmanah Technologies	Victoria, BC	***	***	***
Chamberlain Group	Oak Brook, IL	***	***	***
Cypress Creek	Santa Monica, CA	***	***	***
EDF Renewables	San Diego, CA	***	***	***
EDP Renewables	Houston, TX	***	***	***
First Solar	Tempe, AZ	***	***	***
GCL System	San Ramon, CA	***	***	***
Hanwha America	Irvine, CA	***	***	***
Hanwha	Dalton, GA	***	***	***
Hanwha Irvine	Irvine, CA	***	***	***
Heliene	Sault Ste. Marie, ON	***	***	***
JA Solar	San Jose, CA	***	***	***
Jinko	Jacksonville, FL	***	***	***
Jinko US	San Francisco, CA	***	***	***
LG	Englewood Cliffs, NJ	***	***	***
LONGi	San Ramon, CA	***	***	***
Merlin Solar	San Jose, CA	***	***	***
Mission	San Antonio, TX	***	***	***
NextEra	Juno Beach, FL	***	***	***
Nishati	Gilbert, AZ	***	***	***

Table continued.

Table I-15 Continued
CSPV products: U.S. importers, their headquarters, and share of total imports from all sources, 2020

Shares in percent

Firm	Headquarters	CSPV cells	CSPV modules	CSPV products
Panasonic	Buffalo, NY	***	***	***
Panasonic Life	Newark, NZ	***	***	***
PowerFilm	Ames, IA	***	***	***
Rdk Products	Buford, GA	***	***	***
REC Americas	Pismo Beach, CA	***	***	***
Risen	San Jose, CA	***	***	***
SBM	Concord, NC	***	***	***
Silfab	Mississauga, ON	***	***	***
Silfab WA	Bellingham, WA	***	***	***
Solartech Power	Ontario, CA	***	***	***
Sonali Energees	Closter, NJ	***	***	***
Sunergy	Bac Giang, Vietnam	***	***	***
Sunforce	Montreal West, QC	***	***	***
SunPower CA	San Jose, CA	***	***	***
SunPower Corporation	Richmond, CA	***	***	***
SunPower Pre-acquisition	Hillsboro, OR	***	***	***
SunPower Post-acquisition	Hillsboro, OR	***	***	***
Tesla	Palo Alto, CA	***	***	***
Trina	Fremont, CA	***	***	***
Whitestone	Houston, TX	***	***	***
Winaico	Des Plaines, IL	***	***	***
Yingli	Philadelphia, PA	***	***	***
Yingli Renewable	Philadelphia, PA	***	***	***
All firms	Various	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

U.S. purchasers

The Commission received 55 usable questionnaire responses from firms that purchased CSPV products since February 7, 2018.[143] [144] Twenty-nine of the responding purchasers identified as utility companies/developers, 19 are commercial installers, 8 are residential installers, 8 are distributors, three are module assemblers, and 12 identified as "other" firm types, including a developer/owner of commercial, residential, industrial and small-scale utility projects (***), a developer/owner of commercial, industrial and small-scale utility projects (***), a utility company/developer/financier (***), a solar project developer (***), a commercial an distributed generation developer (***), an end user and retailer (***), an engineering corporation (***), an "operator" (***), a module manufacturer (***), an importer/distributor (***), and an "EPC of utility scale and rooftop solar" (***).

The largest purchasers of CSPV cells during the period were ***, which accounted for *** percent of all cell purchases in 2020, followed by ***, which accounted for *** percent of cell purchases in 2020.[145] The largest purchaser of CSPV modules in 2020 was ***. *** accounted for *** percent of reported module purchases in 2020. The next largest purchasers of modules were ***, which collectively accounted for *** percent of reported module purchases in 2020.[146]

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[143] Of the 55 responding purchasers, one purchased domestic CSPV cells, three purchased imports of cells, 18 purchased domestic CSPV modules, and 54 purchased imports of modules.

[144] For firms that purchased imported cells, the reported sources were China, Korea, Malaysia, Taiwan, Thailand, and Vietnam (one firm each). For firms that purchased imported modules, the reported sources were Vietnam (43 firms); Malaysia (29 firms); Korea (26 firms); Thailand (21 firms); China and Singapore (11 firms each); India (7 firms); Cambodia (6 firms); Canada and Turkey (4 firms each); Japan and Taiwan (3 firms each); Germany, Italy, and the Philippines (2 firms each); and Indonesia, Mexico, and Spain (1 firm each).

[145] *** was the only purchaser of domestic cells during the period. It accounted for *** percent of all cell purchases in 2020.

[146] ***.

(continued…)

Among the responding end user purchasers (i.e. installers or utility firms), 84.5 percent of their total projects completed in 2020 were estimated to be in the utility sector, while 8.6 percent were in the commercial sector, and 6.1 percent were in the residential sector.[147] For purchasers that were distributors, they estimated that 48.7 percent of their 2020 resales were to residential installers, 35.0 percent were to commercial installers, and 16.3 percent were to utility installers/developers.

Table I-16 presents purchasers' purchases in 2020, by market and purchaser type.

Table I-16
CSPV products: Purchasers' purchases in 2020, by market and purchaser type

Quantity in kilowatts; Shares down in percent

Market	Measure	End users	Distributors	All purchaser types
Residential	Quantity	***	***	***
Commercial	Quantity	***	***	***
Utility	Quantity	***	***	***
Unknown	Quantity	***	***	***
All markets	Quantity	***	***	***
Residential	Share	***	***	***
Commercial	Share	***	***	***
Utility	Share	***	***	***
Unknown	Share	***	***	***
All markets	Share	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---".

(continued…)

The largest purchaser of domestically manufactured modules was ***, which accounted for *** percent of such purchases in 2020. ***. The largest purchaser of modules from import sources was ***, which accounted for *** percent of such purchases in 2020 and *** percent of such purchases throughout the period.

[147] Firms reported that 0.7 percent were for unknown sectors.

Scope of the safeguard remedy

Presidential Proclamation 9693 of January 23, 2018

According to Presidential Proclamation 9693,[148] the President's remedy covers the following CSPV products effective with respect to goods entered, or withdrawn from warehouse for consumption, on or after February 7, 2018, and through February 6, 2022:

> *(a) solar cells, whether or not assembled into modules or made up into panels. . .;*
> *(b) parts or subassemblies of solar cells. . .;*
> *(c) inverters or batteries with CSPV cells attached. . .; and*
> *(d) DC generators with CSPV cells attached. . .*
>
> *. . . the term "crystalline silicon photovoltaic cells" ("CSPV cells") means crystalline silicon photovoltaic cells of a thickness equal to or greater than 20 micrometers, having a p/n junction (or variant thereof) formed by any means, whether or not the cell (or subassemblies thereof. . .) has undergone other processing, including, but not limited to, cleaning, etching, coating, and/or addition of materials (including, but not limited to, metallization and conductor patterns) to collect and forward the electricity that is generated by the cell. Such cells include photovoltaic cells that contain crystalline silicon in addition to other photovoltaic materials. This includes, but is not limited to, passivated emitter rear contact cells, heterojunction with intrinsic thin-layer cells, and other so-called hybrid cells. . . .{Included are} goods presented in cell form and which at the time of importation are not presented assembled into circuits, laminates or modules or made up into panels.*
>
> *. . . the term "modules" . . . is a joined group of CSPV cells . . . regardless of the number of cells or the shape of the joined group, that are capable of generating electricity. Also included as a "module" are goods each known as a "panel" comprising a CSPV cell that has undergone any processing, assembly, or interconnection (including, but not limited to, assembly into a laminate). Such CSPV cells assembled into modules or made up into panels include . . . (i) CSPV cells which are presented attached to inverters or batteries . . .; and (ii) CSPV cells classifiable as DC generators . . .*
>
> *{The remedy} . . . shall not cover--*
>
> *(1) thin film photovoltaic products produced from amorphous silicon ("a-Si"), cadmium telluride ("CdTe"), or copper indium gallium selenide ("CIGS");*

[148] 83 FR 3541, January 23, 2018.

(2) CSPV cells, not exceeding 10,000 mm^2 in surface area, that are permanently integrated into a consumer good whose primary function is other than power generation and that consumes the electricity generated by the integrated CSPV cell. Where more than one CSPV cell is permanently integrated into a consumer good, the surface area for purposes of this exclusion shall be the total combined surface area of all CSPV cells that are integrated into the consumer good; and

(3) CSPV cells, whether or not partially or fully assembled into other products, if such CSPV cells were manufactured in the United States.

{The remedy} . . . shall likewise not cover the following goods, . . .:

(1) 10 to 60 watt, inclusive, rectangular solar panels, where the panels have the following characteristics: (A) length of 250 mm or more but not over 482 mm or width of 400 mm or more but not over 635 mm, and (B) surface area of 1000 cm^2 or more but not over 3,061 cm^2, provided that no such panel with those characteristics shall contain an internal battery or external computer peripheral ports at the time of entry;

(2) 1 watt solar panels incorporated into nightlights that use rechargeable batteries and have the following dimensions: 58 mm or more but not over 64 mm by 126 mm or more but not over 140 mm;

(3) 2 watt solar panels incorporated into daylight dimmers, that may use rechargeable batteries, such panels with the following dimensions: 75 mm or more but not over 82 mm by 139 mm or more but not over 143 mm;

(4) off-grid and portable CSPV panels, whether in a foldable case or in rigid form containing a glass cover, where the panels have the following characteristics:

(A) a total power output of 100 watts or less per panel;
(B) a maximum surface area of 8,000 cm^2 per panel;
(C) do not include a built-in inverter;
(D) where the panels have glass covers, such panels must be in individual retail packaging (for purposes of this provision, retail packaging typically includes graphics, the product name, its description and/or features, and foam for transport);

(5) 3.19 watt or less solar panels, each with length of 75 mm or more but not over 266 mm and width of 46 mm or more but not over 127 mm, with surface area of 338 cm^2 or less, with one black wire and one red wire (each of type 22 AWG or 24 AWG) not more than 206 mm in length when measured from panel edge, provided that no such panel shall contain an internal battery or external computer peripheral ports;

(6) 27.1 watt or less solar panels, each with surface area less than 3,000 cm^2 and coated across the entire surface with a polyurethane doming resin, the foregoing joined to a battery charging and maintaining unit, such unit which is an acrylonitrile butadiene styrene ("ABS") box that incorporates a light emitting diode ("LED") by coated wires that include a connector to permit the incorporation of an extension cable.

Additional exclusions of September 19, 2018

Pursuant to authority provided by the President, the U.S. Trade Representative ("USTR") determined that the following additional products should be excluded from the safeguard measure applied to certain solar products, effective with respect to goods entered, or withdrawn from warehouse for consumption, on or after September 19, 2018:[149]

(7) off-grid, 45 watt or less solar panels, each with length not exceeding 950 mm and width of 100 mm or more but not over 255 mm, with a surface area of 2,500 cm^2 or less, with a pressure-laminated tempered glass cover at the time of entry but not a frame, electrical cables or connectors, or an internal battery;

(8) 4 watt or less solar panels, each with a length or diameter of 70 mm or more but not over 235 mm, with a surface area not exceeding 539 cm^2, and not exceeding 16 volts, provided that no such panel with these characteristics shall contain an internal battery or external computer peripheral ports at the time of entry;

(9) solar panels with a maximum rated power of equal to or less than 60 watts, having the following characteristics, provided that no such panel with those characteristics shall contain an internal battery or external computer peripheral ports at the time of entry: (A) Length of not more than 482 mm and width of not more than 635 mm or (B) a total surface area not exceeding 3,061 cm^2;

(10) flexible and semi-flexible off-grid solar panels designed for use with motor vehicles and boats, where the panels range in rated wattage from 10 to 120 watts, inclusive;

(11) frameless solar panels in a color other than black or blue with a total power output of 90 watts or less where the panels have a uniform surface without visible solar cells or busbars;

(12) solar cells with a maximum rated power between 3.4 and 6.7 watts, inclusive, having the following characteristics: (A) A cell surface area between 154 cm^2 and 260 cm^2, inclusive, (B) no visible busbars or gridlines on the front of the cell, and (C)

[149] 83 FR 47393, September 19, 2018.

more than 100 interdigitated fingers of tin-coated solid copper adhered to the back of the cell, with the copper portion of the metal fingers having a thickness of greater than 0.01 mm;

(13) solar panels with a maximum rated power between 320 and 500 watts, inclusive, having the following characteristics: (A) Length between 1,556 mm and 2,070 mm inclusive, and width between 1,014 mm and 1,075 mm, inclusive, (B) where the solar cells comprising the panel have no visible busbars or gridlines on the front of the cells, and (C) the solar cells comprising the panel have more than 100 interdigitated fingers of tin-coated solid copper adhered to the back of the cells, with the copper portion of the metal fingers having thickness greater than 0.01 mm;

(14) modules . . . incorporating only CSPV cells that are products of the United States and not incorporating any CSPV cells that are the product of any other country.

Additional exclusions of June 13, 2019

On June 13, 2019, the USTR announced its determination to grant the following additional exclusion requests, effective with respect to goods entered, or withdrawn from warehouse for consumption, on or after June 13, 2019:[150]

(15) bifacial solar panels that absorb light and generate electricity on each side of the panel and that consist of only bifacial solar cells that absorb light and generate electricity on each side of the cells;

(16) flexible fiberglass solar panels without glass components other than fiberglass, such panels having power outputs ranging from 250 to 900 watts;

(17) solar panels consisting of solar cells arranged in rows that are laminated in the panel and that are separated by more than 10 mm, with an optical film spanning the gaps between all rows that is designed to direct sunlight onto the solar cells, and not including panels that lack said optical film or only have a white or other backing layer that absorbs or scatters sunlight.

Presidential Proclamation 10101 of October 10, 2020

Following receipt of the Commission's monitoring and modification reports, the President issued Proclamation 10101, effective October 10, 2020, revoking the exclusion

[150] 84 FR 27684, June 13, 2019.

previously applied to bifacial modules (i.e., exclusion (15) above, effective with respect to articles entered for consumption, or withdrawn from a warehouse for consumption, on or after October 25, 2020) and increasing the duty on cells entered in excess of the TRQ, and the duty on modules, from 15 percent to 18 percent in the fourth year of the safeguard action.[151] On November 16, 2021, the CIT issued a decision setting aside Proclamation 10101 as null and void, on the grounds that it was outside the President's delegated statutory authority.[152]

[151] *To Further Facilitate Positive Adjustment to Competition From Imports of Certain Crystalline Silicon Photovoltaic Cells (Whether or Not Partially or Fully Assembled Into Other Products),* Proclamation 10101, 85 FR 65639, October 16, 2020.

[152] *Solar Energy Industry Associations v. United States*, Slip Op. 21-154 (Ct. Int'l Trade Nov. 16, 2021.

The safeguard measure

In Presidential Proclamation 9693 of January 23, 2018,[153] the President imposed a safeguard measure on CSPV products for a period of four years beginning on February 7, 2018, in the form of (1) a TRQ on imports of solar cells not partially or fully assembled into other products and (2) an increase in duties on imports of solar modules. The safeguard measure is applicable to imports from all countries, except for imports from certain developing countries that are members of the WTO, as long as such a country's share of total imports of the product, based on imports during a recent representative period, does not exceed 3 percent, provided that imports that are the product of all such countries with less than 3 percent import share collectively account for not more than 9 percent of total imports of the product.[154]

Tariff-rate quota under the safeguard measure

The safeguard measure imposed a TRQ on imports of solar cells not partially or fully assembled into other products ("CSPV cells") for a period of four years, with unchanging within-quota quantities and annual reductions in the rates of duty applicable to goods entered in excess of those quantities in the second, third, and fourth years. The annual aggregate in-quota

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[153] 83 FR 3541, January 25, 2018.

[154] The countries listed in Presidential Proclamation 9693 as developing countries that are WTO members and not subject to the safeguard duties or TRQ are: Afghanistan, Albania, Algeria, Angola, Armenia, Azerbaijan, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Burkina Faso, Burma, Burundi, Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo (Brazzaville), Congo (Kinshasa), Cote d'Ivoire, Djibouti, Dominica, Ecuador, Egypt, Eritrea, Ethiopia, Fiji, Gabon, The Gambia, Georgia, Ghana, Grenada, Guinea, Guinea-Bissau, Guyana, Haiti, India, Indonesia, Iraq, Jamaica, Jordan, Kazakhstan, Kenya, Kiribati, Kosovo, Kyrgyzstan, Lebanon, Lesotho, Liberia, Macedonia, Madagascar, Malawi, Maldives, Mali, Mauritania, Mauritius, Moldova, Mongolia, Montenegro, Mozambique, Namibia, Nepal, Niger, Nigeria, Pakistan, Papua New Guinea, Paraguay, Rwanda, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, Senegal, Serbia, Sierra Leone, Solomon Island, Somalia, South Africa, South Sudan, Sri Lanka, Suriname, Swaziland, Tanzania, Timor-Leste, Togo, Tonga, Tunisia, Turkey, Tuvalu, Uganda, Ukraine, Uzbekistan, Vanuatu, Yemen (Republic of), Zambia and Zimbabwe. If the President determines that a surge in imports of CSPV products from a developing country that is a WTO member results in imports of that product from that developing country exceeding either of the thresholds described, the safeguard measure shall be modified to apply to such product from such country. Turkey was removed from the list of beneficiary developing countries as of May 17, 2019. India was removed from the list of beneficiary developing countries as of June 5, 2019. Proclamation to Modify the List of Beneficiary Developing Countries Under the Trade Act of 1974, May 16, 2019, https://www.whitehouse.gov/presidential-actions/proclamation-modify-list-beneficiary-developing-countries-trade-act-1974/, retrieved January 12, 2020; Proclamation to Modify the List of Beneficiary Developing Countries Under the Trade Act of 1974, May 31, 2019, https://www.whitehouse.gov/presidential-actions/proclamation-modify-list-beneficiary-developing-countries-trade-act-1974-2/, retrieved January 12, 2020.

quantity of solar cell imports not exceeding 2.5 GW in each year under the TRQ will be allocated among all countries, except those that are specifically excluded. Table I-17 presents the safeguard TRQ measure on CSPV cells.[155]

Table I-17
CSPV cells: Safeguard TRQ measure on cells

Duty in percent

Period	Safeguard duty on first 2.5 GW of imported cells	Safeguard duty on imported cells exceeding 2.5 GW
February 7, 2018 - February 6, 2019	—	30
February 7, 2019 - February 6, 2020	—	25
February 7, 2020 - February 6, 2021	—	20
February 7, 2021 - February 6, 2022	—	15

Source: 83 FR 3541, January 25, 2018.

Note: The increase in duties in the fourth year of the measure from 15 percent to 18 percent set forth in Presidential Proclamation 10101 (85 FR 65639, October 16, 2020) was set aside by the CIT on November 16, 2021.

Import duties under the safeguard measure

The safeguard measure imposed an increase in duties on imports of CSPV modules for a period of four years, with annual reductions in the rates of duty in the second, third, and fourth years. The additional duty will be imposed on the declared value of CSPV modules, including the cost or value of the non-cell portions of the modules (such as aluminum frames).[156] Table I-18 presents the import duties under the safeguard measure on CSPV modules.

[155] Since the imposition of the safeguard measure, the level of imported cells subject to the TRQ has yet to reach 2.5 GW in each year. See Feldman, David, Kevin Wu, and Robert Margolis, "H1 2021 Solar Industry Update," National Renewable Energy Lab, June 22, 2021, p. 49, https://www.nrel.gov/docs/fy21osti/80427.pdf, retrieved October 20, 2021. As of November 15, 2021, the TRQ for the period beginning February 7, 2021, has been 81.9 percent filled. See U.S. Customs and Border Protection, Weekly Commodity Status Reports, November 15, 2021, at https://www.cbp.gov/trade/quota/tariff-rate-quotas.

[156] Ibid.

Table I-18
CSPV modules: Safeguard measure on modules

Duty in percent

Period	Safeguard duty on imported modules
February 7, 2018 - February 6, 2019	30
February 7, 2019 - February 6, 2020	25
February 7, 2020 - February 6, 2021	20
February 7, 2021 - February 6, 2022	15

Source: 83 FR 3541, January 25, 2018.

Note: The increase in duties in the fourth year of the measure from 15 percent to 18 percent set forth in Presidential Proclamation 10101 (85 FR 65639, October 16, 2020) was set aside by the CIT on November 16, 2021.

Tariff treatment

The subject merchandise is provided for in subheading 8541.40.60 of the Harmonized Tariff Schedule of the United States ("HTS"), and has been free of duty under the general duty column since at least 1987. Within subheading 8541.40.60, the subject merchandise was included in statistical reporting numbers 8541.40.6020 ("solar cells, assembled into modules or made up into panels") and 8541.40.6030 ("solar cells, other") through June 30, 2018. As of July 1, 2018, a superior text for crystalline silicon photovoltaic cells (described in statistical note 11 to chapter 85) applies to two subordinate reporting categories, 8541.40.6015 ("assembled into modules or made up into panels") and 8541.40.6025 ("other").[157]

Under subheading 9903.45.22, imports of cells in excess of the prescribed TRQ quantity subject to the safeguard measure are currently subject to a general duty rate of 25 percent ad valorem (unless the product of an exempt country); under subheading 9903.45.25 all covered

[157] Statistical Note 11: For the purposes of statistical reporting numbers 8541.40.6015 and 8541.40.6025, the term "crystalline silicon photovoltaic cells" means crystalline silicon photovoltaic cells of a thickness equal to or greater than 20 micrometers, having a p/n junction (or variant thereof) formed by any means, whether or not the cell imported under statistical reporting number 8541.40.6025 (or subassemblies thereof imported under statistical reporting number 8541.40.6015) has undergone other processing, including, but not limited to, cleaning, etching, coating, and/or addition of materials (including, but not limited to, metallization and conductor patterns) to collect and forward the electricity that is generated by the cell. Such cells include photovoltaic cells that contain crystalline silicon in addition to other photovoltaic materials. This includes, but is not limited to, passivated emitter rear contact cells, heterojunction with intrinsic thin-layer cells, and other so-called hybrid cells.

modules from nonexempt countries are currently subject to the safeguard duty rate of 25 percent ad valorem.

These articles may also be imported as parts or subassemblies of goods provided for in subheadings 8501.31.80, 8501.61.00, and 8507.20.80.[158] Inverters or batteries with CSPV cells attached are provided for under HTSUS subheadings 8501.61.00 and 8507.20.80, respectively. In addition, CSPV cells covered by the reviews may also be classifiable as DC generators of subheading 8501.31.80, when such generators are imported with CSPV cells attached. Goods classified in subheadings 8501.31.80 and 8501.61.00 have general duty rates of 2.5 percent ad valorem, and goods classified in subheading 8507.20.80 have a general duty rate of 3.5 percent ad valorem. The following statistical reporting numbers were added on March 1, 2018: 8501.31.8010 (covering DC generators of an output not exceeding 750 W: photovoltaic generators of a kind described in statistical note 9 to subchapter 85),[159] 8501.32.6010 (DC generators of an output exceeding 750 W but not exceeding 75 kW: photovoltaic generators of a kind described in statistical note 9), 8501.61.0010 (AC generators (alternators): photovoltaic generators of a kind described in statistical note 9), and 8507.20.8010 (other lead-acid storage batteries: of a kind described in subheading 9903.45.25).[160] The HTS subheadings and reporting numbers are provided for convenience and the written description of the imported article is

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[158] The subject cells may be presented as integral elements of subassemblies of components or of goods of these three subheadings, even if not treated as "parts" for tariff purposes.

[159] Statistical Note 9 to chapter 85 provides as follows: For the purposes of heading 8501, photovoltaic generators consist of panels of photocells combined with other apparatus, e.g., storage batteries and electronic controls (voltage regulator, inverter, etc.) and panels or modules equipped with elements, however simple (for example, diodes to control the direction of the current), which supply the power directly to, for example, a motor, an electrolyser. In these devices, electricity is produced by means of solar cells which convert solar energy directly into electricity (photovoltaic conversion).

[160] HTS 9903.45.25: Modules as defined in note 18(g) to this subchapter (subchapter III of chapter 99), when the product or originating good of a country other than a country described in note 18(b) to this subchapter.

U.S. Note 18(g) to subchapter III, chapter 99: Subject to the provisions of subdivision (c)(iii) of this note, for purposes of subheading 9903.45.25 to this subchapter, the term "modules" shall include the following goods provided for in subheading 8541.40.60 of the tariff schedule: a module is a joined group of CSPV cells, as such cells are defined in subdivision (c) of this note, regardless of the number of cells or the shape of the joined group, that are capable of generating electricity. Also included as a "module" are goods each known as a "panel" comprising a CSPV cell that has undergone any processing, assembly, or interconnection (including, but not limited to, assembly into a laminate). Such CSPV cells assembled into modules or made up into panels include goods of a type reported for statistical purposes under statistical reporting number 8541.40.6020. Such goods also include (i) CSPV cells which are presented attached to inverters or batteries of subheading 8501.61.00 or 8507.20.80, respectively; and (ii) CSPV cells classifiable as DC generators of subheading 8501.31.80.

dispositive. Decisions on the tariff classification and treatment of imported articles are within the authority of U.S. Customs and Border Protection ("Customs").

The like or directly competitive product

To determine whether an article is being imported into the United States in such increased quantities as to be a substantial cause of serious injury or the threat thereof, the Commission first defines "the domestic industry producing an article like or directly competitive with the imported article."[161] When assessing what constitutes the product(s) that is/are like or directly competitive with the imported article(s), the Commission takes into account such factors as (1) the physical properties of the article, (2) its customs treatment, (3) its manufacturing process (i.e., where and how it is made), (4) its uses, and (5) the marketing channels through which the product is sold. In its safeguard determination, the Commission found that domestically produced CSPV products are "like" the imported CSPV products. Specifically, domestically produced CSPV cells are "like" the imported CSPV cells and domestically produced CSPV modules are "like" imported CSPV modules within the scope of the investigation. Additionally, the Commission defined a single domestic product corresponding to the imported products within the scope of the investigation that includes CSPV cells and CSPV modules. It found that although CSPV modules are not "like" CSPV cells, the facts indicated that they are "directly competitive" within the meaning of the safeguard statute and there were no clear lines differentiating them. Consistent with its definition of the like or directly competitive domestic product, the Commission defined the domestic industry as all U.S. producers of CSPV cells (whether or not partially or fully assembled into other products), including integrated producers of CSPV cells and modules and independent module producers.[162]

Description and applications[163]

CSPV cells are the essential element in CSPV modules (also commonly referred to as panels), which in turn are the main components of CSPV systems (figure I-3). Solar CSPV

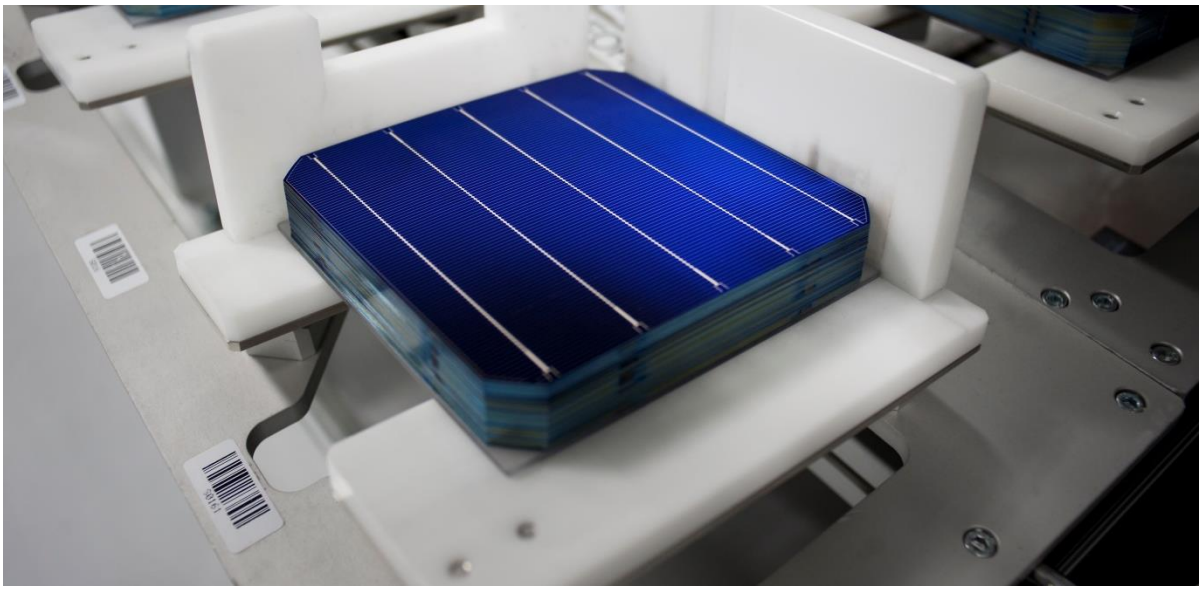
[161] 19 U.S.C. § 2252(b)(1)(A).

[162] Safeguard publication, pp. 13 and 16-18.

[163] This section will cover CSPV cells and modules generally, with a focus on the most common product characteristics. The "discussion of specific products" section will cover various other CSPV technologies and products. Unless otherwise noted, this section is derived from Monitoring publication, pp. I-54–I-59 and I-72–80. Citations to direct quotes, pictures, and data were retained.

systems[164] convert sunlight into electricity for on-site use or for distribution through the electric grid.

Figure I-3
CSPV products: CSPV cell with 5 busbars



Source: SolarWorld Webpage, https://www.solarworld-usa.com/newsroom/media-downloads, retrieved September 4, 2017.

CSPV cells

CSPV cells use crystalline silicon to convert sunlight to electricity and are the basic elements of a CSPV module. CSPV cells may be full square or may have slightly rounded corners ("pseudo square"). Common sizes of CSPV cells, as measured by the side length of the cell, and the type of wafer used in producing cells of that size are shown in Table I-19.

[164] In addition to CSPV products, there is commercial production of thin film photovoltaic products (which are not included in the scope of the investigation). Thin film modules use a several micron thick layer of a photosensitive semiconductor material such as amorphous silicon ("a-Si"), cadmium telluride ("CdTe"), or copper indium (gallium) (di)selenide ("CIS" or "CIGS") to convert sunlight to electricity.

Table I-19
CSPV cells: Examples of wafer sizes used in monocrystalline cell production

Wafer	Side length in mm
M0	156
M2	156.75
G1	158.75
M4	161.7 or 161.75
M6	166
M10	182
M12/G12	210

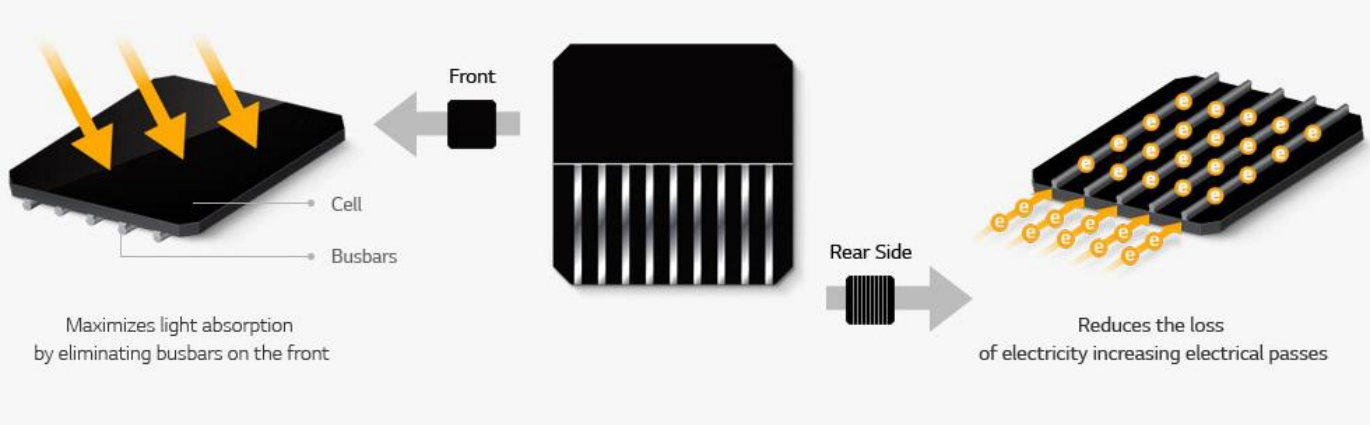
Sources: ITRPV, *Results 2019 Including Maturity Report 2020*, p. 17, https://itrpv.vdma.org, retrieved September 29, 2021; ITRPV, 2020 Results, p. 14, https://itrpv.vdma.org, retrieved September 28, 2021; Pickerel, Kelly, "Big-Wafer Solar Panels Aren't Quite Ready for Their Residential Debut," *Solar Power World*, August 31, 2020, https://www.solarpowerworldonline.com/2020/08/big-wafer-solar-panels-arent-quite-ready-for-their-residential-debut/.

CSPV cells have a positive layer, a negative layer and a positive-negative junction (p/n junction). Electricity is generated when sunlight strikes the CSPV cell, knocking electrons loose that flow onto thin metal "fingers" that run across the CSPV cell and conduct electricity to the busbars.[165] The number of busbars in cells varies, and has increased over time as more busbars improve efficiency and power output.[166] Further, some cells contain no busbars ("busbarless"), which can provide benefits such as reducing electrical losses and increasing the surface area of the CSPV cell that can absorb sunlight. Alternatively, some cells have metal contacts on the rear side of the CSPV cell, creating back (or rear contact) cells (including integrated back contact or IBC cells) (figure I-4). This provides several advantages such as reduced shading, improved cell interconnection, and better aesthetics.

[165] Electricity is carried from the thin metal strips on solar cells to wider metal strips known as busbars. These busbars are interconnected during the manufacturing process so that electricity is carried from the cell to the junction box.

[166] In 2018, 3 and 4 busbar cells accounted for more than 40 percent of the global market, with 5 busbar cells accounting for most of the remaining market. In 2020, there was almost no production of cells with fewer than 5 busbars and cells with more than 6 busbars accounted for more than 40 percent of the global market. International Technology Roadmap for Photovoltaic (ITRPV), *Results 2018 Including Maturity Report 2019*, p. 37, https://itrpv.vdma.org, retrieved September 28, 2021; ITRPV, *2020 Results,* p. 27, https://itrpv.vdma.org, retrieved September 28, 2021.

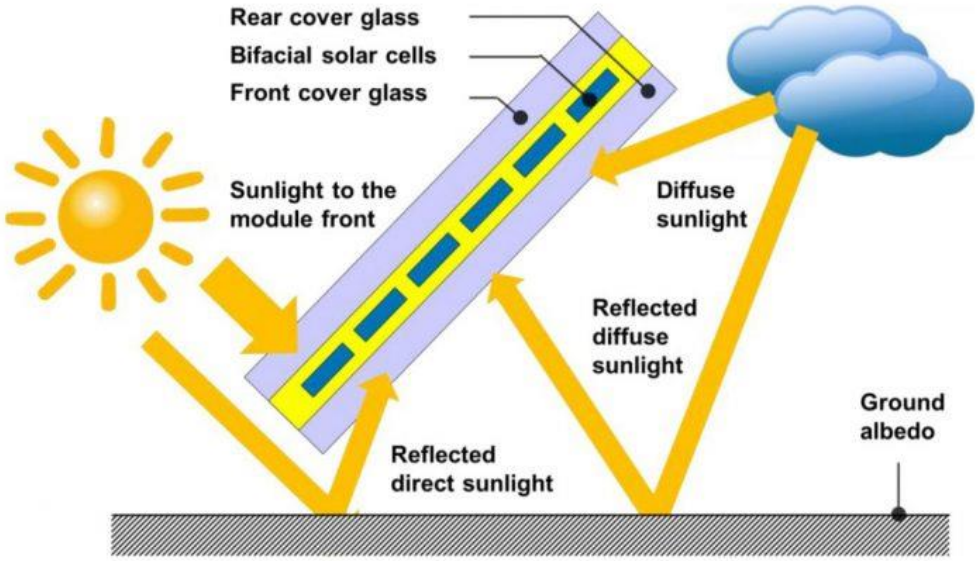
Figure I-4
CSPV products: Back contact CSPV cells



Source: LG Website, https://www.lg.com/uk/business/solar/why-lg-solar/leading-technology, retrieved November 3, 2019.

CSPV cells can be either monofacial or bifacial. Bifacial CSPV cells convert light that hits both the front and back of the CSPV cell into electricity (figure I-5). Whereas most CSPV cells have a metalized back layer, bifacial cells allow light through to the back side of the CSPV cell. They often incorporate either the PERC or heterojunction technologies. When assembled into CSPV modules, they use a transparent back sheet or rear glass layer to allow reflected sunlight on the rear of the CSPV cell.

Figure I-5
CSPV products: Bifacial PV modules absorb sunlight on both sides of the module



Source: Glazer, Becca and Kevin Mayer, "Bifacial or Bust? Engineering Solar Financings of the Future," April 4, 2019, Sol Source, https://www.solsystems.com/blog/2019/04/04/bifacial-or-bust-engineering-solar-financings-of-the-future/, retrieved November 3, 2019.

The two main types of CSPV cells are monocrystalline and multicrystalline (or polycrystalline) silicon, though there are various subtypes within these two categories, as discussed below. Monocrystalline cells are made from a single grown crystal and tend to convert sunlight into electricity more efficiently. Multicrystalline cells have a random crystal structure and tend to have a lower conversion efficiency, though there are a range of conversion efficiencies for monocrystalline and multicrystalline CSPV modules.[167]

Monocrystalline and multicrystalline cells commonly use Passive Emitter Rear Contact ("PERC") and related technologies.[168] PERC cells incorporate an additional rear dielectric layer that reflects light that did not generate electricity as it initially passed through the CSPV cell back into the CSPV cell. There is, therefore, another opportunity for the CSPV cell to absorb this light. PERC cells have a higher efficiency, and improved performance in certain conditions, such as low light and high heat conditions.

Monocrystalline cells can be either p-type or n-type. In the production of p-type of monocrystalline CSPV wafers, the silicon is doped with boron or gallium to create a positive

[167] Conversion efficiency is the percent of sunlight that is converted to electricity.

[168] Related technologies include Passivated Emitter Rear Totally Diffused ("PERT") and Passivated Emitter Rear Locally Diffused ("PERL").

electrical orientation.[169] In the production of n-type mono wafers, the silicon is doped with phosphorous to create a negative electrical orientation. In the CSPV cell production process, a positive layer is added to create the p/n junction.

N-type CSPV cells can be more expensive to produce, but have a number of benefits, such as higher conversion efficiencies and no light-induced degradation. Heterojunction n-type CSPV cells (including heterojunction with intrinsic thin layer ("HIT")) add thin layers of photosensitive semiconductor materials (such as amorphous silicon) on top of an n-type monocrystalline wafer. These additional layers increase the absorption of sunlight and the overall efficiencies of the CSPV cells, as well as improve performance in hot climates. Tunnel Oxide Passivated Contacts (TOPCon) is another technology used for n-type cells. TOPCon cells are created by "depositing a nanometer scale layer of silicon oxide, followed by a thicker polycrystalline silicon layer, between the silicon wafer and metal contacts. The layers reduce charge recombination between the wafer and the contacts, increasing carrier lifetime and resulting in a conversion efficiency boost."[170]

CSPV laminates

CSPV laminates consist of the CSPV cells that are connected, encapsulated (most commonly in an ethyl vinyl acetate ("EVA") film), and covered with a glass front layer and a back sheet or rear glass (figure I-6). The back sheet is most commonly a plastic film composite, though glass is also used in some applications such as bifacial CSPV modules. CSPV laminates can use full cells or cells cut in smaller pieces, such as half-cut cells. These are standard CSPV cells that are cut, such that a standard 60-cell CSPV module would instead have 120 half cells. Half-cut cells result in lower cell currents and, therefore, reduce power losses and increase cell efficiency and overall module output. Some products use shingling, paving, and other low or zero gap technologies to reduce the distance between cells.

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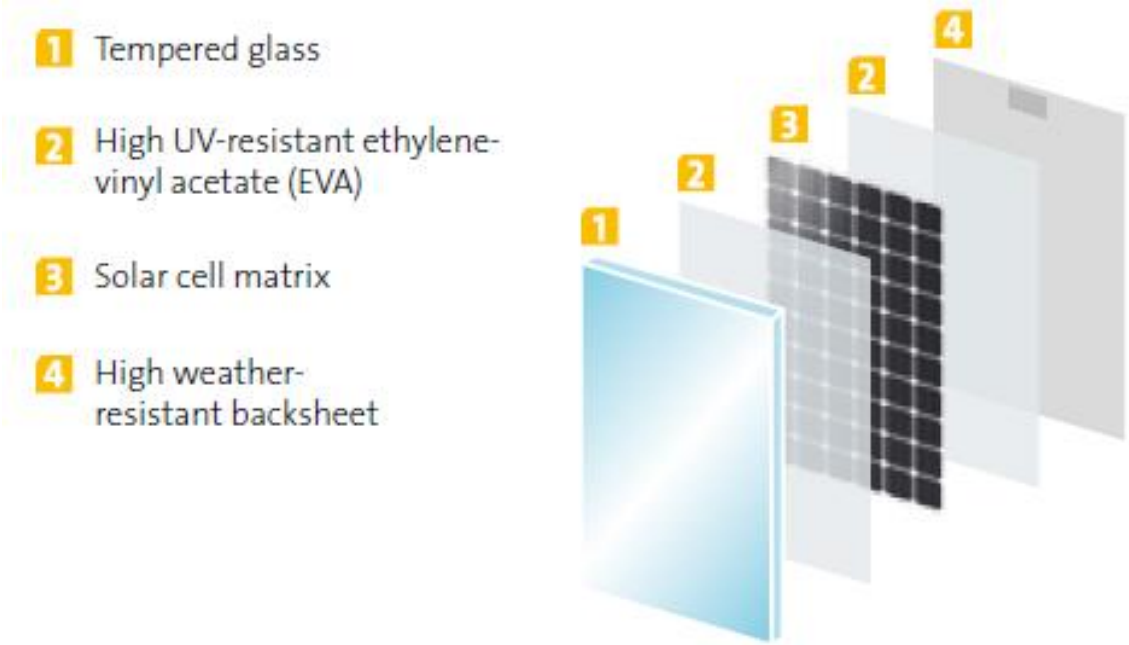
[169] ITRPV, *2020 Results*, pp. 8–9, https://itrpv.vdma.org, retrieved September 28, 2021.

[170] Gifford, Jonathan, "Topcon N-Type Solar Cell Technology Could Be a Rival to Mono PERC," *PV Magazine*, March 7, 2020, https://pv-magazine-usa.com/2020/03/07/topcon-n-type-solar-cell-technology-could-be-a-rival-to-mono-perc/, retrieved October 6, 2021.

Figure I-6
CSPV products: Layers of a typical CSPV laminate



Source: SolarWorld, "SolarWorld Quality," brochure, May 2014, p. 10, https://www.solarworld-usa.com/~/media/www/files/brochures/sw-01-7182us-flyer-solarworldquality.pdf.

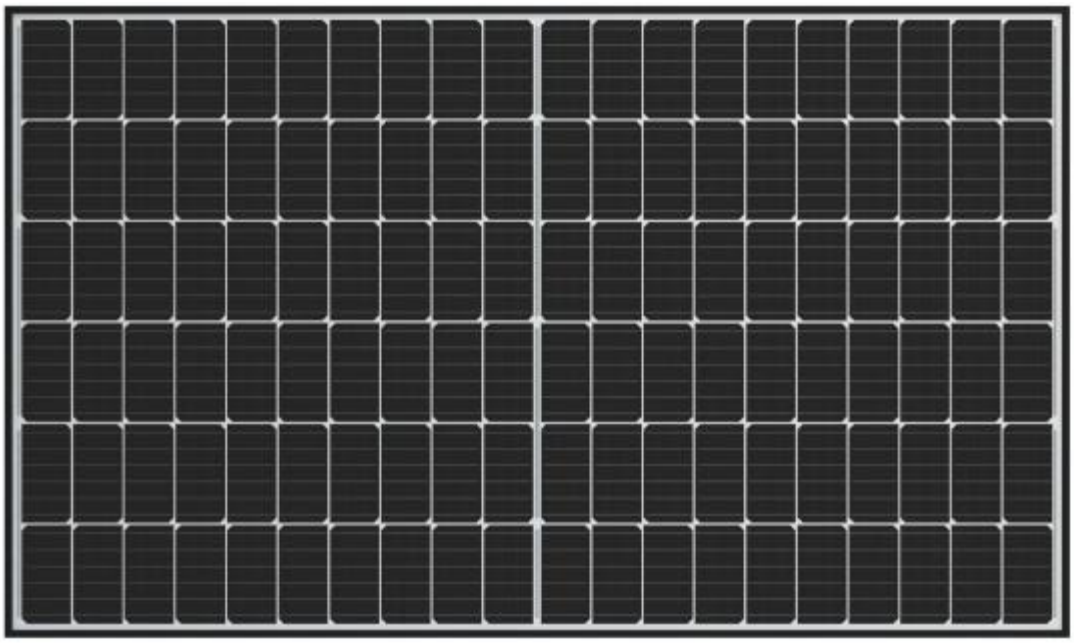
CSPV modules

CSPV modules typically consist of the laminate that is typically framed in aluminum, and then attached to one or more junction boxes (figure I-7).[171] CSPV modules can be used in both ground-mounted and rooftop-mounted systems and in both the off-grid market segment and the three on-grid market segments—residential, nonresidential, and utility.[172] The junction box can be connected to other modules, an inverter (which converts the direct current generated by the system to alternating current), or, in the case of off-grid modules, a battery and a charge controller (which controls battery charging).

[171] Some CSPV modules do not use a frame, which reduces costs. These modules typically use glass as the rear layer to ensure mechanical stability.

[172] Photovoltaics ("PV") do not include solar water heat and concentrated solar power ("CSP"). While PV uses a photosensitive semiconductor material to convert sunlight directly to electricity, solar water heat uses sunlight to heat water and CSP uses reflected sunlight to generate steam or a vapor that turns a turbine to generate electricity.

Figure I-7
CSPV products: CSPV module with half-cut cells



Source: Hanwha Webpage, https://www.q-cells.com/en/main/products/solar_panels/residential/residential01.html, retrieved November 3, 2019.

The most common on-grid CSPV modules have 60 cells (or 120 half cut cells) or 72 cells (or 144 half cut cells). Common sizes of 72 cell solar modules, depending on the size of the wafer, are shown in Table I-20. The average module efficiency, for global module production in 2020, was 19 percent for PERC (and related technologies) p-type multicrystalline, 20 percent for PERC (and related technologies) and TOPCon p-type monocrystalline, more than 20.5 percent for n-type TOPCon, 21 percent for n-type heterojunction, and more than 21 percent for n-type back contact.[173]

[173] ITRPV, *2020 Results*, p. 44, https://itrpv.vdma.org, retrieved September 28, 2021;

Table I-20
CSPV modules: Typical 72 cell module area by wafer size, 2020

Wafer	Wafer side length in mm	Module area, square meters
M0	156	1.94
M2	156.75	2.00
G1	158.75	2.05
M4	161.7 or 161.75	2.11
M6	166	2.24
M10	182	2.56
M12/G12 (60 cell module)	210	2.40

Sources: Chunduri, Shravan K. and Michael Schmela, *500W+ Solar Modules, 2020 Edition*, Taiyang News, p. 10, http://taiyangnews.info/reports/500w-solar-modules-2020/, retrieved September 13, 2021.

The average output of monocrystalline 60/120 half-cut cell module models newly listed on the California Energy Commission's equipment list increased from 301 watts for models listed in 2018 to 328 watts for models listed in 2020. During January to September 2020, the average output was 370 watts. The average output of monocrystalline 72/144 half-cut cell module models newly listed on the California Energy Commission's equipment list increased from 359 watts in 2018 to 397 watts in 2020 and reached 451 watts during the January–September 2021. A declining number of multicrystalline modules were added to the list during 2018–20. However, for 60/120 half-cut cell module models added to the list the average power increased from 274 watts in 2018 to 285 watts in 2020. For 72/144 half-cut cells the average power increased from 333 watts in 2018 to 344 watts in 2020.[174]

In addition to standard size CSPV modules, CSPV cells can be used in building-integrated PV ("BIPV modules" or "BIPV products"). BIPV products are materials integrated into the building envelope, such as the façade or roof, containing CSPV cells. These building integrated materials replace conventional construction materials, such as glass or roof shingles, taking over the function that conventional materials would otherwise perform while also producing electricity.

CSPV modules are also used in off-grid applications. In many instances, CSPV modules typically used in on-grid applications may also be used in off-grid applications. For example, a house that is not connected to the electrical grid could use the same CSPV modules as a house that is grid-connected. However, there are a broad range of off-grid applications, such as power

[174] No multicystalline modules were added during January to September 2021. California Energy Commission, PV Module List - Full Data, October 1, 2021, https://www.energy.ca.gov/sites/default/files/2021-10/PV_Module_List_Full_Data_ADA.xlsx, retrieved October 6, 2021.

generation in remote locations, mobile power solutions, telecommunications power and lighting systems, and portable consumer goods (such as systems for recharging consumer electronics like tablets and phones). The CSPV modules used in some of these applications may be different from those typically used in on-grid applications. For example, these products are often designed for specific power and portability requirements, and some CSPV modules have different wattages than CSPV modules used in grid-connected applications.

Uses and market segments[175]

There are four primary market segments for CSPV products. There are three grid-connected market segments–residential, nonresidential, and utility–and an off-grid market. In the grid-connected market, installations are usually either ground-mounted or roof-mounted. In addition to the CSPV module, there are a number of other components of the installation called the balance of system ("BOS"). The BOS includes components such as the inverter and the racking on which the modules are installed.[176]

Residential grid-connected systems are installed at individual homes. CSPV modules are typically installed on the roof, though they can also be ground-mounted, and connected to an inverter. The system can use a central inverter, which converts the power from multiple CSPV modules, or each module can have its own microinverter attached. In residential installations, the electricity generated by the system is used for power in the individual home (figure I-8). Homeowners use grid energy when solar electricity generation is not sufficient to meet demand, and often feed energy back into the grid when solar electricity generation exceeds home use. In the United States, the median size of a residential PV installation was 6.5 kW in 2020.[177]

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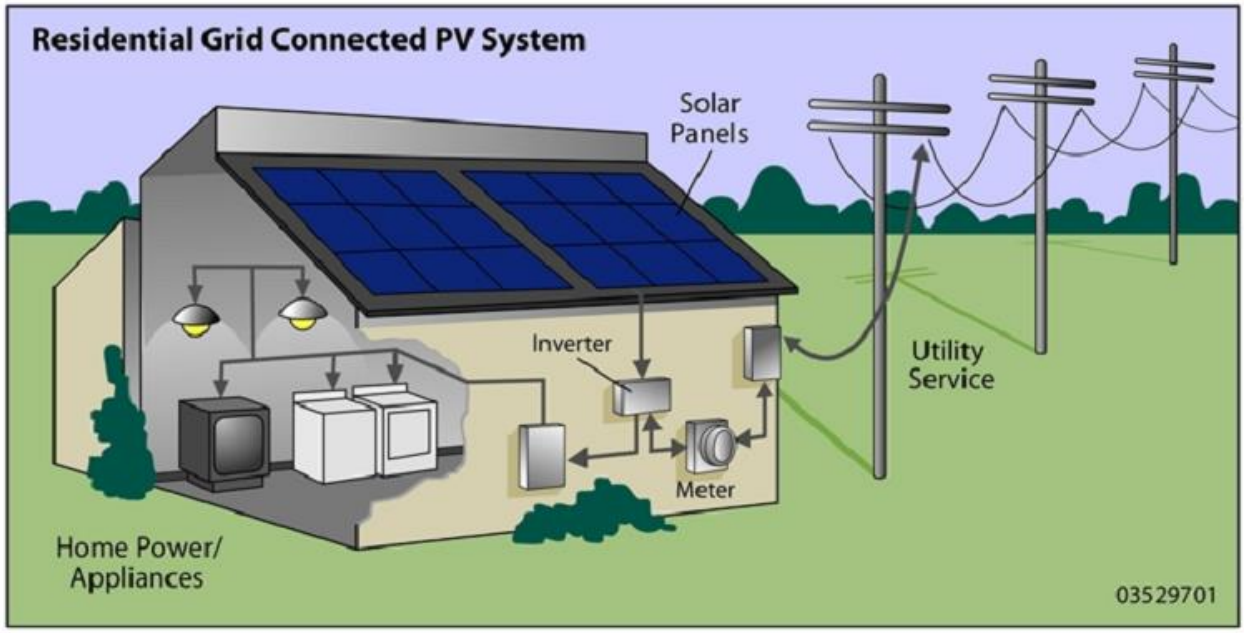
[175] Unless otherwise noted, this section is derived from Monitoring publication, pp. I-69–I-71. Citations to direct quotes, pictures, and data were retained.

[176] In addition to equipment, there are a number of services associated with installing a PV system such as site assessment and design, permitting, financing, and the system installations, as well as operations and maintenance services after the installation is completed.

[177] Barbose, Galen, Naïm Darghouth, Eric O'Shaughnessy, and Sydney Forrester, *Tracking the Sun, 2021 Edition*, Lawrence Berkeley National Laboratory, September 2021, p. 11, https://emp.lbl.gov/sites/default/files/2_tracking_the_sun_2021_report.pdf, retrieved October 6, 2021.

Figure I-8
Residential grid-connected CSPV system



Source: DOE, Office of Energy Efficiency and Renewable Energy (EERE) Webpage, http://www.energysavers.gov/your_home/electricity/index.cfm/mytopic=10720, retrieved November 9, 2011.

Residential systems use a variety of module types. Modules with 60 cells are the most commonly used in residential systems, accounting to 69 percent of installations according to data compiled using module models listed in the Lawrence Berkeley National Lab (Berkeley Lab) *Tracking the Sun* data set.[178] In addition, 63 cell modules (2 percent of installations), 66 cell

[178] Information on U.S. installations by product type in the residential and nonresidential sectors in this section for 2020 is based on a data set of installations in these sectors compiled by Lawrence Berkeley National Laboratory (Berkeley Lab) for their annual *Tracking the Sun* report. Projects 1 MW or larger in the data set are excluded from the data presented here so as to not overlap with the utility sector data discussed below. After excluding large projects and those without module information, the data set includes information for 1.8 GW of installations in 2020. This includes 1.4 GW in residential installations, representing 44 percent of U.S. residential installations in 2020. It also includes 0.4 GW in nonresidential installations, which represents about *** of nonresidential installations (excluding community solar), though this value is only approximate due to differences in sector definitions. A small share of installations do not specify a sector and are not included in the sector-specific data, though they are included in the data that are not sector specific. The data set includes an indicator for whether each module is bifacial. However, the data set does not include the number of cells, which was added based on information from publicly available data sources. All cell counts are based on the full cell equivalent number of cells (e.g., a 120 half-cut cell module is included with 60 cell modules). The mounting type (ground or roof) was not available for all systems. Barbose, Galen, Naïm Darghouth, Eric O'Shaughnessy, and Sydney Forrester, *Tracking the Sun*, 2021 Edition, Public Data File, https://emp.lbl.gov/tracking-the-sun; Petitioner Hanwha/LG/Mission's prehearing brief, exhibit 18.

modules (5 percent), 72 cell modules (7 percent), 96 cell modules (15 percent),[179] and shingled modules produced by Solaria[180] with various cell counts (2 percent) (figure I-9) are used.[181] The 72 and 128 cell modules commonly used in residential applications include both monocrystalline and multicrystalline modules, many of which are installed in both roof and ground mount systems (table I-21). The most commonly used modules are 1.9 to 2.2 square meters, weigh 45 to 56 pounds, and many can be used in systems up to 1,500 volts.[182]

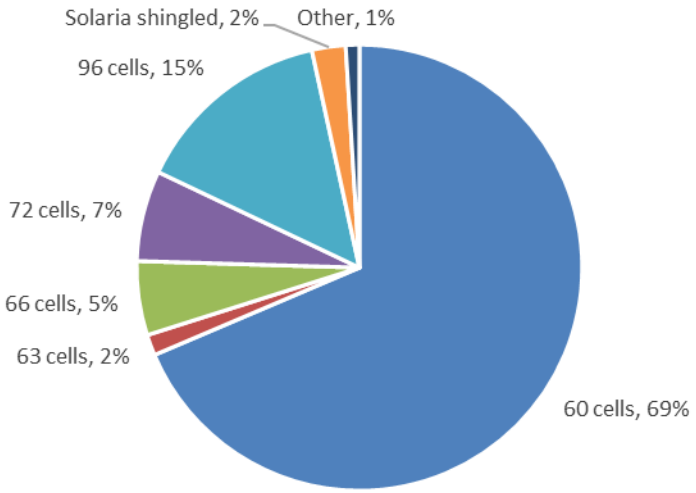
[179] Though 96 cell modules have more cells than 72 cell modules, they are generally SunPower and Panasonic modules that use smaller cells. They are typically more similar in size to 60 cell modules than to 72 cell modules. SunPower E-Series modules, for example, use 96 cells and are 1.6 square meters. SunPower, "SunPower E-Series: E20-327-COM," June 10, 2020, https://us.sunpower.com/solar-resources/sunpower-e-series-commercial-e20-327-com-e20-320-com, retrieved November 11, 2021.

[180] The cell equivalent for Solaria modules was not available in all instances, so they are grouped together. They include a mix of modules, including models with similar dimensions to both 60 and 72 cell modules.

[181] Barbose, Galen, Naïm Darghouth, Eric O'Shaughnessy, and Sydney Forrester, *Tracking the Sun*, 2021 Edition, Public Data File, https://emp.lbl.gov/tracking-the-sun; California Energy Commission, PV Module List - Full Data, October 1, 2021, https://www.energy.ca.gov/sites/default/files/2021-10/PV_Module_List_Full_Data_ADA.xlsx, retrieved October 6, 2021; other publicly available data sources.

[182] Barbose, Galen, Naïm Darghouth, Eric O'Shaughnessy, and Sydney Forrester, *Tracking the Sun*, 2021 Edition, Public Data File, https://emp.lbl.gov/tracking-the-sun; California Energy Commission, PV Module List - Full Data, October 1, 2021, https://www.energy.ca.gov/sites/default/files/2021-10/PV_Module_List_Full_Data_ADA.xlsx, retrieved October 6, 2021; other publicly available data sources.

Figure I-9
CSPV modules: Share of residential and nonresidential installations by module size, 2020



Source: Barbose, Galen, Naïm Darghouth, Eric O'Shaughnessy, and Sydney Forrester, *Tracking the Sun*, 2021 Edition, Public Data File, https://emp.lbl.gov/tracking-the-sun; California Energy Commission, PV Module List - Full Data, October 1, 2021, https://www.energy.ca.gov/sites/default/files/2021-10/PV_Module_List_Full_Data_ADA.xlsx, retrieved October 6, 2021; other publicly available data sources.

Note: Other includes modules with different cell counts and installations that use modules with different cell configurations in the same system. The cell equivalent for Solaria modules was not available in all instances, so they are grouped together. They include a mix of modules, including models with similar dimensions to both 60 and 72 cell modules.

Table I-21
Characteristics of 72 and 128 cell modules commonly used in U.S. residential installations, 2020

Efficiency in percent; size in square meters, weight in pounds, n.a.=not available

Model	Company	Cells	Watts	Type	Efficiency	Maximum volts (UL)	Size	Weight	Roof or ground
LG400N2W-V5	LG	72	400	Mono	19.3	1,500	2.07	44.8	Roof
SPR-E20-435-COM	SunPower	128	435	Mono	20.3	1,500	2.22	56.0	Both
AC-385MH/144S	Axitec	72	385	Mono	19.4	1,000	1.98	40.8	Both
Q.PEAK DUO L-G5.2 400	Hanwha	72	400	Mono	19.9	1,500	2.02	51.8	Both
LG400N2W-A5	LG	72	400	Mono	19.3	1,500	2.07	47.8	Both
Q.PEAK L-G4.2 370	Hanwha	72	370	Mono	18.6	1,500	1.99	52.9	Both
Q.PRO L G4 320	Hanwha	72	320	Multi	n.a.	n.a.	n.a.	n.a.	Roof
Q.PLUS L-G4.2 345	Hanwha	72	345	Multi	17.3	1,500	1.99	50.7	Both
72M370	Heliene	72	370	Mono	19.3	1,500	1.94	52.4	Both
JKM395M-72HL-V	Jinko Solar	72	395	Mono	19.6	1,500	2.01	49.6	Both

Source: Barbose, Galen, Naïm Darghouth, Eric O'Shaughnessy, and Sydney Forrester, *Tracking the Sun*, 2021 Edition, Public Data File, https://emp.lbl.gov/tracking-the-sun; California Energy Commission, PV Module List - Full Data, October 1, 2021, https://www.energy.ca.gov/sites/default/files/2021-10/PV_Module_List_Full_Data_ADA.xlsx, retrieved October 6, 2021; other publicly available data sources.

Note: All modules listed are monofacial. According to the data sheet for the LG400N2W-A5, the cells are capable of absorbing light on both sides of the cell, but it is not identified as a bifacial module in the data sheet. The modules listed are the ten most commonly installed 72 and 128 cell modules from the *Tracking the Sun* data set, but an exact market share is not included as it is possible that the same model will appear elsewhere in the data set with a slightly different naming convention. Nevertheless, the models provide a useful list from which to view common characteristics. Maximum volts represents the maximum system volts for the system into which the module is installed, per the module data sheet. Roof or ground mount is the type of residential system into which the module was installed in 2020 in the *Tracking the Sun* data set. The number of cells is based on the full cell equivalent number of cells.

Bifacial modules are used in residential systems, but systems with bifacial modules (including those that used a mix of mononfacial and bifacial modules) only accounted for 0.3 percent of residential installations in 2020.[183] Bifacial modules were installed in both roof and

[183] Bifacial module data in this section only includes modules that are specifically identified as bifacial modules by the manufacturer. Modules with bifacial cells that do not have transparent rear glass or a transparent backsheet are not included with bifacial modules in these data.

ground mount systems, with installations in roof mounted systems more common.[184] During year-to-date 2021, systems using bifacial modules accounted for 0.8 percent of residential installations in five states for which data were readily available (California, Connecticut, New Hampshire, New York, and Rhode Island).[185] Table I-22 presents the characteristics of the bifacial module models that were among the most commonly used in residential installations in 2020.

[184] Barbose, Galen, Naïm Darghouth, Eric O'Shaughnessy, and Sydney Forrester, *Tracking the Sun*, 2021 Edition, Public Data File, https://emp.lbl.gov/tracking-the-sun.

[185] The residential installations in this data set totaled 784 MW and include *** in the fourth quarter of 2020. The most recent available data varies by state and the data sets may not include all installations in these states. Petitioner Hanwha/LG/Mission's prehearing brief, exhibit 18; Barbose, Galen, Naïm Darghouth, Eric O'Shaughnessy, and Sydney Forrester, *Tracking the Sun*, 2021 Edition, Public Data File, https://emp.lbl.gov/tracking-the-sun; California Energy Commission, "Distributed Generation Interconnection Program Data," https://www.californiadgstats.ca.gov/downloads/, retrieved November 17, 2021; New York Office of Information and Technology Services, "Solar Electric Programs Reported by NYSERDA: Beginning 2000," https://data.ny.gov/Energy-Environment/Solar-Electric-Programs-Reported-by-NYSERDA-Beginn/3x8r-34rs, retrieved November 15, 2021.

Table I-22
Characteristics of bifacial modules commonly used in U.S. residential installations, 2020

Efficiency in percent, size in square meters, weight in pounds, n.a.=not available

Model	Company	Cells	Watts	Type	Efficiency	Maximum volts (UL)	Size	Weight	Roof or ground
LG400N2T-J5	LG	72	400	Mono	19.3	1,500	2.07	44.8	Both
LR6-60BP-310M	Longi	60	310	Mono	18.7	1,500	1.66	48.1	Roof
LG390N2T-A5	LG	72	390	Mono	18.5	1,500	2.11	48.7	Both
LR6-60HBD-310M	Longi	60	310	Mono	18.3	1,500	1.69	48.5	Roof
CS3U-380MB-AG	Canadian Solar	72	380	Mono	18.9	1,500	2.01	57.1	Both
SD25-72BDE-385V	S-Energy	72	NA	Mono	NA	NA	NA	NA	NA
CS3W-400PB-AG	Canadian Solar	72	400	Multi	17.9	1,500	2.23	62.6	Both
LR6-60BP-290M	Longi	60	290	Mono	17.5	n.a.	1.66	48.5	Roof
LG405N2T-J5	LG	72	405	Mono	19.5	1,500	2.07	44.8	Both
LR6-60BP-305M	Longi	60	305	Mono	18.4	1,500	1.66	48.1	Roof
AXN6M612B370	Auxin	72	370	Mono	***	***	***	***	Both
CS3U-350PB-AG	Canadian Solar	72	350	Multi	17.4	1,500	2.01	57.1	Both
CS3U-370MB-AG	Canadian Solar	72	370	Mono	18.5	1,500	2.01	56.7	Both
LR6-60BP-315M	Longi	60	315	Mono	19.0	1,500	1.66	48.1	Both
CS3U-355PB-AG	Canadian Solar	72	355	Multi	17.7	1,500	2.01	57.1	Both

Source: Barbose, Galen, Naïm Darghouth, Eric O'Shaughnessy, and Sydney Forrester, *Tracking the Sun*, 2021 Edition, Public Data File, https://emp.lbl.gov/tracking-the-sun; California Energy Commission, PV Module List - Full Data, October 1, 2021, https://www.energy.ca.gov/sites/default/files/2021-10/PV_Module_List_Full_Data_ADA.xlsx, retrieved October 6, 2021; data sheets for each module model; ***.

Note: NA=not available. All modules listed are monofacial. The modules listed are the ten most commonly installed bifacial module models from the *Tracking the Sun* data set, but an exact market share is not included as it is possible that the same model will appear elsewhere in the data set with a slightly different naming convention. Nevertheless, the models provide a useful list from which to view common characteristics. Maximum volts represents the maximum system volts for the system into which the module is installed, per the module data sheet. Roof or ground mount is the type of residential system into which the module was installed in 2020 in the *Tracking the Sun* data set. The number of cells is based on the full cell equivalent number of cells. ***.

Nonresidential systems are installed at commercial, industrial, government, and similar buildings and sites.[186] Nonresidential installations are typically larger than residential installations—for nonresidential systems, the median size in 2020 was 42 kW, though systems can be substantially larger.[187] However, they function similarly to residential installations, providing electricity to meet onsite needs, pulling additional electricity from the grid when needed, and feeding excess electricity back into the grid when it is not needed.

Nonresidential installations use a variety of different cell configurations, with variation in the share of the market accounted for by 60 cell modules between small nonresidential (≤100 kW) and large nonresidential (100 to 999 kW) installations (figure I-10). In the small nonresidential market segment, 60 cell modules accounted for 22 percent of installations and the generally small format 96 cell modules for another 8 percent in 2020. In the large nonresidential market segment, these decline to 3 percent and 4 percent, respectively.[188] Systems with bifacial modules accounted for 3 percent of small nonresidential installations and 4 percent of large nonresidential installations in 2020. Bifacial modules were used in both roof and ground mount systems, but ground mount systems accounted for a larger share of bifacial modules installed in nonresidential applications.[189] During year-to-date 2021, systems using bifacial modules accounted for 5 percent of small residential installations and 10 percent of

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[186] Community solar was historically included in the nonresidential sector in WoodMac/SEIA market reports, but is now broken out into a separate sector. Community solar is defined by the U.S. Department of Energy as "any solar project or purchasing program, within a geographic area, in which the benefits of a solar project flow to multiple customers such as individuals, businesses, nonprofits, and other groups. In most cases, customers are benefitting from energy generated by solar panels at an off-site array. Community solar customers can either buy or lease a portion of the solar panels in the array, and they typically receive an electric bill credit for electricity generated by their share of the community solar system—similar to someone who has rooftop panels installed on their home." U.S. Department of Energy Website, "Community Solar Basics," https://www.energy.gov/eere/solar/community-solar-basics, retrieved October 12, 2021.

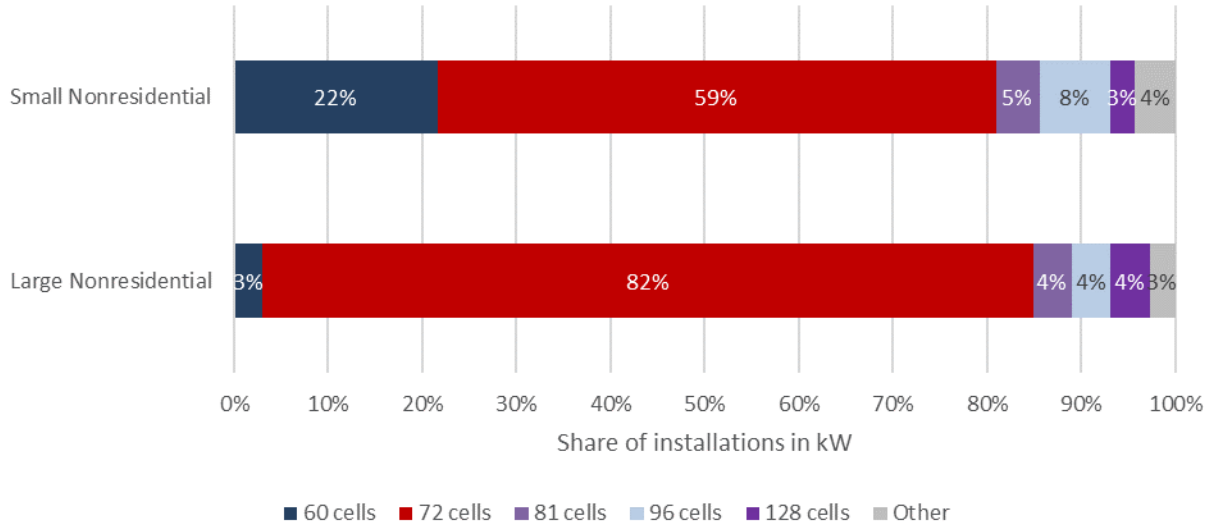
[187] Barbose, Galen, Naïm Darghouth, Eric O'Shaughnessy, and Sydney Forrester, *Tracking the Sun, 2021 Edition*, Lawrence Berkeley National Laboratory, September 2021, p. 11, https://emp.lbl.gov/sites/default/files/2_tracking_the_sun_2021_report.pdf, retrieved October 6, 2021.

[188] Barbose, Galen, Naïm Darghouth, Eric O'Shaughnessy, and Sydney Forrester, *Tracking the Sun*, 2021 Edition, Public Data File, https://emp.lbl.gov/tracking-the-sun; California Energy Commission, PV Module List - Full Data, October 1, 2021, https://www.energy.ca.gov/sites/default/files/2021-10/PV_Module_List_Full_Data_ADA.xlsx, retrieved October 6, 2021; other publicly available data sources.

[189] Barbose, Galen, Naïm Darghouth, Eric O'Shaughnessy, and Sydney Forrester, *Tracking the Sun*, 2021 Edition, Public Data File, https://emp.lbl.gov/tracking-the-sun.

large nonresidential installations in five states for which data were readily available (California, Connecticut, New Hampshire, New York, and Rhode Island).[190]

Figure I-10
CSPV modules: Share of residential and nonresidential installations by module size, 2020



Source: Barbose, Galen, Naïm Darghouth, Eric O'Shaughnessy, and Sydney Forrester, *Tracking the Sun*, 2021 Edition, Public Data File, https://emp.lbl.gov/tracking-the-sun; California Energy Commission, PV Module List - Full Data, October 1, 2021, https://www.energy.ca.gov/sites/default/files/2021-10/PV_Module_List_Full_Data_ADA.xlsx, retrieved October 6, 2021; other publicly available data sources.

Note: Other includes modules with different cell counts and installations that use modules with different cell configurations in the same system.

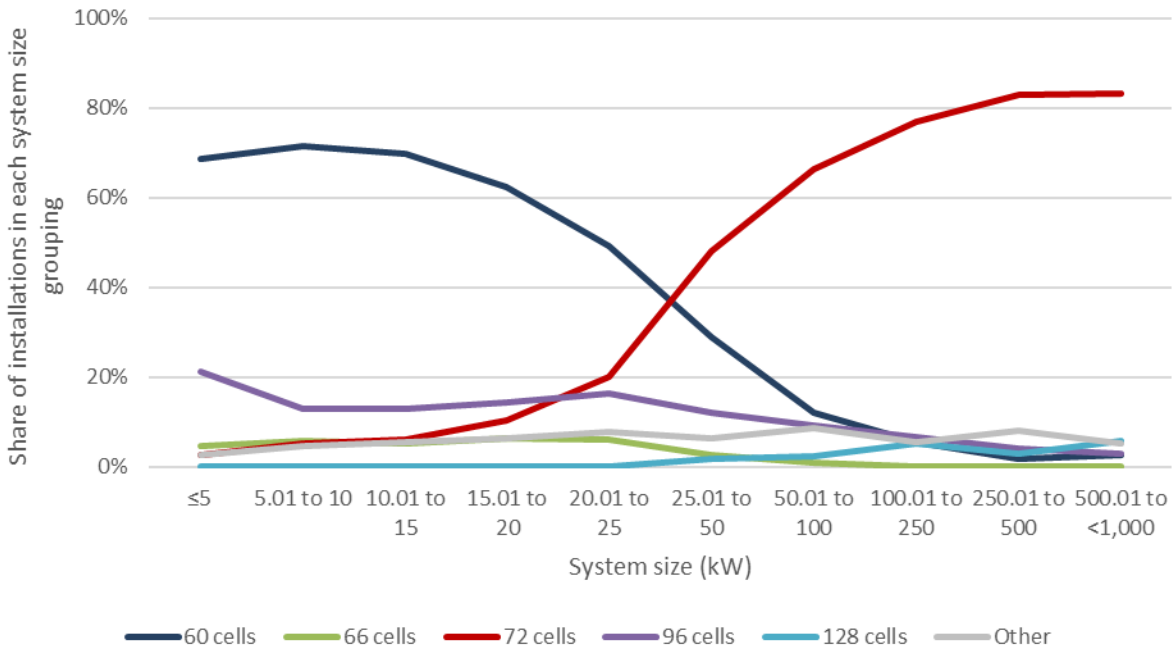
Combining data for the residential and nonresidential sectors, which can overlap in terms of system sizes, figure I-11 shows the share of modules, by the number of cells, used in residential and nonresidential installations of various sizes in 2020. Sixty and 72 cell modules are used in all of the size ranges shown in the figure, with the share of installations accounted

[190] The residential installations in this data set totaled 221 MW and include *** in the fourth quarter of 2020. The most recent available data varies by state and the data sets may not include all installations in these states. Petitioner Hanwha/LG/Mission's prehearing brief, exhibit 18; Barbose, Galen, Naïm Darghouth, Eric O'Shaughnessy, and Sydney Forrester, *Tracking the Sun*, 2021 Edition, Public Data File, https://emp.lbl.gov/tracking-the-sun; California Energy Commission, "Distributed Generation Interconnection Program Data," https://www.californiadgstats.ca.gov/downloads/, retrieved November 17, 2021; New York Office of Information and Technology Services, "Solar Electric Programs Reported by NYSERDA: Beginning 2000," https://data.ny.gov/Energy-Environment/Solar-Electric-Programs-Reported-by-NYSERDA-Beginn/3x8r-34rs, retrieved November 15, 2021.

for by 60 cell modules decreasing as system sizes increase and the share accounted for by 72 cell modules increasing as system sizes increase. The leading suppliers of 60, 63, and 96 cell modules in 2020 were Hanwha (28 percent of 2020 installations), LG (14 percent), SunPower (12 percent), Jinko Solar (9 percent), REC Solar (8 percent), Longi (7 percent), Panasonic (5 percent), Silfab (5 percent), Canadian Solar (3 percent), and Mission (2 percent). The leading suppliers of 72 and 128 cell modules were Hanwha (17 percent), LG (11 percent), Canadian Solar (8 percent), JA Solar (7 percent), Trina Solar (7 percent), Jinko Solar (6 percent), SunPower (5 percent), REC Solar (4 percent), Bovet Solar (3 percent), and Astronergy (3 percent).[191]

[191] Systems with multiple module suppliers are included in the "other" category as it was not possible to break out the share of modules supplied by firms in some instances. Systems that used more than one size module are also included in the other category. The total installations of systems using 60, 63 and 96 cell modules in the data set for which a manufacturer was available totaled 1.2 GW. The total installations of systems using 72 and 128 cell modules in the data set for which a manufacturer names was available totaled 0.4 GW. Barbose, Galen, Naïm Darghouth, Eric O'Shaughnessy, and Sydney Forrester, *Tracking the Sun*, 2021 Edition, Public Data File, https://emp.lbl.gov/tracking-the-sun; California Energy Commission, PV Module List - Full Data, October 1, 2021, https://www.energy.ca.gov/sites/default/files/2021-10/PV_Module_List_Full_Data_ADA.xlsx, retrieved October 6, 2021; other publicly available data sources.

Figure I-11
CSPV modules: Share of the residential and nonresidential installations in each system size grouping, by number of cells, 2020



Source: Barbose, Galen, Naïm Darghouth, Eric O'Shaughnessy, and Sydney Forrester, *Tracking the Sun*, 2021 Edition, Public Data File, https://emp.lbl.gov/tracking-the-sun; California Energy Commission, PV Module List - Full Data, October 1, 2021, https://www.energy.ca.gov/sites/default/files/2021-10/PV_Module_List_Full_Data_ADA.xlsx, retrieved October 6, 2021; other publicly available data sources.

Note: Other includes modules with different cell counts and installations that use modules with different cell configurations in the same system.

Utility systems are generally the largest systems, and provide electricity directly to the electric grid for sale to customers rather than for on-site use (table I-23). These systems are generally ground-mounted and currently tend to use central inverters rather than microinverters. CSPV utility systems may involve fixed-tilt, single-axis tracking (panels rotate to follow the east-west movement of the sun), or dual-axis tracking (panels also move to follow the north-south movement of the sun during the year). Most large systems use single-axis tracking. The majority of utility projects completed in 2020 were small, 5 MW or less in size, though these projects accounted for only 8 percent of the installations in MW. There were 37 projects more than 100 MW in size in 2020, which accounted for 60 percent of installations in

MW.[192] CSPV projects 1 MW or larger in size most commonly use 72 cell monofacial or bifacial modules, but also use a variety of other cell configurations including 60, 81, 96, and 128 cell modules.[193]

Table I-23
U.S. utility installation, 2020

Project size (in MW)	Projects (in number of)	Share of projects (percent)	Volume installed (in MW)	Share of volume installed (percent)
5 or less	350	69	818	8
5.1 to 10	53	10	356	3
10.1 to 20	28	6	423	4
20.1 to 50	15	3	463	4
50.1 to 100	25	5	2,105	20
Greater than 100	37	7	6,244	60
Total	508	100	10,409	100

Source: U.S. Department of Energy, Energy Information Administration, 2020 Form EIA-860 Data - Schedule 3, Solar Technology Data (Operable Units Only), 2020, https://www.eia.gov/electricity/data/eia860/, retrieved October 6, 2021.

As noted above, there are a broad range of off-grid applications, such as power generation in remote locations, mobile power solutions, telecommunications power and lighting systems, and portable consumer goods (such as systems for recharging consumer electronics like tablets and phones). These systems often have additional BOS components, such as a battery and charge controller, though inverters are not needed for all off-grid applications.

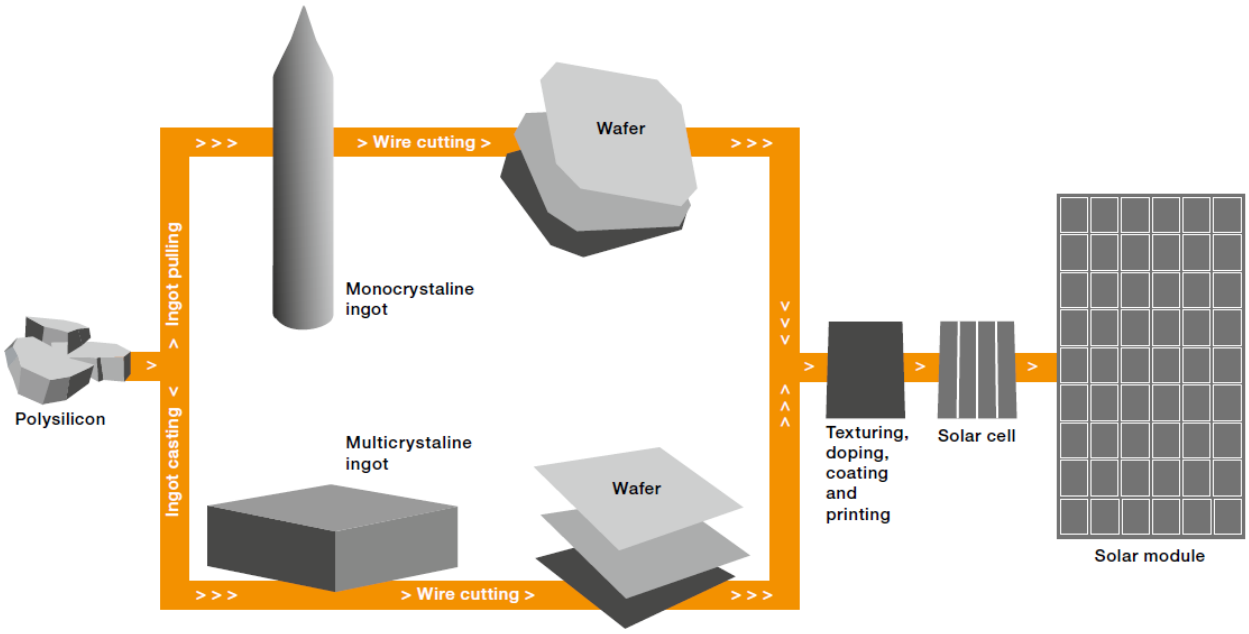
[192] The EIA defines utility projects as those 1 MW or larger in size. The solar portion of the project may be even smaller where multiple technologies are used. U.S. Department of Energy, Energy Information Administration, 2020 Form EIA-860 Data - Schedule 3, Solar Technology Data (Operable Units Only), 2020, https://www.eia.gov/electricity/data/eia860/, retrieved October 6, 2021; USDOE, EIA, "Most U.S. Utility-scale Solar Photovoltaic Power Plants are 5 Megawatts or Smaller," February 7, 2019, https://www.eia.gov/todayinenergy/detail.php?id=38272.

[193] Based on data on CSPV installations 1 MW or larger in size compiled from publicly available data sources and ***. Some of these installations may not fit all definitions of utility solar projects.

Manufacturing facilities and processes[194]

There are five principal stages involved in the manufacture of CSPV products (figure I-12). These are discrete production steps that may be done in different plants or locations, and may be produced in-house or sourced from other companies. First, polysilicon is refined, then it is formed into ingots, using different processes to produce monocrystalline ingots (sometimes referred to as crystals) and multicrystalline ingots. The ingots are then sliced into wafers and converted to CSPV cells, which are then assembled into the finished product, CSPV modules. The following discussion covers some of the most common production processes for each of the five steps.

Figure I-12
CSPV module production process



Source: Wacker Chemie AG, "Polysilicon," n.d., p. 10, https://www.wacker.com/cms/media/publications/downloads/7416_EN.pdf, retrieved October 8, 2019.

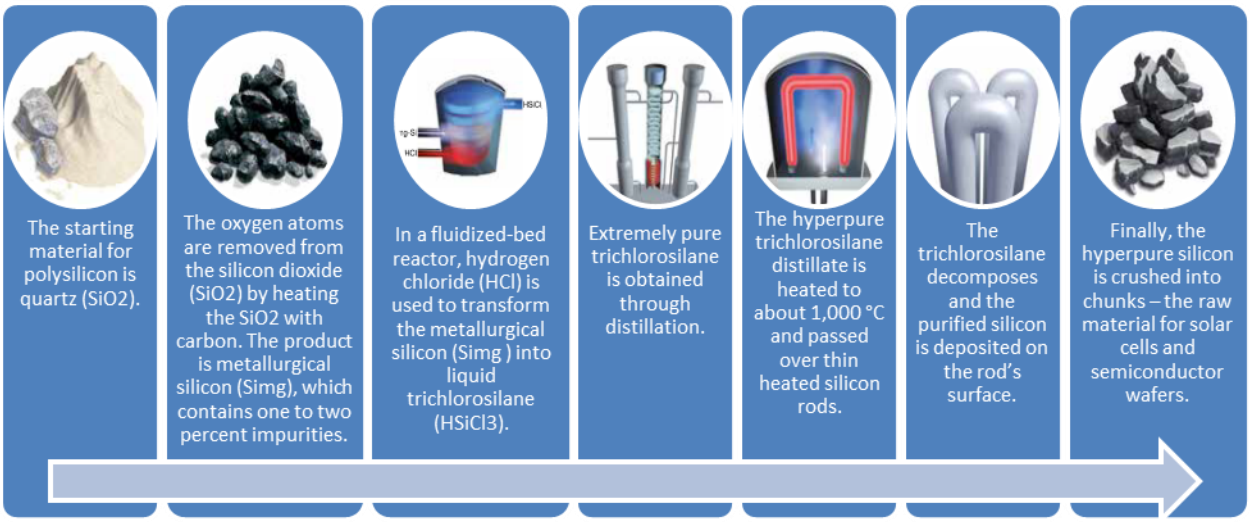
[194] Unless otherwise noted, this section is derived from Monitoring publication, pp. I-59–I-68.

Polysilicon

The first step in the CSPV value chain is refining polysilicon.[195] In the Siemens process (figure I-13), used in the majority of global polysilicon production, first quartz (silicon dioxide) and carbon are heated to around 1,800 degrees Celsius. The carbon reacts with the oxygen, resulting in carbon dioxide and silicon with a purity of around 98 to 99 percent. The silicon is then combined with hydrogen chloride gas at 300 to 350 degrees Celsius, with the reaction resulting in the liquid trichlorosilane. The trichlorosilane is then distilled to increase its purity. Next, heated silicon rods are inserted into a chemical vapor deposition reactor, and hydrogen and trichlorosilane gas are fed into the reactor where they are heated to 1,000 degrees Celsius or more. The silicon from the trichlorosilane is deposited onto the rods, which steadily increase in size until they are removed from the reactor. The resulting high purity polysilicon is crushed into chunks or rocks, then washed, inspected and packaged.

[195] This discussion will focus on the Siemens method, which accounted for 95 percent of global production in 2020. Fluidized bed reactor ("FBR") technology accounted for most of the remaining market. Instead of inserting rods, "FBR uses seed granules of purified silicon. The seed granules are fed into a chamber that has heated silane gas entering from below and exiting above. The flow of gas 'fluidizes' the silicon granules, causing them to flow like a liquid, as the silane gas breaks down and deposits silicon layers on them. The granules grow larger and heavier and exit when they are sufficiently large. As they do so, new seed granules and gas are introduced into the chamber and the process continues." The FBR process, which is newer than the Siemens process, uses 80 to 90 percent less energy, requires a smaller footprint, is a continuous process, takes up less space in shipping, and can increase downstream production efficiency. However, the process is difficult to scale and achieve high purity production at low cost. ITRPV, Results 2017 Including Maturity Report, Ninth Edition, September 2018, p. 8; REC Silicon webpage, http://www.recsilicon.com/technology/rec-silicons-fluidized-bedreactor-process, retrieved June 12, 2017; ITRPV, 2020 Results, p. 7, https://itrpv.vdma.org, retrieved September 28, 2021.

Figure I-13
CSPV products: Polysilicon refining process (Siemens method)



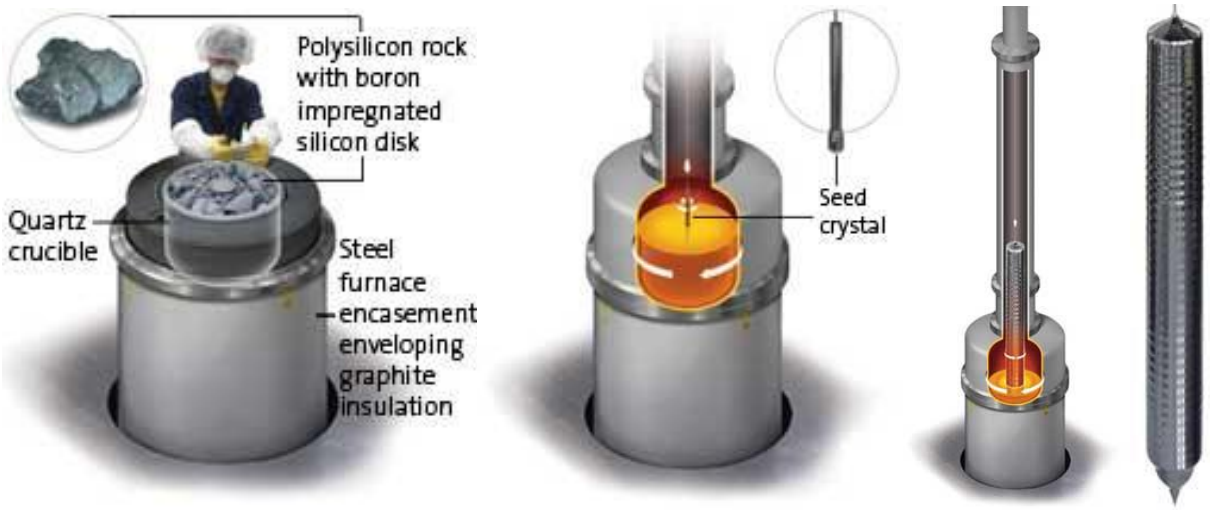
Source: Wacker Chemie AG, "Polysilicon," n.d., p. 8, https://www.wacker.com/cms/media/publications/downloads/7416_EN.pdf, retrieved October 8, 2019.

Ingots

In the Czochralski ("Cz") process[196] for producing crystals used in monocrystalline ingots, polysilicon chunks are first placed into a quartz crucible along with a dopant (boron or gallium), which is used to provide a positive electric orientation (figure I-14).[197] The polysilicon often includes both virgin polysilicon and waste polysilicon generated at later stages of the production process. The crucible is then loaded into a Cz furnace and heated to about 2,500 degrees Fahrenheit. Once the polysilicon is melted, a seed crystal is lowered into the material and rotated, with the crucible rotated in the opposite direction. The melt starts to solidify on the seed and the seed is slowly raised out of the melt—creating a single long crystal. The crystal is then cooled before it is moved onto the next step.

[196] This discussion will focus on the Czochralski process.
[197] ITRPV, *2020 Results*, pp. 8–9, https://itrpv.vdma.org, retrieved September 28, 2021.

Figure I-14
CSPV products: Czochralski process, crucible loading/charging (left), seed crystal (second from left), crystal growing (second from right), and finished crystal (right)



Source: SolarWorld Webpage, https://www.solarworld-usa.com/solar-101/making-solar-panels, retrieved July 15, 2017.

The speed of ingot pulling has increased over time, as has the size of ingots. Firms are moving toward rechargeable Czochralski ("RCz") and continuous Czochralski ("CCz") production processes. These processes enable firms increase the amount that they can cast in a crucible and RCz use has been accompanied by a shift toward using larger crucibles. These processes thus produce larger ingots, reduce energy use and downtime, and increase crucible life.

For multicrystalline ingots, the first step is loading polysilicon (including virgin and recovered waste) into a quartz crucible in a Directional Silicon Solidification ("DSS") furnace for melting (figure I-15). Argon is fed into the furnace to "remove impurities and inhibit oxidation." The "molten silicon is cast into a block and crystallized, forming a multicrystalline structure as the molten silicon and crucible cool." For cast mono (also referred to as quasi-mono or mono-like ingots), which has higher conversion efficiencies, seed ingots are used in the furnace to produce an ingot with a more mono type crystal structure.

Figure I-15
Furnace for multicrystalline ingots: Cross-section (left), single unit (middle), and installed units (right)

Source: ALD Vacuum Technologies, "SCU450 / SCU800 / SCU1200 / SCU1500 Silicon Crystallization Units," October 2016, p. 2, https://www.ald-vt.com/wp-content/uploads/2018/01/SCU2016.pdf, retrieved October 9, 2019; ALD Vacuum Technologies Webpage, https://www.ald-vt.com/portfolio/engineering/vacuum-metallurgy/silicon-crystallization-unit/, retrieved October 9, 2019.

Wafers

Once the ingot has cooled, it is processed into wafers. For monocrystalline ingots: (1) the top and tail (each end of the cylindrical crystal) are cut off, (2) the remaining portion of the crystal (or ingot) is cut into equal length pieces, (3) the ingot is squared,[198] (4) edges are ground, and (5) a wire saw then slices the ingots into wafers. For multicrystalline ingots (1) the ingot is squared, (2) the squared ingot is cut into blocks, (3) the blocks are tested and any parts of the block that do not pass these tests are cropped off, and (4) the blocks are sliced into wafers using a wire saw. Finally, the wafers are cleaned, dried, and inspected. Manufacturers have generally switched to diamond wire saws, which have several benefits, including increasing the speed of the production process.

Another technology for wafer production is Direct-to-Wafer or Direct Wafer technology. This technology involves converting convert molten silicon (or another feedstock) directly into wafers, bypassing the ingot stage. One such process is shown in figure I-16.

[198] In monocrystalline ingot squaring, the rounded sides of the ingot are cut into four flat sides, leaving—in some cases—rounded corners.

Figure I-16
CSPV products: Direct wafer manufacturing process

Source: 1366 technologies webpage, https://1366tech.com/technology-2/#ourwafers, retrieved December 19, 2019.

CSPV cells[199]

The monocrystalline and multicrystalline wafers are next processed into CSPV cells (figure I-17). The main steps in producing a standard, p-type, aluminum back surface field CSPV cell are as follows:

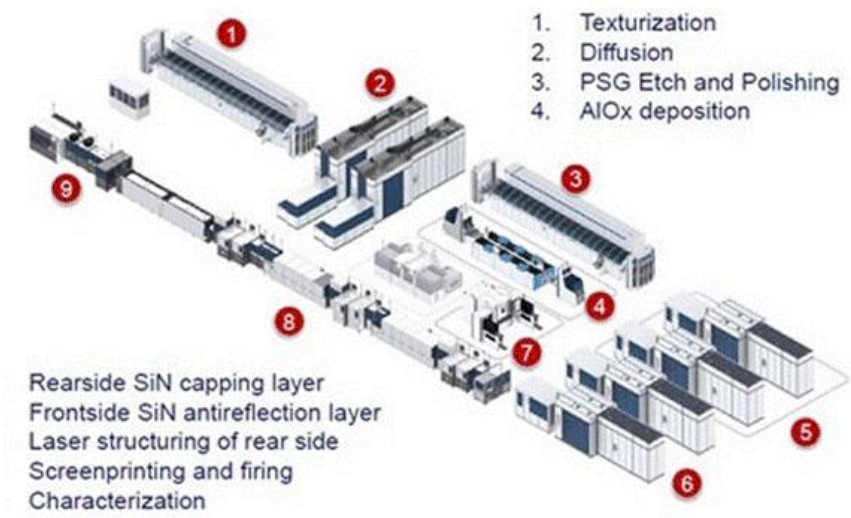
- **Cleaning and texturing:** First, the wafers are cleaned, then the surface of the wafer undergoes a chemical treatment that reduces the reflection of sunlight and increases light absorption.
- **Diffusion:** In the next step, "phosphorus is diffused into a thin layer of the wafer surface. The molecular-level impregnation occurs as the wafer surface is exposed to phosphorus gas at a high heat, a step that gives the surface a negative potential electrical orientation. The combination of that layer and the doped layer below creates a positive-negative, or p/n, junction–a critical partition in the functioning of a PV cell."[200]
- **Edge isolation:** A thin layer of silicon is then removed from the edge of the CSPV cell to separate the positive and negative layers.
- **Coating:** Next, a silicon nitride antireflective coating is added to the CSPV cells to increase the absorption of sunlight.
- **Printing:** Metals are then printed on the solar CSPV cell to collect the electricity. On the front of the CSPV cell, these metals are printed in thin metal strips called fingers, which are connected to the rest of the CSPV module via busbars. A metal layer, typically aluminum, is also printed on the back of the CSPV cell.

[199] The cell manufacturing process varies by company and technology. This section will only describe the process for producing an aluminum back surface field cell and a monocrystalline PERC cell.
[200] SolarWorld, "Energy for You and Me" brochure, p. 12.

- **Co-firing:** The CSPV cells then enter a furnace, where the "high temperature causes the silver paste to become imbedded in the surface of the silicon layer, forming a reliable electrical contact."[201]
- **Testing and sorting:** The final step in the process is the testing and sorting of the CSPV cells based on their characteristics and efficiency.

Producing passive emitter rear contact ("PERC") CSPV cells requires several modifications to the production process for Al-BSF CSPV cells. The first modification is that, in the edge-isolation step, texturing on the rear side of the cell is removed (rear polishing). Further, in addition to coating the front of the cell with silicon nitride, the rear side is passivated with aluminum oxide (AlOx) and an antireflective silicon nitride (SiN) layer is added to the rear side. The final process addition involves using lasers to open holes in the rear passivation layer to allow the aluminum to contact the silicon.

Figure I-17
CSPV cell production process



Source: CETC Solar Energy Webpage, http://cetcsolarenergy.com/products/solar_pv_production_equipments.html, retrieved October 10, 2019.

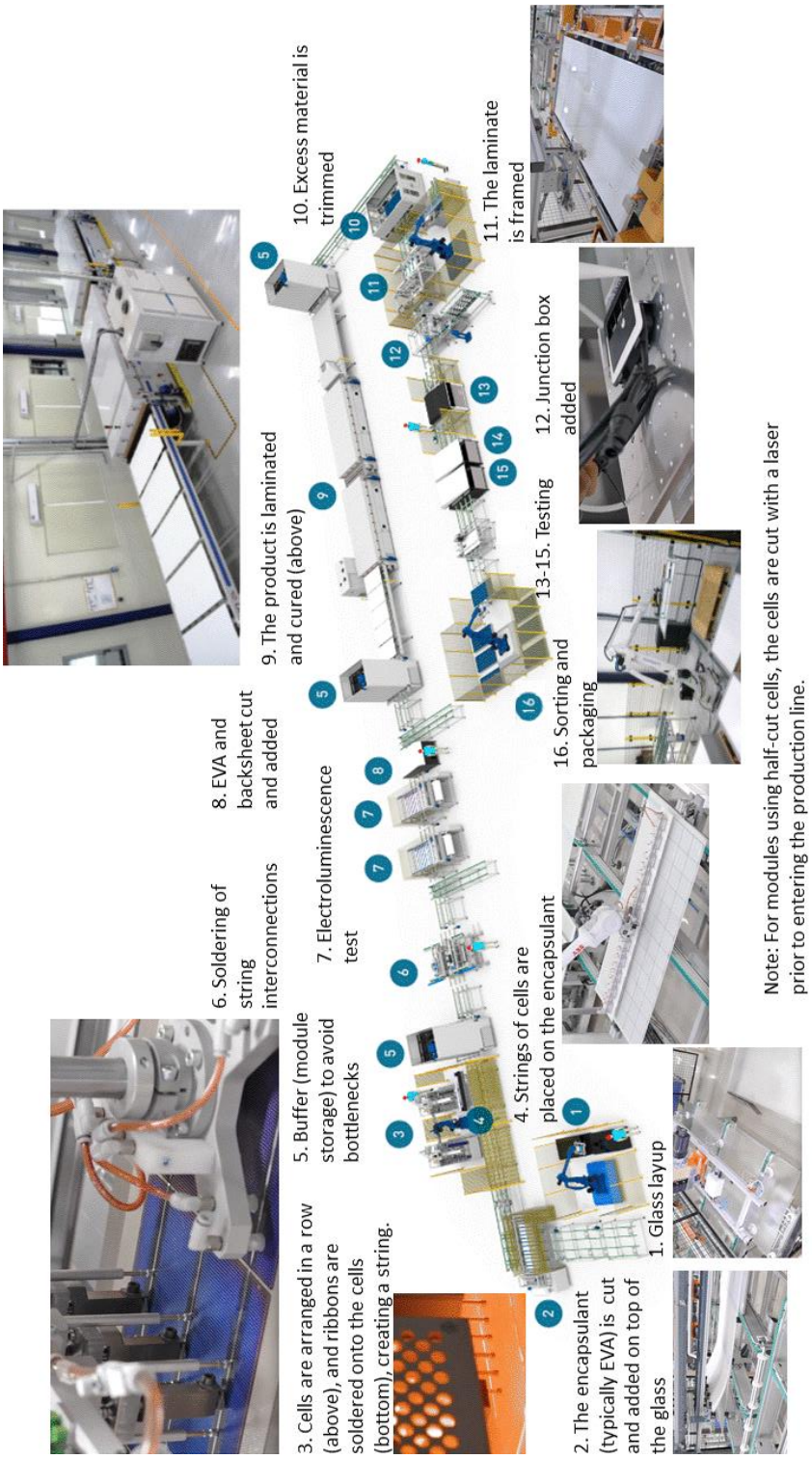
CSPV modules

The CSPV cells are next assembled into CSPV modules (figure I-18). If half-cut cells are used, the CSPV cells are first cut in half using a laser. Next, a piece of glass is placed on the production line, on top of which is added a piece of ethyl vinyl acetate ("EVA") or another encapsulant. Then a group of CSPV cells is placed in a line and soldered together, creating a

[201] JA Solar, "Form 20-F," April 16, 2013, p. 41.

string. The strings are then placed on top of the encapsulant, and the string interconnections are soldered together. After this, another layer of EVA and a backsheet are added, then the product is laminated and cured (creating what is referred to as a “laminate”). Excess material is then trimmed, usually a frame is added, and a junction box is attached to the back. CSPV modules are then tested, sorted, and packaged.

Figure I-18
CSPV module production process, fully automated assembly line



Source: Ecoprogetti Webpage, https://ecoprogetti.com/100mw-fully-automatic/, retrieved October 7, 2019; Mondragon Assembly, "Turnkey Solar Module Manufacturing Line–PV Module Factory–Mondragon Assembly," https://www.youtube.com/watch?v=_KTrq63Q2u4, retrieved October 7, 2019.

Out-of-scope thin film modules

Market

U.S. installations of thin film modules in the utility segment, the largest market segment for thin film products, increased from 1.5 GW in 2018 to 3.2 GW in 2020. Installations of cadmium telluride (CdTe) modules, the type produced by First Solar, increased from 1.1 GW in 2018 to 3.3 GW in 2020 (table I-24). Other technologies accounted for a much smaller share of the utility market.[202] Thin film is installed in residential and nonresidential applications, but accounts for only a small share of the market.[203]

Table I-24
U.S. thin film utility installations, 2018–20

Quantity in megawatts

Technology	2018	2019	2020
Cadmium telluride	1,110	2,251	3,262
Copper indium (gallium) selenide	226	0	34
Amorphous silicon	24	0	0
Other	100	43	27
Total	1,459	2,294	3,322

Source: U.S. Department of Energy, Energy Information Administration, 2020 Form EIA-860 Data - Schedule 3, Solar Technology Data (Operable Units Only), 2020, https://www.eia.gov/electricity/data/eia860/, retrieved October 6, 2021.

Note: The "other" category is other thin film products in the data set and is not further defined.

U.S. industry

U.S. production of thin film modules increased from *** GW in 2018 to *** GW in 2020, according to ***.[204] *** estimates that First Solar accounted for *** percent of shipments of domestically produced thin film modules in 2020.[205] In 2020, CIGS producers MiaSolé (150 MW in annual capacity) and Global Solar (50 MW) ended

[202] U.S. Department of Energy, Energy Information Administration, 2020 Form EIA-860 Data - Schedule 3, 'Solar Technology Data' (Operable Units Only), 2020, https://www.eia.gov/electricity/data/eia860/, retrieved October 6, 2021.

[203] Barbose, Galen, Naïm Darghouth, Eric O'Shaughnessy, and Sydney Forrester, *Tracking the Sun*, 2021 Edition, Public Data File, https://emp.lbl.gov/tracking-the-sun.

[204] Petitioner Hanwha/LG/Mission's prehearing brief, exhibit 18; Petition SEIA/REC's prehearing brief, exhibit 97.

[205] ***.

U.S. production, while CdTe producer Toledo Solar opened a 100 MW plant in Ohio.[206] The remainder of this section will focus on First Solar since it is the largest U.S. producer.

First Solar

U.S. headquartered First Solar is the leading U.S. and global producer of thin film modules. First Solar's thin film production involves the deposition of the photosensitive semiconductor material (CdTe) onto the glass surface of the module. As a result, there is not the separate production of ingots, wafers, cells, and modules on different production lines or in different production plants that takes place with CSPV. Instead, the entire production process from raw materials to a finished module takes place on the same production line.

First Solar significantly increased both domestic and foreign production capacity during 2018–20, and is planning significant additional capacity expansions (table I-25). In the United States, First Solar increased production capacity in Ohio from 800 MW in 2018 to 2.2 GW in 2020. The firm plans to further increase U.S. production capacity to 2.6 GW in 2021 and 2.7 GW in 2022. The firm broke ground on a new plant in Ohio in August 2021 that is expected to bring production capacity to 5.7 GW in 2023.[207] The firm had about 2,000 employees in North America as of the end of 2020.[208]

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[206] Pickerel, Kelly, "The Winners and Losers in U.S. Solar Manufacturing in 2020," *Solar Power World*, November 16, 2020, https://www.solarpowerworldonline.com/2020/11/the-winners-and-losers-in-u-s-solar-manufacturing-in-2020/, retrieved November 11, 2021.

[207] NSG Group opened a new glass plant in Ohio in 2020 in response to a long-term supply agreement with First Solar. Compiled from First Solar investor materials and other publicly available data sources; NSG Group, "NSG's Solar Glass Float Furnace in U.S. Starts Operation," News release, November 12, 2020, https://www.nsg.com/en/media/ir-updates/announcements-2020/nsgs-solar-glass-float-furnace-in-us-starts-operation, retrieved November 15, 2021.

[208] First Solar, *Sustainability Report 2021*, 2021, p. 38, https://www.firstsolar.com/-/media/First-Solar/Sustainability-Documents/FirstSolar_Sustainability-Report_2021.ashx, retrieved November 15, 2021.

Table I-25
First Solar's production and capacity, 2021–24

Quantity in GW; n.a.=not available

Year	U.S. and global production (in gigawatts)	End of year U.S. production capacity (in gigawatts)	End of year production capacity in Malaysia and Vietnam (in gigawatts)
2018	2.7	0.8	4.4
2019	5.7	1.9	5.6
2020	6.1	2.2	4.1
2021 (projected)	7.4–7.6	2.6	6.1
2022 (projected)	8.6–9.0	2.7	6.7
2023 (projected)	n.a.	5.7	9.7

Source: Compiled from First Solar investor materials.

Notes: Capacity is end of the year capacity and comparing production and capacity in a year may understate capacity utilization levels. During 2018 to 2021, First Solar was shifting from production of its Series 4 to Series 6 modules and decreases in production capacity from one year to the next reflect taking plants offline to bring in new production equipment for Series 6 production. First Solar's 2018 U.S. production capacity includes Series 6 production as well as legacy Series 4 production that was restarted to meet demand. First Solar's 2019 production capacity in Malaysia includes Series 4 production that was online during the year. Production capacity in Malaysia for 2020 does not include Series 4 capacity that was taken offline at the end of 2019 and in 2020.

First Solar also increased production in Malaysia and Vietnam. Prior to 2018, First Solar only had production in Malaysia. During 2018 to 2020, the firm added production in Vietnam and brought online new and retooled production in Malaysia to produce its latest product. First Solar's total production capacity in Southeast Asia increased from 4.4 GW in 2018 to 5.6 GW in 2019 and is expected to reach 6.1 GW at the end of 2021, after dropping in 2020 due to plant retooling. Foreign production is expected to further increase to 9.7 GW in 2023, primarily driven by opening a new 3 GW plant in India.[209]

The United States is the largest market for First Solar, accounting for 66 percent of net sales in 2018, 87 percent in 2019, and 68 percent in 2020 (table I-26).[210] About *** percent of First Solar's module production went to the U.S. market in 2019, while about *** percent of their production went to the US. market in 2020 (table I-27). Of production that went to the

[209] Compiled from First Solar investor materials and other publicly available information.

[210] First Solar, Form 10-K, Annual Filing to the Securities and Exchange Commission for the Fiscal Year Ending December 31, 2020, p. 141, https://investor.firstsolar.com/financials/sec-filings/default.aspx, retrieved November 12, 2021.

U.S. market, about *** percent was provided by imports in 2019 and about *** percent was provided by imports in 2020.

Table I-26
First Solar net sales, by country and period

Net sales in thousand dollars; shares in percent

Country	Measure	2020	2019	2018
United States	Value	1,843,433	2,659,940	1,478,034
Japan	Value	469,657	34,234	234,814
France	Value	127,097	88,816	28,796
Canada	Value	118,865	5,944	5,391
India	Value	33,848	7,451	232,130
Australia	Value	20,788	138,327	153,163
All other foreign countries	Value	97,644	128,405	111,716
Total net sales	Value	2,711,332	3,063,117	2,244,044
United States	Share of value	68	87	66
Japan	Share of value	17	1	10
France	Share of value	5	3	1
Canada	Share of value	4	0	0
India	Share of value	1	0	10
Australia	Share of value	1	5	7
All other foreign countries	Share of value	4	4	5
Net sales	Share of value	100	100	100

Source: First Solar, Form 10-K, Annual Filing to the Securities and Exchange Commission for the Fiscal Year Ending December 31, 2020, p. 141, https://investor.firstsolar.com/financials/sec-filings/default.aspx, retrieved November 12, 2021.

Table I-27
First Solar's U.S. production, global production and U.S. imports, by period

Production and imports in megawatts; shares in percent

Item	Unit	2019	2020
U.S. production	Megawatts	***	***
U.S. imports	Megawatts	4,177	3,662
Total global production	Megawatts	5,700	6,100
U.S. production and imports as a share of total production	Share of quantity	***	***

Source: ***; First Solar investor materials; USITC DataWeb/Census, retrieved November 11, 2021.

Note: U.S. imports are based on U.S. imports from Malaysia and Vietnam in HTS 8541.40.6035 and rate provision code 10 and may include some non-First Solar products. Data for 2018 are not included as import volumes in watts and separate data for non-CSPV products are not available for the full year.

Part II: Conditions of competition in the U.S. market

U.S. market characteristics

CSPV products are primarily used in three on-grid market segments – residential, nonresidential (commercial), and utility. Modules vary in size, nominal power output, and efficiency, and output efficiency generally improves year after year. Residential and small commercial solar installations typically use 60-cell/120 half-cut cell modules, often with a high conversion efficiency, due to their smaller size. Larger commercial projects and utility-scale projects typically use 72-cell/144 half-cut cell modules because they are usually less expensive to install due to lower labor and balance of system costs.[1]

All three on-grid market segments have experienced growth since the implementation of the safeguard tariff-rate quota (TRQ) on February 7, 2018, and demand for solar power has grown each year. Several new domestic producers of CSPV modules have also either begun module manufacturing/assembly operations or increased production, including Hanwha, Jinko Solar, and LG. While domestic production of CSPV modules has grown since February 7, 2018, domestic production of CSPV cells has decreased to zero in January-June 2021. Apparent U.S. consumption of CSPV cells was *** percent higher by quantity in 2020 compared to 2018 but *** percent lower in January-June 2021 compared to January-June 2020. Apparent U.S. consumption of CSPV modules was 290.9 percent higher by quantity in 2020 compared to 2018 and 7.1 percent higher in January-June 2021 compared to January-June 2020.

U.S. producers and importers were asked whether there been any significant changes in the product range, product mix, technology, or marketing of CSPV products since February 7, 2018.[2] A large majority of firms (including 12 of 13 U.S. producers and 33 of 42 importers) reported that there had been significant changes. As in the monitoring phase, most of the firms reporting changes identified improvements in cell and module efficiency, larger wafer/cell sizes, more bifacial modules (particularly for the utility segment), and more PERC/mono-PERC modules. A few firms also mentioned a movement from multi-crystalline to mono-crystalline products. One firm each also reported an increase in half-cut cells, N-type cells, demand in the trucking industry, and demand for full black modules in the residential sector. Tesla also

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[1] Previously, utilities also purchased 60-cell modules, including 60-cell mono-crystalline modules. Monitoring publication, p. II-1.

[2] In the monitoring phase investigation, roughly half of the responding firms (8 of 15 U.S. producers and 23 of 43 importers) indicated that there had been significant changes since February 7, 2018, with nearly all firms highlighting improvements in cell and module efficiency and greater output power. Monitoring publication, p. II-2.

reported in the monitoring phase that it introduced a new version of its Solar Roof tiles in 2019, which has increased in efficiency since its introduction to the market.[3]

Channels of distribution

U.S. producers reported selling their cells *** to ***, but *** during January 2020-June 2021.[4] U.S. producers reported selling most of their modules to distributors in 2018 and increasingly larger shares to residential, commercial, and utility segments in 2019–20.[5] A plurality of U.S. producers' domestic module shipments reportedly went to the utility market in 2020 and January-June 2021. Importers reported selling most of their cells to distributors in 2018 and the vast majority to assemblers during the rest of the period. Importers also reported selling a plurality of their modules to utility end users in 2018 and a majority to utility end users during the rest of the period for which data were collected.

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[3] On October 25, 2019, Tesla started selling version 3 of its glass Solar Roof tiles. See CNBC, *Tesla releases a new version of Solar Roof tiles*, available at https://www.cnbc.com/2019/10/25/tesla-releases-solar-roof-tiles-v-3.html, accessed November 12, 2021. "Now the company is now producing quotes and starting installations with a new 'SR72T1' solar tile. The new tile features a higher max power output of 71.67 watts… {yielding} a 22 % increase in max power output." Electrek, *Tesla launches new solar roof tiles with more power, higher efficiency*, https://electrek.co/2021/11/01/tesla-launches-new-solar-roof-tiles-more-power-higher-efficiency/, accessed November 12, 2021. See also Petitioners Hanwha and Mission's prehearing brief, p. 39.

[4] Three U.S. producers (***) reported commercial shipments of cells during 2018-19. Eleven firms, ***, reported commercial shipments of modules during January 2018-June 2021.

[5] ***. See also Petitioners Hanwha and Mission's posthearing brief, pp. 4-7. Staff notes that ***.

Table II-1
CSPV products: Share of U.S. producers' and importers' U.S. shipments, by source, product type, channel of distribution, and period

Shares in percent

Source	Product type	Channel	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
United States	Cells	Assemblers	***	***	***	***	***
United States	Cells	Distributors	***	***	***	***	***
United States	Cells	Residential	***	***	***	***	***
United States	Cells	Commercial	***	***	***	***	***
United States	Cells	Utilities	***	***	***	***	***
United States	Modules	Assemblers	***	***	***	***	***
United States	Modules	Distributors	***	***	***	***	***
United States	Modules	Residential	***	***	***	***	***
United States	Modules	Commercial	***	***	***	***	***
United States	Modules	Utilities	***	***	***	***	***
Imports sources	Cells	Assemblers	***	***	***	***	***
Imports sources	Cells	Distributors	***	***	***	***	***
Imports sources	Cells	Residential	***	***	***	***	***
Imports sources	Cells	Commercial	***	***	***	***	***
Imports sources	Cells	Utilities	***	***	***	***	***
Imports sources	Modules	Assemblers	***	***	***	***	***
Imports sources	Modules	Distributors	***	***	***	***	***
Imports sources	Modules	Residential	***	***	***	***	***
Imports sources	Modules	Commercial	***	***	***	***	***
Imports sources	Modules	Utilities	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---". The term "assemblers" in this table refers to sales or shipment to module assemblers or manufacturers.

Supply and demand considerations

Changes in U.S. supply

Table II-2 summarizes supply information for U.S. and foreign producers of CSPV cells, and table II-3 summarizes supply information for U.S. and foreign producers of CSPV modules. As shown in table II-2, domestic cell capacity decreased between 2018 and 2020, while cell capacity among all foreign sources combined increased during this time, as it did in most of the individual countries identified.

Table II-2
CSPV cells: Supply factors that affect the ability to increase shipments to the U.S. market, by factor and country

Quantity in kilowatts; ratio in percent; count is number of “yes” responses

Factor	Measure	United States	Canada	China	Korea	Malaysia
Capacity 2018	Quantity	***	***	***	***	***
Capacity 2020	Quantity	***	***	***	***	***
Capacity utilization 2018	Ratio	***	***	***	***	***
Capacity utilization 2020	Ratio	***	***	***	***	***
Ending inventories 2018	Ratio	***	***	***	***	***
Ending inventories 2020	Ratio	***	***	***	***	***
Home market 2020	Ratio	***	***	***	***	***
Non-US export markets 2020	Ratio	***	***	***	***	***
Ability to shift production	Count	NA	***	***	***	***

Table continued

Table II-2 Continued
CSPV cells: Supply factors that affect the ability to increase shipments to the U.S. market, by factor and country

Quantity in kilowatts; ratio in percent; count is number of “yes” responses

Factor	Measure	Mexico	Singapore	Thailand	Vietnam	All other sources	All foreign sources
Capacity 2018	Quantity	***	***	***	***	***	50,636,526
Capacity 2020	Quantity	***	***	***	***	***	91,746,178
Capacity utilization 2018	Ratio	***	***	***	***	***	83.3
Capacity utilization 2020	Ratio	***	***	***	***	***	76.3
Ending inventories 2018	Ratio	***	***	***	***	***	4.3
Ending inventories 2020	Ratio	***	***	***	***	***	3.5
Home market 2020	Ratio	***	***	***	***	***	87.8
Non-US export markets 2020	Ratio	***	***	***	***	***	7.9
Ability to shift production	Count	***	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent.

As shown in table II-3, module capacity for domestic producers and all foreign sources combined increased between 2018 and 2020. Among foreign producers, module capacity increased the most for China, Vietnam, Thailand, and Malaysia, while it increased slightly for Singapore. Reported module capacity decreased slightly for Canada and Korea and more so for Mexico.

Table II-3
CSPV modules: Supply factors that affect the ability to increase shipments to the U.S. market, by factor and country

Quantity in kilowatts; ratio in percent; count is number of "yes" responses

Factor	Measure	United States	Canada	China	Korea	Malaysia
Capacity 2018	Quantity	1,121,200	***	32,453,097	***	4,473,000
Capacity 2020	Quantity	3,830,309	***	71,851,102	***	5,507,660
Capacity utilization 2018	Ratio	41.9	***	86.2	***	90.3
Capacity utilization 2020	Ratio	57.9	***	82.1	***	89.4
Ending inventories 2018	Ratio	***	***	6.2	***	***
Ending inventories 2020	Ratio	***	***	3.8	***	***
Home market 2020	Ratio	***	***	***	***	***
Non-US export markets 2020	Ratio	***	***	***	***	***
Ability to shift production	Count	NA	***	***	***	***

Table continued

Table II-3 Continued
CSPV modules: Supply factors that affect the ability to increase shipments to the U.S. market, by factor and country

Quantity in kilowatts; ratio in percent; count is number of "yes" responses

Factor	Measure	Mexico	Singapore	Thailand	Vietnam	All other sources	All foreign sources
Capacity 2018	Quantity	***	***	***	***	***	54,018,797
Capacity 2020	Quantity	***	***	***	***	***	100,899,586
Capacity utilization 2018	Ratio	***	***	***	***	***	82.1
Capacity utilization 2020	Ratio	***	***	***	***	***	82.9
Ending inventories 2018	Ratio	***	***	***	***	***	6.7
Ending inventories 2020	Ratio	***	***	***	***	***	5.5
Home market 2020	Ratio	***	***	***	***	***	35.5
Non-US export markets 2020	Ratio	***	***	***	***	***	42.7
Ability to shift production	Count	***	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent.

Domestic production

Based on available information, U.S. producers of CSPV cells have the ability to respond to changes in demand with small changes in the quantity of shipments of U.S.-produced CSPV cells to the U.S. market. The main contributing factors to this degree of responsiveness of supply include decreases in total capacity and production and *** inventories ***. Cell producers also reported no *** production in January-June 2021. Overall, domestic cell capacity decreased *** during 2018-2020, while production decreased ***. Ending inventories decreased from *** percent of total shipments to *** in 2020. U.S. producers reported *** home market shipments in 2020, and *** identified their export markets as China, Philippines, and Vietnam. Panasonic was the only confirmed domestic producer of cells at the beginning of 2020, and the firm reported ceasing its operations ***.[6]

Based on available information, U.S. producers of CSPV modules have the ability to respond to changes in demand with large changes in the quantity of shipments of U.S.-produced CSPV modules to the U.S. market. The main contributing factors to this degree of responsiveness of supply include increasing capacity and production, some available capacity, and some inventories. A factor mitigating this degree of responsiveness include a limited ability to shift shipments from alternate markets. U.S. module producers also reported more transfers to related firms during 2019-20 and January-June 2021 than commercial shipments, and several purchasers reported very long lead times due to high domestic demand. Overall, domestic module capacity and production increased more than three-fold between 2018 and 2020, while the ratio of inventories to total shipments increased from *** percent to *** percent. *** reported very limited export shipments after 2018, and it indicated that they were "***."

Imports

Based on available information, producers of CSPV cells from outside the United States have the ability to respond to changes in demand with large changes in the quantity of shipments of CSPV cells to the U.S. market. The main contributing factor to this degree of responsiveness of supply are large and increasing global capacity, the availability of some unused capacity, and the ability to shift shipments from foreign producers' home markets. As shown in table II-2, all of the individual countries listed aside from ***

[6] See also Monitoring publication, pp. I-38 and II-7.

reported increases in cell capacity between 2018 and 2020. The largest source of wafers and cells, China, reported *** its capacity between 2018 and 2020 while its overall capacity utilization decreased. Responding foreign producers also reported that their home market shipments accounted for nearly *** percent of their total shipments in 2020. A factor mitigating this responsiveness of supply is the inability to shift shipments from alternate products.

Based on available information, producers of CSPV modules from outside the United States have the ability to respond to changes in demand with large changes in the quantity of shipments of CSPV modules to the U.S. market. The main contributing factors to this degree of responsiveness of supply are large and increasing global capacity, the availability of some unused capacity, and the ability to shift shipments from foreign producers' home markets. As shown in table II-3, reported capacity for all foreign sources combined increased nearly two-fold between 2018 and 2020. Foreign producers' total home market shipments and non-U.S. export shipments combined accounted for more than three-quarters of their total shipments in 2020.

Supply constraints

Half of the responding U.S. producers (7 of 14 firms) reported constraints on their supply (such as refusing, declining, or being unable to supply CSPV products) since February 7, 2018. Among responding importers, most (28 of 44 firms) reported that they did not experience any supply constraints since February 7, 2018. Among the firms reporting supply constraints, a plurality reported that the constraints were at least partially due to the COVID-19 pandemic, which caused shipping problems and lead time delays. Several firms, including *** also reported that the safeguard tariff constrained supply. *** reported that its supplier delivered less than promised after it stopped importing products subject to the safeguard tariff, while *** reported that it was on allocation status in the second half of 2018. Importer *** stated that it is "harder to buy modules due to increased prices," and *** stated that it experienced "material price hikes."

In terms of cells specifically, *** reported that the safeguard tariff had a "chilling effect" on cell capacity expansion, as well as the Section 301 tariffs on some raw materials and manufacturing equipment. *** reported that its module production is constrained by a general lack of cell availability, and *** added that it anticipates a shortage of cells by the end of 2021 and "for the coming years" when it believes the cell requirements of domestic CSPV module manufacturers will exceed the import quota

under the current safeguard measure. Petitioner and former cell producer Suniva, which has not produced any cells since idling its operations in April 2017, reported that its cell manufacturing facility is temporarily idled.[7]

Among purchasers, just under half (22 of 46 firms) reported that they experienced supply constraints with regards to U.S. producers, while almost 70 percent (36 of 52 firms) reported that they experienced supply constraints from import sources. For the purchasers that reported supply constraints from domestic producers, several referred to COVID-related shipping delays and production constraints, and several reported that domestic capacity is insufficient to meet domestic demand. Five firms (including ***) reported that the domestic producers are limited in their ability to meet demand in the utility market, in particular.[8] Other firms reported that while the domestic industry is able to supply the market, it is only able to do so in limited quantity and with delays. Three firms (***) reported that domestic producers are only taking orders on products to be delivered 2-3 years out. Five firms (including ***) also reported that domestic prices are higher than import prices.

For the purchasers that reported supply constraints from import sources, a number of constraints were highlighted. Several firms reported shipment delays related to the COVID-19 pandemic, indicating that the pandemic caused factory shutdowns, production delays, and shipment delays for both ocean freight and inland trucking. Several firms also pointed to either the safeguard tariff, AD/CVD tariffs, or the Withhold Release Order placed on silica-based

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[7] Suniva estimated that the COVID-19 pandemic contributed to ***. See Petitioner Suniva's prehearing brief, p. 29.

[8] See also Respondents SEIA and REC America's prehearing brief, pp. 12-39; Respondents SEIA and REC America's posthearing brief, pp. 6-8 and Responses to Commission Questions, pp. 1-12 and 42-47; Respondents ACP and Clearway's prehearing brief, pp. 17-23; Respondents ACP and Clearway's posthearing brief, pp. 10-15 and Responses to Commissioner Kearns' Question 2, Commissioner Johanson's Questions 1-4, and Commissioner Schmidtlein's Questions 2-3, and 5; Respondent NextEra's prehearing brief, pp. 6-9; and Respondent NextEra's posthearing brief, pp. 3-6 and Responses to Commission Questions, pp. 1-10. Petitioner Hanwha argues that "the domestic module industry that has developed and grown under the safeguard serves all market segments – residential, commercial, and utility – with *** directed to utility customers." Hanwha, the largest U.S. module producer in 2020, states that more than *** of its shipments were directed to utility customers during the period, and that the company's largest customer is in the utility sector. Petitioners Hanwha and Mission's posthearing brief, pp. 4-7, and Responses to Commission Questions, pp. 39-40. See also Petitioner Auxin's posthearing brief, Responses to Commission Questions, pp. II-11–18; and Petitioner LG's posthearing brief, pp. 5-6, Responses to Commission Questions, pp. 18-20.

products from Hoshine (China) as causing uncertainty in the supply chain.[9] Other firms highlighted general supply issues, including capacity and supply limitations, shipment delays, capacity that is already booked for several months or years out, or deliveries of only limited quantities.

Availability of supply

U.S. producers, importers, and purchasers were asked if the availability of cells and, separately, modules from U.S. producers and import sources had changed since February 7, 2018. Regarding cells, most firms (8 of 12 U.S. producers, 24 of 36 importers, and 17 of 25 purchasers) reported that the availability of domestic cells had not changed, with almost all responding firms indicating that there is either no current domestic cell production or that it has decreased since February 7, 2018. Several firms highlighted the closure of Suniva's and Panasonic's cell manufacturing operations, while a handful more highlighted the closure of SunPower/SolarWorld's cell operations. Most U.S. producers (7 of 11 firms) and purchasers (16 of 24 firms) reported that the availability of imported cells had changed since February 7, 2018, while most importers (19 of 33 firms) reported that it had not. Most of the firms reporting a change in the availability of imported cells cited an increase in overseas production, capacity, and output, with several firms pointing to the expansion of domestic module manufacturing combined with the as-yet unmet cell import quota as a reason. A few firms reported a decrease in the availability of imported cells, with five firms (***) citing COVID-19 as the reason, two citing the WRO as the reason (***), and one (***) indicating that its *** cell supplier shut down and its cell vendors *** lost their ability to supply multi-crystalline cells.

Regarding modules, most firms reported that the availability of both domestic modules (including all 11 U.S. producers, 23 of 36 importers, and 35 of 51 purchasers) and imported

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[9] In June 2021 U.S. Customs and Border Protection (CBP) issued a WRO, or Withhold Release Order, against Hoshine Silicon Industry Co. Ltd., a company located in China's Xinjiang Uyghur Autonomous Region, on shipments containing silica-based products made by Hoshine and its subsidiaries. CBP issued its WRO "based on information reasonably indicating that Hoshine uses forced labor to manufacture silica-based products." *U.S. Customs and Border Protection website*, https://www.cbp.gov/newsroom/national-media-release/department-homeland-security-issues-withhold-release-order-silica, accessed October 7, 2021. Several firms, including JinkoSolar, Trina Solar, Canadian Solar, and LONGi all appear to have had at least some imported product of Chinese origin held at the port due to the WRO. *PVTech*, "LONGi Solar the latest module manufacturer targeted by US WRO enforcement, reports suggest," https://www.pv-tech.org/longi-solar-the-latest-module-manufacturer-targeted-by-us-wro-enforcement-reports-suggest/, accessed November 4, 2021.

modules (including 8 of 10 U.S. producers, 23 of 35 importers, and 42 of 52 purchasers) had changed. Among the firms reporting a change in domestic module availability, the vast majority of responding U.S. producers and importers reported it had increased, highlighting the construction of new facilities by Hanwha, Heliene, Jinko Solar, LG, and capacity expansions by Silfab. *** also noted that a company called Convalt Energy purchased SolarWorld's former manufacturing with plans to begin manufacturing solar panels from a new-build factory in Watertown, NY beginning in July 2022.[10] Purchaser responses were more mixed, though most also reported that U.S. module availability had increased. Several firms reported that domestic demand is larger than domestic supply, particularly in the utility segment. A few firms also pointed to the COVID-19 pandemic as having caused production and shipment delays.

Among the firms reporting a change in the availability of imported modules, most indicated that such modules had become more available, with several reporting that imports have fulfilled the increase in domestic demand. Several of these firms indicated that the increase in imported modules was for the utility market. Several firms also reported that there has been an increase in global module capacity, particularly in Southeast Asia. Other firms, primarily purchasers, indicated that the combination of high domestic demand, the COVID-19 pandemic, and the WRO created module shortages, port congestion, and greater volatility.

Changes in U.S. demand

During the safeguard investigation, the Commission found that demand for CSPV products was derived from the demand for solar electricity, which is influenced by factors such as total energy consumption, cost competitiveness with traditional energy sources,[11] the availability of Federal, state, and local incentives, environmental concerns, and a desire for national energy independence.[12]

Electricity demand in the United States remains supplied primarily by conventional fuel sources, with natural gas and coal accounting for between 57.5 percent and 62.2 percent of the total electricity generated during January 2018-June 2021. Nonetheless, the share of electricity generated from these sources declined during this time, while the share of electricity generated

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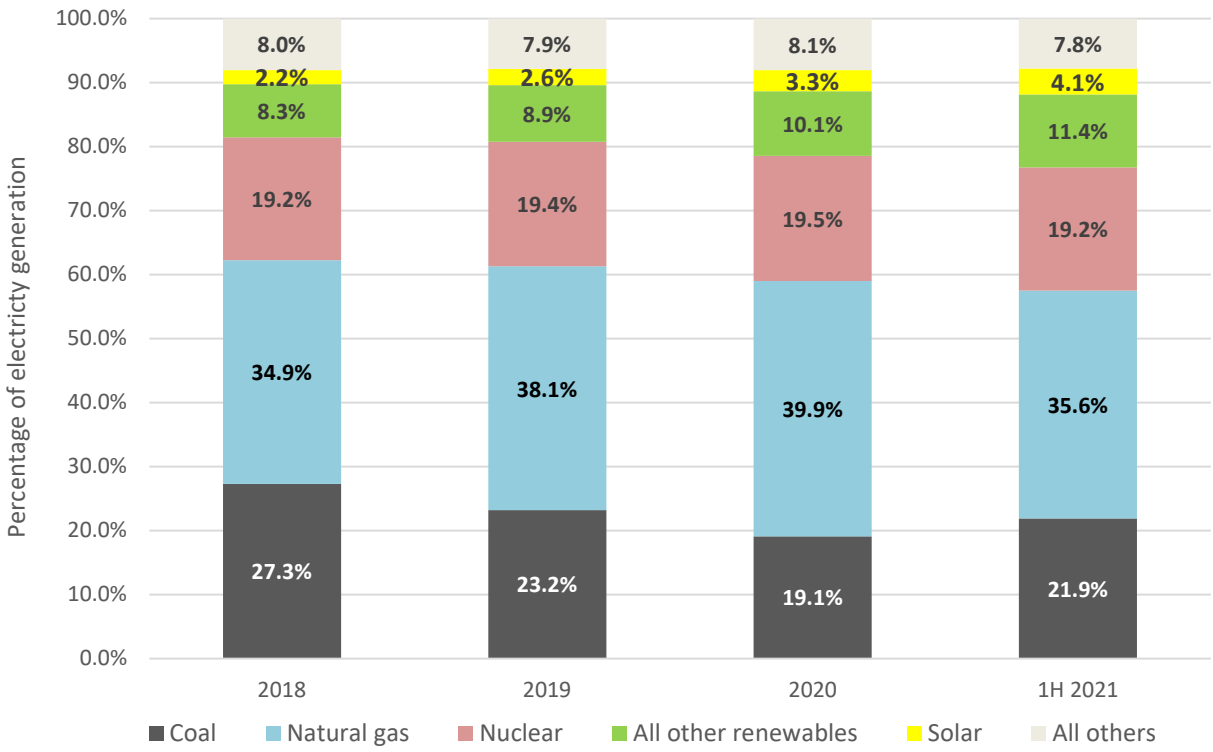
[10] Solar Power World website, *Convalt Energy to open 700-MW solar panel assembly facility in New York in 2022*, https://www.solarpowerworldonline.com/2021/07/convalt-energy-to-open-700-mw-solar-panel-assembly-facility-in-new-york-in-2022/ , accessed October 7, 2021.

[11] For more on how changes in the prices of conventional energy sources affected the price of solar generation electricity since February 7, 2018, see part VII.

[12] Safeguard publication, vol. I, p. 32.

from renewable resources increased (figure II-1).[13] The share of solar power specifically (including both utility and small-scale solar) increased from 2.2 percent of total U.S. electricity generation in 2018 to 3.3 percent in 2020 and 4.1 percent in the first half of 2021.

Figure II-1
Net U.S. electricity generation, by sector, annually, 2018-2020, January-June 2021



Source: U.S. Energy Information Administration, https://www.eia.gov/electricity/data/browser/#/topic/0?agg=2, retrieved October 9, 2021.

The share of utility-scale solar generation increased slightly more than that of small-scale solar generation during January 2018-June 2021, and makes up more than two-thirds of the total solar power generated in the United States. According to the U.S. Energy Information Administration (EIA), U.S. CSPV utility installations, excluding out-of-scope thin film products, decreased from 5.1 GW in 2018 to 4.9 GW in 2019, then increased to 10.4 GW in 2020.[14]

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[13] U.S. Energy Information Administration website, *Electricity Data Browser*, available at http://www.eia.gov/electricity/data/browser/, retrieved October 4, 2021.

[14] U.S. Department of Energy, Energy Information Administration, 2020 Form EIA-860 Data - Schedule 3, 'Solar Technology Data' (Operable Units Only), 2020, https://www.eia.gov/electricity/data/eia860/, retrieved October 6, 2021.

According to industry publications WoodMackenzie (WoodMac) and SEIA, U.S. PV installations, including out-of-scope thin film products, increased from 10.8 GW in 2018 to 19.2 GW in 2020 (table II-4). The utility segment increased from 6.1 GW in 2018 to 14.0 GW in 2020, and rose from 57 percent to 73 percent of installations.[15] The residential market segment increased from 2.4 GW to 3.2 GW, though it declined from 23 percent of the market to 17 percent. The nonresidential sector declined from 20 percent of the market to 11 percent of the market. U.S. PV installation forecasts vary, but most forecasts project U.S. installations of more than 24 GW in 2021 and an average of more than 25 GW in annual installations during 2022–25.[16]

Table II-4
CSPV products: U.S. PV installations, by period and market segment

Quantity in kilowatts

Year	Residential	Nonresidential	Utility	Total
2018	2,436	2,200	6,119	10,755
2019	2,865	2,157	8,462	13,484
2020	3,194	2,074	13,953	19,221

Source: Utility-Scale Solar, 2021 Edition, Lawrence Berkeley National Laboratory, October 2021, data file, https://emp.lbl.gov/utility-scale-solar, retrieved October 6, 2021.

[15] WoodMac and SEIA data from Bolinger, Mark, Joachim Seel, Cody Warner, and Dana Robson, *Utility-Scale Solar, 2021 Edition*, Lawrence Berkeley National Laboratory, October 2021, data file, https://emp.lbl.gov/utility-scale-solar, retrieved October 6, 2021.

[16] WoodMac and SEIA data from Bolinger, Mark, Joachim Seel, Cody Warner, and Dana Robson, *Utility-Scale Solar, 2021 Edition*, Lawrence Berkeley National Laboratory, October 2021, data file, https://emp.lbl.gov/utility-scale-solar, retrieved October 6, 2021; U.S. Department of Energy, Energy Information Administration, Short Term Energy Outlook Data Browser, https://www.eia.gov/outlooks/steo/data/browser/#/?v=25&f=A&s=0&maptype=0&ctype=linechart, retrieved October 6, 2021; Eckhouse, Brian, "Renewables Buildout to Fall Short of Biden's Climate Goal," Bloomberg Green, April 9, 2021; EnergyTrend, "TrendForce: Global PV Demand Will Reach 158GW for 2021 as Many Regional Markets Rebound, but Risks Remain as Subsidies Drop," January 1, 2021, https://www.energytrend.com/research/20210121-20804.html, retrieved October 6, 2021; Chang, Mars, "Global PV installations to surpass 150 GW in 2021," PV Magazine, February 16, 2021, https://www.pv-magazine.com/2021/02/16/global-pv-installations-to-surpass-150-gw-in-2021/, retrieved October 6, 2021.

Firms were asked how changes in the availability of government incentives affected demand for CSPV products since February 7, 2018.[17] As shown in table II-5, responses with regards to state and local government incentives were mixed. A plurality of importers reported that changes in these incentives had not changed the demand for CSPV products, an equal number of U.S. producers reported that such changes had either increased demand or not changed demand, and a plurality of purchasers reported that such changes led to an increase in demand for CSPV products. For federal government incentives, pluralities of importers and purchasers reported that changes in these incentives increased demand for CSPV products, while an equal number of U.S. producers reported that such changes had either increased or not changed demand for CSPV products. Overall, more firms reported that changes in the availability of local, state, and federal government incentives increased demand for CSPV products than decreased demand.

Table II-5
CSPV products: Count of firms' responses regarding government incentives, by firm type and by incentive

Incentive	Firm type	Increase	No change	Decrease	Fluctuate
State and local government incentives	U.S. producers	4	4	1	3
State and local government incentives	Importers	9	16	6	7
State and local government incentives	Purchasers	21	16	6	9
Federal government incentives	U.S. producers	4	4	2	1
Federal government incentives	Importers	16	12	5	4
Federal government incentives	Purchasers	29	15	7	3

Source: Compiled from data submitted in response to Commission questionnaires.

[17] The Internal Revenue Service ("IRS") currently grants income tax credits of 26 percent for residential, commercial, and utility-scale solar project owners. In June 2018, the IRS created a legal method to freeze the credit for future projects, provided certain conditions are met, through a process informally known as the solar safe harbor agreement. In June 2021, the IRS granted an extension of safe harbor relief "to taxpayers impacted by project delays related to the COVID-19 pandemic by allowing additional time to satisfy the Continuity Safe Harbor rules {and adding} flexibility for taxpayers to satisfy the continuity requirement outside of the safe harbor." See IRS website, https://www.irs.gov/newsroom/energy-incentives-for-individuals-residential-property-updated-questions-and-answers, accessed October 9, 2021; IRS website, https://www.irs.gov/pub/irs-drop/n-18-59.pdf, accessed October 9, 2021; and IRS website, https://www.irs.gov/newsroom/treasury-irs-extend-safe-harbor-for-renewable-energy-projects, accessed October 9, 2021.

State-level incentives vary by state. See part I, "U.S. policies" for additional details.

For the firms reporting an increase in demand for CSPV products resulting from state and local government incentives, most described general increases in the amount of net energy metering (NEM) programs, renewable energy certificates (REC), renewable portfolio standards (RPS), tax incentives programs, or rebate programs. For the firms reporting an increase in demand for CSPV products resulting from federal government incentives, most referenced the federal Investment Tax Credit (ITC) and extension of the safe harbor rules for renewable energy projects.

For the firms reporting a decrease in demand resulting from government incentives, firms generally cited decreases in the value of local and state incentives and initiatives and the stepdown of the federal ITC from 30 percent (for projects placed in service after December 31, 2016, and before January 1, 2020) to 26 percent (for projects placed in service after December 31, 2019, and before January 1, 2023).[18] Some firms also reported that state and local incentives are tied to decreasing solar costs, and that as solar energy prices have dropped, state and local renewable energy standards and incentive programs have been reduced.

Demand trends

In the original safeguard investigation, the vast majority of firms reported that U.S. demand for CSPV products increased during January 2012-June 2017 due to a reduction in CSPV system prices; federal, state, and local incentive programs; and a general interest in renewable energy.[19] In the monitoring investigation, majorities or pluralities of firms also reported that U.S. demand for CSPV products increased since February 7, 2018 and that future demand for CSPV products will continue to increase.[20]

In the current proceeding, firms were again asked how demand for CSPV products within the United States and outside of the United States had changed since February 7, 2018, as well as how they anticipate demand would change in the future. As shown in tables II-6 and II-7, the vast majority of responding firms reported that demand for CSPV products increased since February 7, 2018 and will continue to increase across all sectors.

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[18] The ITC is scheduled to step down to 22 percent for projects placed in service after December 31, 2022, and before January 1, 2024. See IRS website, https://www.irs.gov/newsroom/energy-incentives-for-individuals-residential-property-updated-questions-and-answers, accessed October 9, 2021. See also Respondents SEIA and REC America's prehearing brief, pp. 6-8.

[19] Safeguard publication, vol. II, p. V-11.

[20] Monitoring publication, p. II-17.

Table II-6
CSPV products: Count of firms' responses regarding demand, by sector and firm type

Sector	Firm type	Increase	No change	Decrease	Fluctuate
Demand in the United States: Residential	U.S. producers	12	0	0	0
Demand in the United States: Residential	Importers	33	3	1	1
Demand in the United States: Residential	Purchasers	26	1	2	3
Demand in the United States: Commercial	U.S. producers	9	2	0	1
Demand in the United States: Commercial	Importers	29	5	1	6
Demand in the United States: Commercial	Purchasers	29	1	4	5
Demand in the United States: Utility	U.S. producers	11	0	0	1
Demand in the United States: Utility	Importers	32	4	1	3
Demand in the United States: Utility	Purchasers	41	2	1	5
Demand in the United States: All sectors	U.S. producers	10	0	0	0
Demand in the United States: All sectors	Importers	35	3	1	3
Demand in the United States: All sectors	Purchasers	39	1	1	2
Demand outside the United States: All sectors	U.S. producers	8	0	0	1
Demand outside the United States: All sectors	Importers	28	4	0	4
Demand outside the United States: All sectors	Purchasers	27	2	0	4

Source: Compiled from data submitted in response to Commission questionnaires.

Table II-7
CSPV products: Count of firms' responses regarding anticipated demand, by sector and firm type

Sector	Firm type	Increase	No change	Decrease	Fluctuate
Anticipated demand in the United States: Residential	U.S. producers	9	0	1	1
Anticipated demand in the United States: Residential	Importers	28	4	1	4
Anticipated demand in the United States: Residential	Purchasers	26	1	2	4
Anticipated demand in the United States: Commercial	U.S. producers	9	0	1	1
Anticipated demand in the United States: Commercial	Importers	29	4	1	6
Anticipated demand in the United States: Commercial	Purchasers	29	1	3	5
Anticipated demand in the United States: Utility	U.S. producers	9	0	1	1
Anticipated demand in the United States: Utility	Importers	29	4	1	5
Anticipated demand in the United States: Utility	Purchasers	37	2	3	7
Anticipated demand in the United States: All sectors	U.S. producers	9	0	1	1
Anticipated demand in the United States: All sectors	Importers	32	3	1	5
Anticipated demand in the United States: All sectors	Purchasers	35	0	2	4
Anticipated demand outside the United States: All sectors	U.S. producers	10	0	0	0
Anticipated demand outside the United States: All sectors	Importers	31	3	0	3
Anticipated demand outside the United States: All sectors	Purchasers	28	2	2	4

Source: Compiled from data submitted in response to Commission questionnaires.

Firms reported that the increase in demand since February 7, 2018 was due to several factors, including more local, state, and federal government incentives (including the federal ITC); improved financing options; better availability of capital in the market for third party installations (leases and PPAs (purchase power agreements)); the improved cost of solar power compared to oil and gas-derived power; lower hardware and soft costs; more corporate green energy incentives; an increase in ESG (environmental, social, governance) ambitions; an increase in the number of commercial projects; and a general interest in climate change issues and environmental responsibility, as well as a need for electricity reliability during extreme weather events.

Only three of the firms reporting a decrease in demand since February 7, 2018 elaborated, stating that it was due to certain state policies constraining solar growth in the

commercial sector (***), "high costs" leading to a drop in demand in the commercial sector (***), and the combination of the safeguard measure and COVID-19 pandemic (***).

Changes in purchasing patterns

Purchasers were asked about changes in their purchasing patterns from different sources since February 7, 2018 (table II-8). Among the firms that reported purchasing CSPV products, pluralities reported increasing their purchases of both domestic product and product from all other countries. Few firms reported decreasing their purchases of either domestic or imported product. Firms that reported increasing domestic purchases reported doing so for reasons related to the increase in domestic production capacity and a general increase in demand. Firms that reported decreasing domestic purchases reported doing so for reasons related to a lack of availability and higher costs compared to imported product.

Firms that reported increasing purchases of CSPV products from all other countries reported doing so for reasons related to a general growth in their business or demand, more competitive prices compared to domestic product, better quality or performance of modules produced in countries outside the United States, and a lack of bankable domestic CSPV producers. The only two firms that elaborated on their reasons for decreasing purchases of CSPV products from all other countries reported doing so because they were "difficult to purchase" (***) and because the company's solar installations were limited to what was mandated by jurisdictional requirements (***).

Table II-8
CSPV products: Count of firms' responses regarding changes in purchasing patterns, by source

Source	Increase	No change	Decrease	Fluctuate	Did not purchase
United States	10	8	3	9	23
All other sources	22	19	3	10	1
Sources unknown	1	1	0	2	26

Source: Compiled from data submitted in response to Commission questionnaires.

Most responding purchasers (39 of 55 firms) reported that they had changed suppliers since February 7, 2018. Firms reported adding the following suppliers: JA Solar (7 firms); Boviet, First Solar, Hanwha, Longi, and Risen (3 firms each); ET Solar and United Renewable Energy (URE) (2 firms each); and BYD, Calsolar, Heliene, HT-SAAE, Jinko Solar, LG, Phono Solar, REC, Seraphim USA (prior to its bankruptcy), Silfab, Sunergy, Talesun, Trina Solar, VSUN, and ZNShine (one firm each). The reasons listed for adding these firms were competitive pricing, availability, the need for additional sources of supply, product performance, and "to mitigate against the uncertainty of the looming 201 tariff decision."

Firms also reported dropping the following suppliers: Canadian and REC (2 firms each); and Adani, Boviet, CSUN, First Solar, GCL, Hyundai, Jinko Solar, LG, and Solarworld (one firm each). The reasons listed for dropping these firms were pricing, total cost of ownership, lack of availability, credit problems, quality and product performance issues, supplier performance, delivery problems, and firms going out of business. One firm (***) also reported that some firms, including *** "moved their U.S. supply from utility scale to support commercial and residential markets, which paid higher pricing than utility scale market."

Purchasers were asked to describe the significance of the tariff rate quota imposed by the President on February 7, 2018 in terms of its effect on their purchasing operations related to CSPV products. Most purchasers reported negative effects for their firm, investors, and/or consumers. Twenty-four of the responding purchasers reported that the TRQ increased module prices and/or overall costs, with several of these firms reporting that it decreased their profitability and/or hurt consumers. Eight firms reported that the safeguard created uncertainty in the market, with several stating that along with the bifacial exemption and subsequent withdrawal,[21] the WRO against polysilicon products from Hoshine, and the investigations of potential circumvention of duties through operations in Malaysia, Vietnam, and Thailand increased the level of caution among some suppliers. Some firms reported that the safeguard tariff increased the risk to investors and developers, with *** reported that "within the last month, a major Tier 1 producer advised that they will not be proposing on any new work until path forward on these points is better understood." Six firms also reported that the TRQ strained supply and created bottlenecks, with five firms indicating that they delayed or abandoned projects. Three firms stated that while demand is high, domestically produced modules are not capable of meeting demand.

Relatively few firms, ***, elaborated on improvements for U.S. producers since the implementation of the safeguard measure. *** reported that the safeguard allowed the firm to build a module production plant *** and – although initially increasing domestic prices – provided greater pricing stability overall. ***

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[21] As discussed in part I, on October 10, 2020, the President issued Proclamation 10101 revoking the exclusion of bifacial panels from the safeguard measure. See 85 FR 65639, https://www.federalregister.gov/documents/2020/10/16/2020-23108/to-further-facilitate-positive-adjustment-to-competition-from-imports-of-certain-crystalline-silicon, accessed November 16, 2021.

On November 16, 2021, the Court of International Trade (CIT) issued a decision setting aside Proclamation 10101 as null and void, on the grounds that it was outside the President's delegated statutory authority. See *Solar Energy Industry Associations v. United States*, Slip Op. 21-154 (Ct. Int'l Trade Nov. 16, 2021).

reported that the safeguard created a more level playing field for domestic manufacturers and increased domestic production capacity. Two firms reported that the TRQ increased the supply and/or popularity of domestic modules, with another stating that it initially limited imports, though imports have since increased. One firm also reported that the TRQ sped up the shift toward bifacial products.

Purchasers were also asked whether certain wattages/types/technologies/sizes of CSPV products were available from only certain country sources. Most firms (32 of 53) reported that there were not, but 22 reported that there were.[22] All of the elaborating firms generally reported that CSPV technology, availability, and product variety were more available outside the United States. For example, several firms reported that large capacities of higher wattage modules were only available in large quantities from Southeast Asia. Several firms also indicated that bifacial products (particularly higher wattage bifacials) were very limited in the United States, with most availability coming from India, Malaysia, Philippines, Thailand, and Vietnam. Some firms also reported that larger wafers (including 166mm, 182mm, and 210 mm wafers) were only available from China, Malaysia, Thailand, and Vietnam, with others indicating that bifacial and large-wafer modules were most competitive in the utility sector.[23] A few firms also reported that N-type modules were only in available in China, Malaysia, Thailand, and Vietnam. One firm (***) observed that "new cell and module architectures tend to appear in the Rest of the World markets 2-4 quarters before the U.S. market" and opined that "this is due to limited cell, wafer and ingot production in the United States."

Changes in the conditions of competition

Firms were asked if there had been any changes in the business cycles or conditions of competition for CSPV products since February 7, 2018. Most firms (including 7 of 11 U.S. producers, 21 of 44 importers, and 40 of 54 purchasers) reported that there had been changes, although a substantial number (4 U.S. producers, 23 importers, and 14 purchasers) indicated that there had not been any changes. In terms of challenges to the CSPV market, the most frequently cited change was the COVID-19 pandemic (highlighted by 1 U.S. producer, 4 importers, and 17 purchasers), which led to temporary shutdowns, delivery delays, and a backlog of supply. Several firms noted general supply constraints (including 5 importers and 9 purchasers), while others highlighted the following specific supply challenges:

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[22] One firm, ***, reported both 'yes' and 'no' in response to this question.
[23] See also staff virtual field trip repot, Hanwha, November 8, 2021.

- General tariff uncertainty (including the safeguard, bifacial exemption, threat of Section 301 tariffs against Vietnam, and threat of an anticircumvention proceeding on Solar 1 AD/CVD tariffs) (reported by 2 importers and 4 purchasers).
- The WRO against polysilicon from Hoshine (reported by 1 importer and 3 purchasers).
- An increase in the cost of components (including Section 301 duties on solar glass, junction boxes, and aluminum frames) (mentioned by 1 U.S. producer and 1 purchaser).
- An increase in prices and/or cost to build (4 purchasers).
- A decrease in competition for foreign modules along with an increase in competition among domestic module manufacturers (1 U.S. producer).

Several firms (including 4 U.S. producers, 6 importers, and 5 purchasers) also highlighted the bifacial exemption and shift toward more bifacial use, particularly in the utility sector, with several firms noting that bifacial modules are dominant in the utility sector.[24]

In terms of other changes in the conditions of competition, five purchasers cited an increase in overall demand, one U.S. producer mentioned an increase in financing options, and several firms mentioned domestic capacity growth. One U.S. producer and one purchaser highlighted the opening of several major domestic module plants, including Hawha, Jinko Solar, and LG, as well as Convalt Energy and Philadelphia Solar, which are expected to open in 2022.[25] One U.S. producer/importer indicated that there were shorter domestic lead times, while one U.S. producer/importer and one purchaser reported that there was better cost competitiveness from domestic producers. One importer and one purchaser reported that there were more suppliers overall. Some firms (including 3 U.S. producers, 1 importer, and 2 purchasers) also reported that there are lower prices for imported CSPV products, while a couple of firms (one U.S. producer and one importer) indicated that there is a global overcapacity for CSPV products. One U.S. producer also indicated that there have been cost declines for solar power compared to oil and gas power, while one purchaser stated that there is more competition from other renewable energy sources (including wind, hydro, and geothermal power).

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[24] As noted above, on November 16, 2021 the CIT issued an opinion removing the exemption of bifacial panels from the safeguard measure.

[25] Petitioner Hanwha elaborated on several firms' planned construction and/or expansion, including Convalt Energy, Meyer Burger, Philadephia Solar, REC Solar, GAF Energy, Ubiquity Solar, and Maxeon. See Petitioners Hanwha and Mission's prehearing brief, pp. 63-68; Petitioners Hanwha and Mission's posthearing brief, Responses to Commission Questions, p. 45; and Petitioner LG's posthearing brief, Responses to Commission Questions, pp. 21-22. Respondent SEIA argues that while U.S. producers have "more than tripled their capacity and production between 2018 and 2020… domestic supply remains quite small in comparison to the need." Respondents SEIA and REC America's prehearing brief, pp. 8-10, and 12.

Two firms also highlighted general technology changes as a change in the conditions of competition, including more imports of thin film, larger wafer sizes (cited by 1 purchaser). One importer also noted an increase in low-wattage semiflexible or portable panels into the United States. Two purchasers also mentioned that there has been a shift away from multi-crystalline PV modules to mono-crystalline modules, with *** stating that there has been a shift in demand "almost entirely {toward} to high efficiency mono-PERC products."

Purchasers were also asked if domestic producers took certain actions to make a positive adjustment to import competition since February 7, 2018. Most purchasers reported that U.S. producers had not taken the identified actions. Specifically, 35 of 50 purchasers reported that U.S. producers had not introduced new or innovative product; 37 of 47 reported that U.S. producers had not improved product quality; 37 of 48 reported that U.S. producers had not expanded marketing efforts, including e-commerce; 41 of 47 reported that U.S. producers had not made improvements in customer service; and 39 of 50 reported that U.S. producers had not made other efforts to adjust to import competition.

Changes in bankability

In the solar industry, bankability refers to "whether projects using the solar products are likely to be offered non-recourse debt financing by banks."[26] In the original safeguard investigation, the Commission determined that at a minimum, bankability encompasses both the financial viability of a supplier and the product's performance reliability, especially in the CSPV industry where manufacturers provide warranties of 25 years or longer on their products, and allows installing firms to apply for non-recourse loans for their solar development projects.[27]

Several companies develop lists of bankable firms in the solar industry. One such firm is BloombergNEF, which publishes a "tier 1" list of bankable firms quarterly.[28] Another is PV

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[26] ***.

[27] Safeguard publication, vol. I, pp. 36 and 55.

[28] BloombergNEF has developed a tiering system for PV module makers based on bankability and publishes a tier 1 list quarterly. It does not publish a tier 2 or 3 list. According to Bloomberg, 'Bankability' refers to whether projects using the solar products are likely to be offered non-recourse debt financing by banks, and is the key criterion for tiering. "Tier 1 module manufacturers are those which have provided own-brand, own-manufacture products to at least six different projects, which have been financed non-recourse by six different commercial (i.e. not development, not export-import) banks, in the past two years. See Monitoring report, pp. II-23-26; BloombergNEF PV Module Tier 1 List Methodology, October 1, 2020, available at https://data.bloomberglp.com/professional/sites/24/BNEF-PV-Module-Tier-1-List-Methodology.pdf, accessed October 13, 2021.

Evolution Labs (PVEL), which bills itself as a "testing lab for downstream solar project developers, financiers, and asset owners around the world."[29] Table II-9 shows PVEL's list of top solar performers in 2020.

Table II-9
PVEL list of top performer factory locations in 2020, by firm name and location

Firm name	Location
Adani (Mundra Solar PV Ltd.)	Gujarat, India
Astronergy (Chint Solar (Zhejiang)) Co., Ltd.	Haining, China; Yixing, China
Boviet Solar Technology Co., Ltd.	Song Khe-Noi Hoang Industrial Zone, Vietnam
Canadian Solar Inc.	Sriracha, Thailand
First Solar Inc.	Perrysburg, U.S.A.
GCL System Integration Technology Co., Ltd.	Van Trung Industrial Park, Vietnam
Hanwha Q CELLS Co., Ltd.	Jincheon-gun, South Korea; Cyberjaya, Malaysia; Dalton, U.S.A.
Heliene Inc.	Mountain Iron, U.S.A.
JA Solar Technology Co.	Hefei, China; Fengxian, China
Jinko Solar Co., Ltd.	Shangrao, China; Van Trung Industrial Park, Vietnam
LONGi Solar Technology Co., Ltd.	Kuching, Malaysia; Taizhou, China
Panasonic Corporation	Buffalo, U.S.A.
REC Group	Tuas, Singapore
Seraphim Solar System Co., Ltd.	Changzhou, China
Silfab Solar Inc.	Mississauga, Canada; Bellingham, U.S.A.
Shanghai Aerospace Automobile Electromechanical Co. ("HT-SAAE")	Istanbul, Turkey
Sunergy California, LLC	Dinh Tram Industrial Zone, Vietnam
SunPower Corporation	Ensenada, Mexico
Trina Solar Co., Ltd.	Changzhou, China; Van Trung Industrial Park, Vietnam; Sriracha, Thailand
Vikram Solar Ltd.	Kolkata, India
Wuxi Suntech Power Co., Ltd.	Wuxi, China
ZNShine PV-Tech Co., Ltd.	Changzhou, China

Source: PVEL 2020 PV Module Reliability Scorecard, Sixth Edition, p. 27.

In both the monitoring phase and the current phase investigation, purchasers were asked whether the role of bankability in their or their customers' purchasing decisions had changed since February 7, 2018. In the monitoring phase, the vast majority of responding firms (37 of 41) reported that it had not.[30] In the current proceeding, most firms (30 of 54) again reported that it had not, although 24 firms reported that it had. Among the firms reporting a change in the role of bankability, responses were mixed, but firms generally indicated that

[29] PVEL 2020 PV Module Reliability Scorecard, Sixth Edition, https://www.pvel.com/wp-content/uploads/2020-PVEL-PV-Module-Reliability-Scorecard.pdf, accessed October 14, 2021.

[30] Monitoring publication, pp. II-25–26.

bankability had become more important than in 2018. Several firms reported that financing parties placed greater emphasis on bankability, with some indicating that they only use manufacturers listed on Bloomberg's Tier 1 Bankability Report. Other firms indicated that they have been able to work with more firms, with one firm stating that it is willing to take more risk because of high demand (***).

Substitute competition with other solar products

Purchasers were asked to describe the extent to which other solar products (such as thin film products and CSPV products excluded from the safeguard measure) competed with CSPV products, including whether these products are used in the same end uses and market segments. Most firms reported that thin film products are less efficient and have lower output than in-scope CSPV products and are therefore not typically competitive with them, particularly for rooftop installations. One firm (***) suggested that this is "due to technology constraints that limit energy density and energy efficiency," and that "thin film technology requires additional costs including more equipment, higher construction costs, and higher land costs to offset the lower energy output." Two firms, *** also reported that cadmium telluride (CdTe) is in direct competition with CSPV products, with *** stating that this is true for the utility segment of the market only, and that thin film CdTe modules "are unsuitable for residential or commercial rooftop applications due to their low conversion efficiency, high weight, and incorporation of the hazardous material cadmium."

Some firms reported that thin film products can and do compete with in-scope CSPV products, particularly in the utility sector, although some of these firms reiterated that thin film has some disadvantages in efficiency and installation costs in certain applications. Only one firm, ***, reported that thin film products "have recently become a factor in rooftop solar applications." *** also stated that thin film products compete against CSPV products in hot and humid environments.

Part III: U.S. producers' production, shipments, and employment

In the safeguard investigation on CSPV products, the Commission defined the domestic industry as all U.S. producers of CSPV cells (whether or not partially or fully assembled into other products), including integrated producers of CSPV cells and modules and independent module producers.[1] The information in this section of the report was compiled from responses to the Commission's domestic producers' questionnaire submitted by 14 firms that are estimated to have accounted for all known U.S. capacity to produce CSPV cells and approximately 81.0 percent of known U.S. capacity to produce CSPV modules during 2020 and all known U.S. capacity to produce CSPV cells and 78.9 percent of U.S. capacity to produce CSPV modules during the first half of 2021.[2] The list of responding domestic producers, each company's position on the safeguard measures, production locations, and share of reported production during 2020 is presented in Part I of this report at "U.S. market participants." Nine notable current or historical U.S. CSPV cell and module producers are profiled below.

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[1] Safeguard publication, vol. I, p. 18. In the safeguard investigation, the Commission defined a single domestic product corresponding to the imported products within the scope of the investigation that includes CSPV cells and CSPV modules. Safeguard publication, vol. I, p. 16. The term "domestic industry" is defined in section 202(c)(6)(A)(i) of the Trade Act, 19 U.S.C. § 2252(c)(6)(A)(i), as "the domestic producers as a whole of the like or directly competitive article or those producers whose collective production of the like or directly competitive article constitutes a major proportion of the total domestic production of such article."

[2] Estimates are based on a comparison of U.S. producers' reported capacity to produce CSPV cells and modules during 2020 (*** MW (cells) and 3.8 GW (modules)) and the first six months of 2021 (*** MW (cells) and 1.8 GW (modules)) with the total estimated U.S. capacity to produce cells and modules during 2020 (*** MW (cells) and 4.69 GW (modules)) and the first six months of 2021 (*** MW (cells) and 2.28 GW (modules)), as calculated by Commission staff using publicly available capacity estimates for known non-responding U.S. producers.

In addition to *** submitted since the release of the prehearing report, this section of the report includes updated information from ***.

U.S. producer profiles[3]

Auxin Solar

Auxin Solar ("Auxin"), located in San Jose, California, is a U.S. based module producer founded in 2008. The company currently produces monocrystalline PERC 60 and 72 cell modules and has production of bifacial modules.[4] The company has produced ***. Past production used *** type cells, while future production of ***. The company has 150 MW in annual production capacity.[5]

Auxin stated that it is ***.[6]

Hanwha Q CELLS USA, Inc.

Hanwha Q CELLS USA, Inc. ("Hanwha"), located in Dalton, Georgia, is a wholly owned subsidiary of its ultimate parent company based in Korea, Hanwha Chemical Corporation. The plant was reported to be the largest facility of its kind in the Western Hemisphere with an announced annual module production capacity of 1.7 GW. Hanwha began production at its $157 million CSPV module assembly plant in Dalton, Georgia in February 2019.[7]

Hanwha assembles modules at its Georgia facility for residential, commercial, and utility markets using cells *** that are manufactured using proprietary Q.ANTUM

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[3] Information in this section is derived from the monitoring publication, pp. III-2 – III-7, with updates added from information collected in this proceeding including from questionnaire responses and briefs.

[4] Auxin Solar website, http://www.auxinsolar.com/products/ and http://www.auxinsolar.com/company/, retrieved October 18, 2021; Auxin and Suniva's petition, p. 2.

[5] Solar Power World, "U.S. Solar Panel Manufacturers," September 2021, https://www.solarpowerworldonline.com/u-s-solar-panel-manufacturers/, retrieved October 18, 2021.

In its questionnaire response in this proceeding, Auxin reported CSPV module capacity at *** MW, production at *** MW, and employment at *** production and related workers ("PRWs") during January-June 2021.

[6] Auxin's posthearing brief, Responses to Commission Questions, p. II-9.

[7] In its questionnaire response in this proceeding, Hanwha reported CSPV module capacity at *** MW, production at *** MW, and employment at *** PRWs during January-June 2021.

technology. During 2019–June 2021, the firm produced ***. In 2021, the firm ***. The firm is also ***. Hanwha is an importer of cells *** and is related to U.S. importers of modules *** and leading foreign producers of CSPV cells and modules in China, Korea, and Malaysia. According to the company, ***.[8]

JinkoSolar (U.S.) Industries Inc.

JinkoSolar (U.S.) Industries Inc. ("Jinko"), located in Jacksonville, Florida, is a wholly owned subsidiary of its ultimate parent company based in China, JinkoSolar Holding Co., Ltd. Jinko began commercial production of mono-PERC modules early in 2019 at its $50.5 million Jacksonville facility. Jinko's site, with an announced 400 MW of annual production capacity, produces 60-cell (for residential) and 72-cell (for industrial and utilities) mono-PERC modules.[9] Jinko is an importer of cells and modules and is related to a U.S. importer *** and foreign producers of CSPV cells and modules in China and Malaysia.

LG Electronics U.S.A., Inc.

LG Electronics U.S.A., Inc. ("LG"), located in Huntsville, Alabama, is a wholly owned subsidiary of its parent corporation based in Korea, LG Electronics Inc. LG began commercial production of high-performance n-type solar modules for the *** markets in February 2019 at its new $*** Huntsville facility. The firm has produced modules with ***. The firm also stated that ***.[10] LG's new site had an announced 500 MW of annual production capacity.[11] An importer of both cells and modules from Korea, LG is related to a foreign producer of CSPV cells and modules in Korea.

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[8] Respondents Hanwha and Mission Solar's posthearing brief, Responses to Commission Questions, p. 57, and staff virtual field trip report attachment, Hanwha Q Cells USA, Inc., October 28th, 2021.

[9] In its questionnaire response in this proceeding, Jinko reported CSPV module capacity at *** MW, production at *** MW, and employment at *** PRWs during January-June 2021.

[10] Staff virtual field trip report, LG Electronics U.S.A., Inc., October 29th, 2021.

[11] In its questionnaire response in this proceeding, LG reported CSPV module capacity at *** MW, production at *** MW, and employment at *** PRWs during January-June 2021.

Mission Solar Energy

Mission Solar Energy ("Mission Solar") is headquartered in San Antonio, Texas, and is a fully owned subsidiary of OCI Solar Power.[12] Mission Solar produced n-type monocrystalline (including bifacial) CSPV solar cells and assembled modules with mono and mono-PERC cells in both 60-cell and 72-cell formats for residential, commercial, and utility markets. The company produced modules with *** size cells during January 2018 to June 2021, and ***. The company opened its manufacturing plant in San Antonio, Texas, in 2014. In September 2016, however, Mission Solar closed its n-type mono PV cell production lines.[13] Following the closure of cell production, Mission Solar has continued module assembly with CSPV cells imported from ***.

Suniva, Inc.

Suniva, Inc. ("Suniva"), one of the petitioners in the original Safeguard proceeding, is headquartered in Norcross, Georgia, and produced mono (including PERC) CSPV cells and CSPV modules until April 2017. Suniva was founded in 2007 as a producer of CSPV cells based on the work of the Georgia Institute of Technology's University Center of Excellence in Photovoltaics. In 2015, Shungfeng International Clean Energy (China) acquired approximately 63 percent of Suniva. Suniva started CSPV cell production in Norcross, Georgia, in November 2008 with capacity of 32 MW and, by 2016, Suniva had expanded the capacity to produce CSPV cells at its Norcross facility to 450 MW. Suniva also opened a CSPV module assembly facility in Saginaw, Michigan in 2015 with the capacity to produce *** of CSPV modules. Since Suniva's capacity to produce CSPV cells (450 MW) was ***.

In April 2017, Suniva filed for bankruptcy protection and production ceased at both its U.S. cell and module manufacturing operations. ***. In April 2019, Suniva successfully completed a

[12] OCI Solar Power is a subsidiary of OCI Enterprises, the North American subsidiary of OCI Company, Ltd. (Korea). Mission Solar was formerly known as Nexolon America when it was a joint venture of OCI Solar Power and Texas-based CPS Energy.

[13] In its questionnaire response in this proceeding, Mission Solar reported CSPV module capacity at *** MW, production at *** MW, and employment at *** PRWs during January-June 2021.

reorganization and exited bankruptcy with a court-approved restructuring plan. The company is now under new U.S. ownership (Granite Holdings I, LLC c/o Lion Point Capital).

The company stated that it retains its production facility and equipment, and could rapidly restart production.[14] The firm states that it is preparing to ***.[15] Further, the firm reported that ***.[16]

SunPower Manufacturing Oregon LLC (formerly SolarWorld Americas Inc.)

SolarWorld Americas Inc. ("SolarWorld"), headquartered in Hillsboro, Oregon, produced *** CSPV cells and CSPV modules. SolarWorld's Hillsboro, Oregon plant opened in 2008 with operations dedicated to growing crystals and producing wafers and CSPV cells. In 2010, SolarWorld added 350 MW of CSPV module production to become the first fully integrated monocrystalline plant in the Americas.[17] By 2017, SolarWorld reported nameplate production capacity of *** MW for CSPV modules and *** MW for CSPV cells.

On October 1, 2018, SunPower Corporation announced that it completed its acquisition of certain assets of SolarWorld, including its U.S. manufacturing plant in Hillsboro. SunPower Corporation created SunPower Manufacturing Oregon LLC ("SunPower" or "SPMOR") to hold and manage the Hillsboro assets and related operations. It subsequently transitioned the U.S. production facility to produce SunPower's "P-Series" products, although it continued to produce SolarWorld products during the transition period.[18] Specifically, ***

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[14] Auxin and Suniva's petition, p. 26.

[15] Auxin and Suniva's petition, p. 31.

[16] Petitioner Suniva's posthearing brief, Responses to Commission questions, p. 3, and staff virtual field trip notes, Suniva Inc., October 7th, 2021.

[17] An additional 150 MW of module capacity was in place at its now-closed Camarillo plant, for a total of 500 MW.

[18] SunPower, "SunPower Begins a New Chapter in American Solar Manufacturing," News release, October 1, 2018, http://newsroom.SunPower.com/2018-10-01-SunPower-Begins-A-New-Chapter-in-American-Solar-Manufacturing, retrieved December 18, 2018.

***. By the beginning of 2019, SunPower had retired the Hillsboro facility's CSPV cell line and had upgraded half of the module assembly facility to produce SunPower's proprietary "P Series" modules based on monocrystalline silicon cells.[19] In May 2019, SunPower announced that it would seek to sell the former SolarWorld factory and then lease back a portion of the factory from the new owners to continue assembly of its P-Series modules.[20] The Hillsboro facility focused entirely on module assembly – ***.[21] On November 11, 2019, SunPower announced that it planned to spin off its high-efficiency cell and module production into a new company, Maxeon Solar, in partnership with Chinese wafer maker Tainjin Zhonghouan Semiconductor ("TZS"). Maxeon Solar is a publicly traded company headquartered in Singapore. SunPower originally retained the P-Series module factory in Hillsboro, Oregon.[22] However, SunPower announced, in January 2021, that it would stop production at this facility.[23] In April 2021, Convalt Energy purchased SunPower's production equipment and subsequently shipped the equipment to a 700 MW plant that Convalt plans to open in New York in July 2022.[24] [25]

SunPower was a U.S. importer of *** and is also related to U.S. importers ***

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[19] SunPower "P Series" modules are shingled modules requiring specialized production equipment ***.

[20] Roselund, Christian, "SunPower is selling the former SolarWorld factory in Oregon," PV Magazine, May 17, 2019, https://pv-magazine-usa.com/2019/05/17/SunPower-is-selling-the-former-solarworld-factory-in-oregon/, retrieved November 2, 2019.

[21] In addition, SunPower ***.

[22] Roselun, Christian, "SunPower splits in two," PV magazine, November 11, 2019, https://pv-magazine-usa.com/2019/11/11/SunPower-splits-in-two/, retrieved November 12, 2019.

[23] Enkhardt, Sandra, "SunPower to Close Module Factory in Oregon in June," *PV Magazine*, January 28, 2021, https://www.pv-magazine.com/2021/01/08/SunPower-to-close-module-factory-in-oregon-in-june/, retrieved October 18, 2021.

[24] Pickerel, Kelly, "Convalt Energy to Open 700-MW Solar Panel Assembly Facility in New York in 2022," Solar Power World, July 12, 2021, https://www.solarpowerworldonline.com/2021/07/convalt-energy-to-open-700-mw-solar-panel-assembly-facility-in-new-york-in-2022/, retrieved October 18, 2021.

[25] In its questionnaire response in this proceeding, SunPower reported CSPV module capacity at *** MW, production at *** MW, and employment at *** PRWs during January-June 2021.

*** and formerly to leading foreign producers of CSPV products in ***.

Tesla, Inc./Panasonic Solar North America

Tesla, Inc.

Tesla, Inc. ("Tesla") is a U.S. producer of electric vehicles and alternative energy solutions, such as solar modules and battery-powered back-up storage units. Tesla has a factory in Buffalo, New York to produce *** solar roof tiles. Tesla initially produced cells and modules at a Fremont, California facility, which opened in 2014.[26] With regard to its production of solar roof tiles in Buffalo, Tesla began "volume production" in 2019, and reported producing ***. Tesla is a U.S. importer of ***.

Panasonic Solar North America

In December 2016, Tesla entered into an agreement with Panasonic Solar North America ("Panasonic") to manufacture CSPV cells and modules at the Buffalo, New York plant while Tesla managed factory operations and produced solar roof tiles.[27] Panasonic in Buffalo, which was established in ***. In 2019, Panasonic reported annual production capacity of *** for cells and *** for modules and produced *** of cells and *** of modules. In February 2020, Panasonic announced that they would end cell and module production in Buffalo by the end of May 2020.[28] Panasonic is a U.S. importer of *** and is related to an importer of ***, as well as *** foreign producers of ***.

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[26] Tesla acquired SolarCity in 2016, which was working at its location in Fremont, California, to develop higher efficiency cells and modules in-house through its subsidiary, Silevo, which it had acquired in 2014. Tesla began moving production from its initial Fremont, California plant to Buffalo, New York during the fourth quarter of 2017 and currently ***.

[27] In 2017, Tesla announced a new product, SolarRoof, which are tiles that incorporate solar cells.

[28] Rowe, Ashley and Jeff Rusack, "Panasonic to End Solar Production at Buffalo's Riverbend Facility," WKBW, February 25, 2020, https://www.wkbw.com/news/local-news/sources-panasonic-expected-to-end-solar-production-at-buffalos-solar-city#:~:text=BUFFALO%2C%20N.Y.&text=By%20the%20end%20of%20May,with%20Panasonic%20officials%20on%20Wednesday, retrieved October 18, 2021.

Developments in the U.S. CSPV products industry

Since January 1, 2018, there have been several developments affecting the U.S. CSPV products industry. Producer entries and exits from the U.S. industry were presented in Part I (see section entitled "U.S. developments"). In January 2018, the President imposed the safeguard measure, effective February 7, 2018, adding product exclusions from the measure in September 2018 and June 2019 and withdrawing a product exclusion in October 2020.[29] In March 2019, Commerce continued the antidumping and countervailing duty orders on CSPV cells and modules from China in the CSPV 1 case, and in September 2020, Commerce continued the antidumping and countervailing duty orders on CSPV cells and modules from China, and of the antidumping duty orders on imports of CSPV cells and modules from Taiwan, in the CSPV 2 case. As discussed in greater detail in Part I, Part II, and appendix E, tariffs covering material inputs have been implemented following investigations under Section 232 and Section 301.

In this safeguard extension proceeding, domestic producers were asked to indicate whether their firm had experienced any plant openings, relocations, expansions, acquisitions, consolidations, closures, or prolonged shutdowns because of strikes or equipment failure; curtailment of production because of shortages of materials or other reasons, including revision of labor agreements; or any other change in the character of their operations or organization relating to the production of CSPV products since January 1, 2018. The domestic producers' responses are presented in table III-1.

Table III-1
CSPV products: U.S. producers' reported changes in operations

Item	Firm name and accompanying narrative response
Plant openings	***
Plant openings	***
Plant openings	***
Plant openings	***
Plant openings	***

[29] On November 16, 2021, the CIT issued a decision setting aside the Presidential Proclamation which withdrew this exclusion as null and void.

Item	Firm name and accompanying narrative response
Plant openings	***
Plant openings	***
Plant closings	***
Plant closings	***
Plant closings	***
Plant closings	***
Relocations	***
Relocations	***
Expansions	***
Expansions	***
Expansions	***
Expansions	***
Acquisitions	***

Item	Firm name and accompanying narrative response
Prolonged shutdowns or curtailments	***
Prolonged shutdowns or curtailments	***
Prolonged shutdowns or curtailments	***
Technology	***
Technology	***
Technology	***
Technology	***
Other	***
Other	***

Item	Firm name and accompanying narrative response
Other	***
Other	***

Source: Compiled from data submitted in response to Commission questionnaires.

U.S. production, capacity, and capacity utilization

CSPV cells

Table III-2 and figure III-1 present U.S. cell producers' production, capacity, and capacity utilization. Three U.S. firms reported usable capacity and production data for CSPV cells in this proceeding for the period January 2018-June 2021.[30] However, with several CSPV cell production facility closures, by 2020, only one firm (***) reported production of CSPV cells, which were ***. ***. Total U.S. cell capacity fell from *** MW in

[30] SunPower's "pre-acquisition" response covers data for SolarWorld Americas' Hillsboro, Oregon facility from January 1, 2018 through September 30, 2018, at which point SunPower acquired this facility (or "SPMOR" as it is referred to in its questionnaire responses). SunPower's "post-acquisition" response covers the period from October 1, 2018 through June 2021. ***. These responses are counted as one company response with regards to counting firm responses in this report.

SunPower produced *** of cells ***.

In the Commission's 2017 Section 201 investigation on CSPV products, U.S. producer questionnaire responses containing usable data were received from four firms (Mission, SolarWorld, Suniva, and Tesla) that were believed to have accounted for all known U.S. cell production during 2015. Safeguard publication, vol. II, p. I-4 and table III-4. Mission and SolarWorld closed their production facilities in 2016 and 2019 respectively. Tesla and Suniva ceased CSPV cell manufacturing in 2017.

2018 across three firms to *** MW in 2020 reported by ***. *** reported capacity in January-June 2020 was *** MW; following closure of its facility, CSPV cell capacity and production in January-June 2021 were zero.

Reported data show that total U.S. production of CSPV cells declined by *** percent (from *** MW in 2018 to *** MW) in 2020. Average capacity utilization of responding domestic CSPV cell producers increased from *** percent in 2018 to *** percent in 2019 as two firms exited CSPV cell production, yet capacity utilization decreased to *** percent from 2019 to 2020, for an overall decrease of *** percentage points.[31]

Table III-2
CSPV cells: U.S. producers' capacity, by firm and by period

Capacity in kilowatts

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
SunPower Pre-acquisition	***	***	***	***	***
SunPower Post-acquisition	***	***	***	***	***
Yingli	***	***	***	***	***
All firms	***	***	***	***	***

Table continued.

Table III-2 Continued
CSPV cells: U.S. producers' production, by firm and by period

Production in kilowatts

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
SunPower Pre-acquisition	***	***	***	***	***
SunPower Post-acquisition	***	***	***	***	***
Yingli	***	***	***	***	***
All firms	***	***	***	***	***

Table continued.

[31] ***.

Table III-2 Continued
CSPV cells: U.S. producers' capacity utilization ratio, by firm and by period

Capacity utilization ratios in percent

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
SunPower Pre-acquisition	***	***	***	***	***
SunPower Post-acquisition	***	***	***	***	***
Yingli	***	***	***	***	***
All firms	***	***	***	***	***

Table continued.

Table III-2 Continued
CSPV cells: U.S. producers' share of production, by firm and by period

Share of production in percent

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
SunPower Pre-acquisition	***	***	***	***	***
SunPower Post-acquisition	***	***	***	***	***
Yingli	***	***	***	***	***
All firms	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“. Capacity utilization ratio represents the ratio of the U.S. producers’ production to its production capacity.

Figure III-1
CSPV cells: U.S. producers' capacity, production, and capacity utilization, by period

* * * * * * *

Source: Compiled from data submitted in response to Commission questionnaires.

As shown in table III-3, *** of the cells produced from 2018 to June 2021 consisted of bifacial cells.

Table III-3
CSPV cells: U.S. producers' production, by cell type and by period

Quantity in kilowatts; Shares in percent

Cell type	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Bifacial cells	Quantity	***	***	***	***	***
All other cells types	Quantity	***	***	***	***	***
All cell types	Quantity	***	***	***	***	***
Bifacial cells	Share	***	***	***	***	***
All other cells types	Share	***	***	***	***	***
All cell types	Share	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

CSPV modules

Table III-4 and figure III-2 present U.S. module producers' production, capacity, and capacity utilization. Twelve U.S. firms reported usable capacity and production data for CSPV modules in this proceeding.[32] The largest responding U.S. assemblers of CSPV modules during 2020 were ***, accounting for *** percent of reported U.S. module assembly, respectively, during 2020. Reported data show that total U.S. capacity to assemble CSPV modules increased by 241.6 percent (from 1,121 MW in 2018 to 3,830 MW in 2020) as Hanwha, Jinko, and LG opened new CSPV module manufacturing facilities in the United States. *** also reported expansions (table III-1). Production of CSPV modules increased by 371.8 percent from 470 MW in 2018 to 2,217 MW in 2020. Average capacity utilization of responding domestic CSPV module producers increased by 16.0 percentage points from 41.9 percent in 2018 to 57.9 percent in 2020.

[32] In the Commission's 2017 investigation on CSPV products, certain data of 16 U.S. module producers (Itek, Kyocera, Mission, Motech, SBM, Seraphim, Sharp, Silicon, Solaria, SolarTech, SolarWorld, Suniva, Sunstream, TenKSolar, Tesla, and Wanxiang) that were believed to have accounted for 63.9 percent of all known U.S. module production during 2015 were presented in the Commission's report. Safeguard publication, vol. II, p. I-4 and table III-7.

Table III-4
CSPV modules: U.S. producers' capacity, by firm and period

Capacity in kilowatts

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
Silfab	***	***	***	***	***
SBM Solar	***	***	***	***	***
Sunpower Pre-acquisition	***	***	***	***	***
Sunpower Post-acquisition	***	***	***	***	***
Tesla	***	***	***	***	***
All firms	1,121,200	3,703,017	3,830,309	1,901,447	1,766,521

Table continued.

Table III-4 Continued
CSPV modules: U.S. producers' production, by firm and by period

Production in kilowatts

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
Silfab	***	***	***	***	***
SBM Solar	***	***	***	***	***
Sunpower Pre-acquisition	***	***	***	***	***
Sunpower Post-acquisition	***	***	***	***	***
Tesla	***	***	***	***	***
All firms	469,829	2,077,344	2,216,759	1,160,948	1,117,057

Table continued.

Table III-4 Continued
CSPV modules: U.S. producers' capacity utilization, by firm and by period

Capacity utilization ratio in percent

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
Silfab	***	***	***	***	***
SBM Solar	***	***	***	***	***
Sunpower Pre-acquisition	***	***	***	***	***
Sunpower Post-acquisition	***	***	***	***	***
Tesla	***	***	***	***	***
All firms	41.9	56.1	57.9	61.1	63.2

Table continued.

Table III-4 Continued
CSPV modules: U.S. producers' share of production, by firm and by period

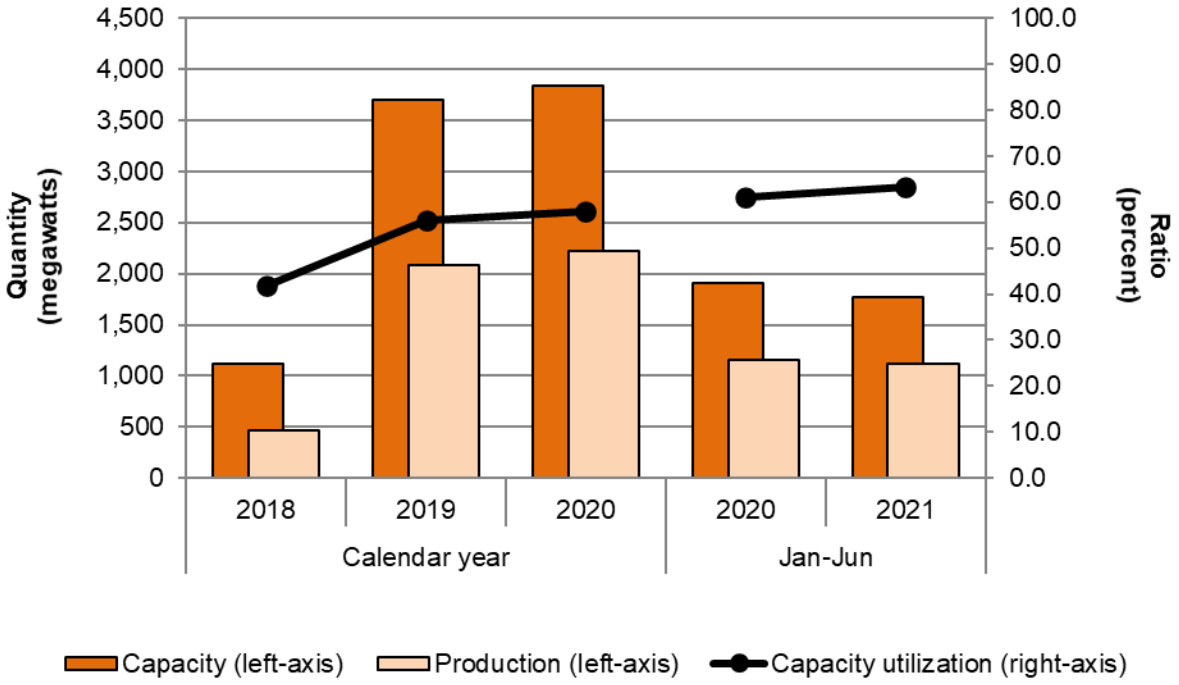
Share of production in percent

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
Auxin	***	***	***	***	***
Silfab	***	***	***	***	***
SBM Solar	***	***	***	***	***
Sunpower Pre-acquisition	***	***	***	***	***
Sunpower Post-acquisition	***	***	***	***	***
Tesla	***	***	***	***	***
All firms	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“. Capacity utilization ratio represents the ratio of the U.S. producers’ production to its production capacity.

Figure III-2
CSPV modules: U.S. producers' capacity, production, and capacity utilization, by period



Source: Compiled from data submitted in response to Commission questionnaires.

The Commission requested that domestic CSPV module producers provide data concerning the source of the CSPV cells from which their modules were produced. These data show that during January 2018 to June 2021, the use of internally produced cells for U.S.-produced modules ceased after 2018, when the share of production of CSPV modules that used internally produced cells was *** percent. The share of purchased U.S.-produced cells used in U.S. module production was minimal in all periods, resulting in *** percent of U.S.-produced modules containing cells produced outside the United States from 2019 through June 2021 (table III-5).

Table III-5
CSPV modules: U.S. producers' production, by source of cells and by period

Quantity in kilowatts; shares in percent

Source of cells used in module production	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Internally produced cells	Quantity	***	***	***	***	***
Purchased domestic cells	Quantity	***	***	***	***	***
Purchased foreign cells	Quantity	***	***	***	***	***
All sources	Quantity	469,829	2,077,344	2,216,759	1,160,948	1,117,057
Internally produced cells	Share	***	***	***	***	***
Purchased domestic cells	Share	***	***	***	***	***
Purchased foreign cells	Share	***	***	***	***	***
All sources	Share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

The Commission also requested that domestic CSPV module producers provide data concerning the composition of the CSPV cells from which their modules were produced (i.e., bifacial cells or any other type of cell). These data show that during January 2018 to June 2021, bifacial cells made up a small but growing proportion of the share of cell composition for U.S. produced modules. While the use of non-bifacial cells was never lower than *** percent in any full-year period, the quantity of modules produced using bifacial cells increased more than *** percent from 2018 to 2020. The quantity of modules using bifacial cells almost doubled in January-June 2021 compared to the same period in 2020 (table III-6).

Table III-6
CSPV modules: U.S. producers' production, by cell type and by period

Quantity in kilowatts; shares in percent

Cell type	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Modules using bifacial cells	Quantity	***	***	***	***	***
Modules using all other cell types	Quantity	***	***	***	***	***
Modules using all cell types	Quantity	469,829	2,077,344	2,216,759	1,160,948	1,117,057
Modules using bifacial cells	Share	***	***	***	***	***
Modules using all other cell types	Share	***	***	***	***	***
Modules using all cell types	Share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---".

U.S. producers also provided additional information in their questionnaire responses concerning their actual and planned production of CSPV products by type of cell and by cell form factor (whether for cell production or to be used in modules).[33] These data are presented in tables III-7 and III-8.

Table III-7
CSPV products: Count of U.S. producers' responses regarding production by cell type

Count in number of firms reporting

Cell type	Actual production	Planned production
Mono	5	3
Multi	6	1
PERC	6	3
Heterojunction	3	1
Bifacial	4	3
P-type	5	4
N-type	4	4
Greater than 162 by 162 millimeter cells	3	4
All other cell types	3	3

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Responses for actual production are since January 1, 2018 and planned production is for 2022 to 2024.

[33] See Part I for additional information concerning these cell types and form factors.

Table III-8
CSPV products: Count of U.S. producers' responses regarding production by cell form factor

Count in number of firms reporting

Cell type	Actual production	Planned production
M0	1	0
G1	6	1
M2	8	1
M4	3	1
M6	6	5
Larger than M6	0	7
All other cell form factors	4	5

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Responses for actual production are since January 1, 2018 and planned production is for 2022 to 2024.

U.S. producers' shipments

CSPV cells

Following the same general downward trend as U.S. producers' CSPV cell production, the quantity of U.S. producers' U.S. shipments of CSPV cells declined nearly completely from 2018 to 2019, before ceasing in 2020 (table III-9).[34] Export shipments increased *** percent from 2018 to 2019, before decreasing in 2020, as ***. There were *** export shipments in January-June 2021. While the vast majority of total shipments were composed of U.S. shipments in 2018,[35] in 2019 and 2020 that share had shifted nearly entirely to being composed of export shipments.

[34] Three firms reported shipments of U.S.-produced cells in 2018, but from 2019 to 2020 only *** reported any shipments, primarily export shipments.

[35] The majority of U.S. cell producers' U.S. shipments in 2018 were reported as ***.

Table III-9
CSPV cells: U.S. producers' shipments, by location of shipment and period

Quantity in kilowatts; value in 1,000 dollars; unit values in dollars per kilowatt; shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
U.S. shipments	Quantity	***	***	***	***	***
Export shipments	Quantity	***	***	***	***	***
Total shipments	Quantity	***	***	***	***	***
U.S. shipments	Value	***	***	***	***	***
Export shipments	Value	***	***	***	***	***
Total shipments	Value	***	***	***	***	***
U.S. shipments	Unit value	***	***	***	***	***
Export shipments	Unit value	***	***	***	***	***
Total shipments	Unit value	***	***	***	***	***
U.S. shipments	Share of quantity	***	***	***	***	***
Export shipments	Share of quantity	***	***	***	***	***
Total shipments	Share of quantity	***	***	***	***	***
U.S. shipments	Share of value	***	***	***	***	***
Export shipments	Share of value	***	***	***	***	***
Total shipments	Share of value	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---".

CSPV modules

Table III-10 presents U.S. module producers' U.S. shipments, export shipments, and total shipments. The U.S. shipment quantity of CSPV modules assembled in the United States increased by 369.2 percent, from 457 MW in 2018 to 2,143 MW in 2020. The U.S. shipment quantity of CSPV modules assembled in the United States in January-June 2021 was largely unchanged from the comparable period of 2020. U.S. shipments comprised at least *** percent of the quantity of total shipments in each period. Export shipments were reported only by *** and by ***.[36]

[36] ***.

Table III-10
CSPV modules: U.S. producers' shipments, by location of shipment and period

Quantity in kilowatts; Value in 1,000 dollars; Unit values in dollars per kilowatt; Shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
U.S. shipments	Quantity	456,839	1,930,230	2,143,308	1,116,366	1,116,751
Export shipments	Quantity	***	***	***	***	***
Total shipments	Quantity	***	***	***	***	***
U.S. shipments	Value	251,392	870,390	897,107	476,851	454,524
Export shipments	Value	***	***	***	***	***
Total shipments	Value	***	***	***	***	***
U.S. shipments	Unit value	550	451	419	427	407
Export shipments	Unit value	***	***	***	***	***
Total shipments	Unit value	***	***	***	***	***
U.S. shipments	Share of quantity	***	***	***	***	***
Export shipments	Share of quantity	***	***	***	***	***
Total shipments	Share of quantity	100.0	100.0	100.0	100.0	100.0
U.S. shipments	Share of value	***	***	***	***	***
Export shipments	Share of value	***	***	***	***	***
Total shipments	Share of value	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Tables III-11 presents additional information on U.S. producers’ U.S. shipments by type of cell (i.e., using bifacial cells or using all other types of cell). While most U.S. shipments consisted of modules using non-bifacial cells in any period, the share attributable to modules using bifacial cells increased by *** percentage points from 2018 to 2020, and was *** percentage points higher in January-June 2021 than in the comparable period in 2020. The unit value of U.S. shipments of modules using bifacial cells was higher in all periods compared to modules using other type of cells.

Table III-11
CSPV Modules: U.S. producers' U.S. shipments, by type of cell and by period

Quantity in kilowatts; Value in 1,000 dollars; Unit values in dollars per kilowatt; Shares in percent

Cell type	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Modules using bifacial cells	Quantity	***	***	***	***	***
Modules using all other cell types	Quantity	***	***	***	***	***
Modules using all cell types	Quantity	456,839	1,930,230	2,143,308	1,116,366	1,116,751
Modules using bifacial cells	Value	***	***	***	***	***
Modules using all other cell types	Value	***	***	***	***	***
Modules using all cell types	Value	251,392	870,390	897,107	476,850	454,524
Modules using bifacial cells	Unit value	***	***	***	***	***
Modules using all other cell types	Unit value	***	***	***	***	***
Modules using all cell types	Unit value	550	451	419	427	407
Modules using bifacial cells	Share of quantity	***	***	***	***	***
Modules using all other cell types	Share of quantity	***	***	***	***	***
Modules using all cell types	Share of quantity	100.0	100.0	100.0	100.0	100.0
Modules using bifacial cells	Share of value	***	***	***	***	***
Modules using all other cell types	Share of value	***	***	***	***	***
Modules using all cell types	Share of value	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---".

Tables III-12 and III-13 present additional information on U.S. producers' U.S. shipments of modules by type of cell (i.e., using bifacial cells or using all other types of cell) by month. While the majority of shipments in each monthly period consisted of modules using non-bifacial cells, the share of monthly shipments attributable to bifacial cells began to increase in 2020 and 2021. From February 2020 to June 2021, the share of monthly shipments attributable to modules using bifacial cells ranged from 2.8 to 11.0 percent. Before February 2020, the share of

monthly shipments attributable to modules using bifacial cells was above one percent in only five monthly periods.

Table III-12
CSPV modules using bifacial cells: U.S. producers' U.S. shipments, by month

Quantity in kilowatts; Value in 1,000 dollars; Unit values in dollars per kilowatt; Shares in percent

Product type	Year	Month	Quantity	Value	Unit value	Share
Modules using bifacial cells	2018	January	***	***	***	0.8
Modules using bifacial cells	2018	February	***	***	***	---
Modules using bifacial cells	2018	March	***	***	***	---
Modules using bifacial cells	2018	April	***	***	***	---
Modules using bifacial cells	2018	May	***	***	***	---
Modules using bifacial cells	2018	June	***	***	***	---
Modules using bifacial cells	2018	July	***	***	***	---
Modules using bifacial cells	2018	August	***	***	***	0.7
Modules using bifacial cells	2018	September	***	***	***	1.3
Modules using bifacial cells	2018	October	***	***	***	0.7
Modules using bifacial cells	2018	November	***	***	***	1.3
Modules using bifacial cells	2018	December	***	***	***	0.8
Modules using bifacial cells	2019	January	***	***	***	2.3
Modules using bifacial cells	2019	February	***	***	***	1.6
Modules using bifacial cells	2019	March	***	***	***	1.7
Modules using bifacial cells	2019	April	***	***	***	0.3
Modules using bifacial cells	2019	May	***	***	***	0.1
Modules using bifacial cells	2019	June	***	***	***	0.2
Modules using bifacial cells	2019	July	***	***	***	---
Modules using bifacial cells	2019	August	***	***	***	0.1
Modules using bifacial cells	2019	September	***	***	***	0.3
Modules using bifacial cells	2019	October	***	***	***	---
Modules using bifacial cells	2019	November	***	***	***	0.2
Modules using bifacial cells	2019	December	***	***	***	0.1

Table continued.

Table III-12 Continued
CSPV modules using bifacial cells: U.S. producers' U.S. shipments, by month

Quantity in kilowatts; Value in 1,000 dollars; Unit values in dollars per kilowatt; Shares in percent

Product type	Year	Month	Quantity	Value	Unit value	Share
Modules using bifacial cells	2020	January	***	***	***	0.3
Modules using bifacial cells	2020	February	***	***	***	5.5
Modules using bifacial cells	2020	March	***	***	***	4.4
Modules using bifacial cells	2020	April	***	***	***	11.0
Modules using bifacial cells	2020	May	***	***	***	8.4
Modules using bifacial cells	2020	June	***	***	***	2.8
Modules using bifacial cells	2020	July	***	***	***	4.8
Modules using bifacial cells	2020	August	***	***	***	5.2
Modules using bifacial cells	2020	September	***	***	***	6.2
Modules using bifacial cells	2020	October	***	***	***	7.7
Modules using bifacial cells	2020	November	***	***	***	10.3
Modules using bifacial cells	2020	December	***	***	***	10.2
Modules using bifacial cells	2021	January	***	***	***	7.6
Modules using bifacial cells	2021	February	***	***	***	8.0
Modules using bifacial cells	2021	March	***	***	***	8.4
Modules using bifacial cells	2021	April	***	***	***	9.7
Modules using bifacial cells	2021	May	***	***	***	7.0
Modules using bifacial cells	2021	June	***	***	***	9.2

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“. Shares represent the share of modules using bifacial cells out of modules using all cell types within the specified month.

Table III-13
CSPV modules using all other cells: U.S. producers' U.S. shipments, by month

Quantity in kilowatts; Value in 1,000 dollars; Unit values in dollars per kilowatt; Shares in percent

Product type	Year	Month	Quantity	Value	Unit value	Share
Modules using all other cells	2018	January	***	***	***	99.2
Modules using all other cells	2018	February	***	***	***	100.0
Modules using all other cells	2018	March	***	***	***	100.0
Modules using all other cells	2018	April	***	***	***	100.0
Modules using all other cells	2018	May	***	***	***	100.0
Modules using all other cells	2018	June	***	***	***	100.0
Modules using all other cells	2018	July	***	***	***	100.0
Modules using all other cells	2018	August	***	***	***	99.3
Modules using all other cells	2018	September	***	***	***	98.7
Modules using all other cells	2018	October	***	***	***	99.3
Modules using all other cells	2018	November	***	***	***	98.7
Modules using all other cells	2018	December	***	***	***	99.2
Modules using all other cells	2019	January	***	***	***	97.7
Modules using all other cells	2019	February	***	***	***	98.4
Modules using all other cells	2019	March	***	***	***	98.3
Modules using all other cells	2019	April	***	***	***	99.7
Modules using all other cells	2019	May	***	***	***	99.9
Modules using all other cells	2019	June	***	***	***	99.8
Modules using all other cells	2019	July	***	***	***	100.0
Modules using all other cells	2019	August	***	***	***	99.9
Modules using all other cells	2019	September	***	***	***	99.7
Modules using all other cells	2019	October	***	***	***	100.0
Modules using all other cells	2019	November	***	***	***	99.8
Modules using all other cells	2019	December	***	***	***	99.9

Table continued.

Table III-13 Continued
CSPV modules using all other cells: U.S. producers' U.S. shipments, by month

Quantity in kilowatts; Value in 1,000 dollars; Unit values in dollars per kilowatt; Shares in percent

Product type	Year	Month	Quantity	Value	Unit value	Share
Modules using all other cells	2020	January	***	***	***	99.7
Modules using all other cells	2020	February	***	***	***	94.5
Modules using all other cells	2020	March	***	***	***	95.6
Modules using all other cells	2020	April	***	***	***	89.0
Modules using all other cells	2020	May	***	***	***	91.6
Modules using all other cells	2020	June	***	***	***	97.2
Modules using all other cells	2020	July	***	***	***	95.2
Modules using all other cells	2020	August	***	***	***	94.8
Modules using all other cells	2020	September	***	***	***	93.8
Modules using all other cells	2020	October	***	***	***	92.3
Modules using all other cells	2020	November	***	***	***	89.7
Modules using all other cells	2020	December	***	***	***	89.8
Modules using all other cells	2021	January	***	***	***	92.4
Modules using all other cells	2021	February	***	***	***	92.0
Modules using all other cells	2021	March	***	***	***	91.6
Modules using all other cells	2021	April	***	***	***	90.3
Modules using all other cells	2021	May	***	***	***	93.0
Modules using all other cells	2021	June	***	***	***	90.8

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---". Shares represent the share of modules using all other cells (i.e., other than bifacial) out of modules using all cell types within the specified month.

U.S. producers' inventories

Tables III-14 and III-15 presents U.S. producers' end-of-period inventories and the ratio of these inventories to U.S. producers' production, U.S. shipments, and total shipments for CSPV cells and CSPV modules, respectively.

Inventories of CSPV cells decreased by *** percent from 2018 to 2019. Ratios of CSPV cell inventories to U.S. production and shipments, and total shipments, increased from 2018 to 2019, however with the steep decline in U.S. shipments of CSPV cells from 2018 to 2019, the ratio of inventories to U.S. shipments increased many more times than the ratio of inventories to U.S. production or total shipments. There were *** reported inventories in 2020 or in either interim period, as ***.

Inventories and the associated ratios for CSPV modules generally increased between 2018 and 2020, and were higher in interim 2021 than in June 2020, driven primarily by

increases reported by ***. Inventories increased by more than 1,200 percent from 2018 to 2020, and inventory ratios to U.S. production and shipments increased by at least *** percentage points for each metric.

Table III-14
CSPV cells: U.S. producers' inventories and inventory ratios, by period

Quantity in kilowatts; Inventory ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
End-of-period inventory quantity	***	***	***	***	***
Inventory ratio to U.S. production	***	***	***	***	***
Inventory ratio to U.S. shipments	***	***	***	***	***
Inventory ratio to total shipments	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---".

Table III-15
CSPV modules: U.S. producers' inventories and inventory ratios, by period

Quantity in kilowatts; Inventory ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
End-of-period inventory quantity	12,500	118,041	168,692	151,993	155,734
Inventory ratio to U.S. production	2.7	5.7	7.6	6.5	7.0
Inventory ratio to U.S. shipments	2.7	6.1	7.9	6.8	7.0
Inventory ratio to total shipments	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---".

U.S. employment, wages, and productivity

Tables III-16 through III-18 shows U.S. producers' employment-related data for CSPV cells, CSPV modules, and for CSPV products combined, respectively. In line with other data presented for U.S. produced CSPV cells, data for 2018 reflects the reporting of three firms, but for all other periods, only *** reported data.[37]

[37] ***.
***

(*continued…*)

Table III-16
CSPV cells: U.S. producers' employment related data, by period

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Production and related workers (PRWs) (number)	***	***	***	***	***
Total hours worked (1,000 hours)	***	***	***	***	***
Hours worked per PRW (hours)	***	***	***	***	***
Wages paid ($1,000)	***	***	***	***	***
Hourly wages (dollars per hour)	***	***	***	***	***
Productivity (kilowatts per 1,000 hours)	***	***	***	***	***
Unit labor costs (dollars per kilowatt)	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Table III-17
CSPV modules: U.S. producers' employment related data, by period

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Production and related workers (PRWs) (number)	1,097	2,644	2,583	2,489	2,305
Total hours worked (1,000 hours)	1,584	4,367	4,239	2,250	1,941
Hours worked per PRW (hours)	1,444	1,652	1,641	904	842
Wages paid ($1,000)	50,085	106,071	91,357	46,596	47,951
Hourly wages (dollars per hour)	$31.62	$24.29	$21.55	$20.71	$24.70
Productivity (kilowatts per 1,000 hours)	296.6	475.7	522.9	516.0	575.5
Unit labor costs (dollars per kilowatt)	$106.60	$51.06	$41.21	$40.14	$42.93

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

(*continued…)*
***.
***.

Table III-18
CSPV products: U.S. producers' employment related data, by period

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Production and related workers (PRWs) (number)	***	***	***	***	***
Total hours worked (1,000 hours)	***	***	***	***	***
Hours worked per PRW (hours)	***	***	***	***	***
Wages paid ($1,000)	***	***	***	***	***
Hourly wages (dollars per hour)	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Part IV: Financial experience of U.S. producers

Background[1]

Thirteen U.S. producers provided usable financial results on their CSPV products operations.[2] The financial results on U.S.-produced cell operations (commercial sales and transfer sales to related firms) reflect Panasonic, SunPower (pre and post-acquisition), and Yingli.[3] The financial results on U.S.-produced module operations reflect Auxin, Hanwha, Heliene, Jinko, LG, Mission, Panasonic, PowerFilm, SBM, Silfab, SunPower (pre and post-acquisition), and Tesla. U.S. producers reported their financial results for calendar year periods and, for the most part, on the basis of U.S. GAAP.[4] As described earlier in this report, several U.S. producers effectively began or expanded their operations during the period examined, while several ceased operations and exited the market.

---

[1] The following abbreviations may be used in the tables and/or text of this section: generally accepted accounting principles ("GAAP"), fiscal year ("FY"), net sales ("NS"), cost of goods sold ("COGS"), selling, general, and administrative expenses ("SG&A expenses"), average unit values ("AUVs"), research and development expenses ("R&D expenses"), and return on assets ("ROA").

[2] While separate U.S. producer questionnaires were submitted for SunPower (pre-acquisition) and SunPower (post-acquisition), they represent the same underlying facility and are, where applicable, counted as a single U.S. producer. ***. USITC auditor notes (prehearing). ***. Ibid.

[3] Financial results on U.S.-produced cells only reflect commercial sales and transfer sales to related firms and do not include internal consumption of U.S.-produced cells to produce modules. To the extent applicable, internal consumption of U.S.-produced cells are reflected in module financial results as a separate component of COGS (see footnote 6).

[4] *** reported financial results on the basis of International Financial Reporting Standards ("IFRS"). *** U.S. producer questionnaire, response to III-2.B.4. USITC auditor notes (prehearing). ***. Ibid. ***. *** U.S. producer questionnaire, response to III-2.B.4. Submission by ***, September 29, 2021.

Operations on CSPV cells and modules

Figures IV-1 and IV-2 present U.S. producers' firm-specific share of total 2020 net sales quantity of CSVP cells and modules, respectively. Table IV-1 presents the aggregated financial results of U.S. producers' CSPV cell operations (commercial sales and transfer sales to related firms). Table IV-2 presents corresponding changes in AUVs.[5] Table IV-3 presents the aggregated financial results of U.S. producers' CSPV module operations. Table IV-4 presents corresponding changes in AUVs. Appendix G presents firm-specific financial information for cells and modules, respectively.

Figure IV-1
CSPV cells: Share of net sales quantity in 2020, by firm

* * * * * * *

Source: Compiled from data submitted in response to Commission questionnaires.

[5] In addition to differences in underlying product mix, cell and module financial results reflect the presence of start-up and exit costs, which impacted cost structures during the period and generally reduce comparability. A variance analysis under these conditions does not appear meaningful and is therefore not presented in this section of the report.

Table IV-1
CSPV cells: Results of commercial and transfer operations of U.S. producers, by item and period

Quantity in kilowatts; value in 1,000 of dollars; ratios in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Commercial sales	Quantity	***	***	***	***	***
Transfers to related firms	Quantity	***	***	***	***	***
Total net sales	Quantity	***	***	***	***	***
Commercial sales	Value	***	***	***	***	***
Transfers to related firms	Value	***	***	***	***	***
Total net sales	Value	***	***	***	***	***
Raw material costs	Value	***	***	***	***	***
Direct labor costs	Value	***	***	***	***	***
Other factory costs	Value	***	***	***	***	***
Cost of goods sold	Value	***	***	***	***	***
Gross profit or (loss)	Value	***	***	***	***	***
SG&A expenses	Value	***	***	***	***	***
Operating income or (loss)	Value	***	***	***	***	***
Interest expense	Value	***	***	***	***	***
All other expenses	Value	***	***	***	***	***
All other income	Value	***	***	***	***	***
Net income or (loss)	Value	***	***	***	***	***
Depreciation/amortization	Value	***	***	***	***	***
Cash flow	Value	***	***	***	***	***
Raw material costs	Ratio	***	***	***	***	***
Direct labor costs	Ratio	***	***	***	***	***
Other factory costs	Ratio	***	***	***	***	***
Cost of goods sold	Ratio	***	***	***	***	***
Gross profit or (loss)	Ratio	***	***	***	***	***
SG&A expenses	Ratio	***	***	***	***	***
Operating income or (loss)	Ratio	***	***	***	***	***
Net income or (loss)	Ratio	***	***	***	***	***

Table continued.

Table IV-1 Continued
CSPV cells: Results of commercial and transfer operations of U.S. producers, by item and period

Shares in percent; unit values in dollars per kilowatt; count in number of firms reporting

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Raw material costs	Share	***	***	***	***	***
Direct labor costs	Share	***	***	***	***	***
Other factory costs	Share	***	***	***	***	***
Cost of goods sold	Share	***	***	***	***	***
Commercial sales	Unit value	***	***	***	***	***
Transfers to related firms	Unit value	***	***	***	***	***
Total net sales	Unit value	***	***	***	***	***
Raw material costs	Unit value	***	***	***	***	***
Direct labor costs	Unit value	***	***	***	***	***
Other factory costs	Unit value	***	***	***	***	***
Cost of goods sold	Unit value	***	***	***	***	***
Gross profit or (loss)	Unit value	***	***	***	***	***
SG&A expenses	Unit value	***	***	***	***	***
Operating income or (loss)	Unit value	***	***	***	***	***
Net income or (loss)	Unit value	***	***	***	***	***
Operating losses	Count	***	***	***	***	***
Net losses	Count	***	***	***	***	***
Data	Count	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Ratios represent the ratio to net sales value and shares represent the share of COGS.

Table IV-2
CSPV cells: Changes in commercial and transfer AUVs between comparison periods

Changes in percent

Item	2018-20	2018-19	2019-20	Jan-Jun 2020-21
Commercial sales	***	***	***	***
Transfers to related firms	***	***	***	***
Total net sales	***	***	***	***
Raw material costs	***	***	***	***
Direct labor costs	***	***	***	***
Other factory costs	***	***	***	***
Cost of goods sold	***	***	***	***

Table continued.

Table IV-2 Continued
CSPV cells: Changes in commercial and transfer AUVs between comparison periods

Changes in dollars per kilowatt

Item	2018-20	2018-19	2019-20	Jan-Jun 2020-21
Commercial sales	***	***	***	***
Transfers to related firms	***	***	***	***
Total net sales	***	***	***	***
Raw material costs	***	***	***	***
Direct labor costs	***	***	***	***
Other factory costs	***	***	***	***
Cost of goods sold	***	***	***	***
Gross profit or (loss)	***	***	***	***
SG&A expense	***	***	***	***
Operating income or (loss)	***	***	***	***
Net income or (loss)	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Figure IV-2
CSPV modules: Share of net sales quantity in 2020, by firm

* * * * * * *

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent.

Table IV-3
CSPV modules: Results of total market operations of U.S. producers, by item and period

Quantity in kilowatts; value in 1,000 of dollars; ratio in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Commercial sales	Quantity	***	***	***	***	***
Internal consumption	Quantity	***	***	***	***	***
Transfers to related firms	Quantity	***	***	***	***	***
Total net sales	Quantity	***	***	***	***	***
Commercial sales	Value	***	***	***	***	***
Transfers to related firms	Value	***	***	***	***	***
Total net sales	Value	***	***	***	***	***
Raw material costs	Value	***	***	***	***	***
Direct labor costs	Value	***	***	***	***	***
Other factory costs	Value	***	***	***	***	***
Cost of goods sold	Value	***	***	***	***	***
Gross profit or (loss)	Value	***	***	***	***	***
SG&A expenses	Value	***	***	***	***	***
Operating income or (loss)	Value	***	***	***	***	***
Interest expense	Value	***	***	***	***	***
All other expenses	Value	***	***	***	***	***
All other income	Value	***	***	***	***	***
Net income or (loss)	Value	***	***	***	***	***
Depreciation/amortization	Value	***	***	***	***	***
Cash flow	Value	***	***	***	***	***
Raw material costs	Ratio	***	***	***	***	***
Direct labor costs	Ratio	***	***	***	***	***
Other factory costs	Ratio	***	***	***	***	***
Cost of goods sold	Ratio	***	***	***	***	***
Gross profit or (loss)	Ratio	***	***	***	***	***
SG&A expenses	Ratio	***	***	***	***	***
Operating income or (loss)	Ratio	***	***	***	***	***
Net income or (loss)	Ratio	***	***	***	***	***

Table continued.

Table IV-3 Continued
CSPV modules: Results of total market operations of U.S. producers, by item and period

Shares in percent; unit values in dollars per kilowatt; count in number of firms reporting

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Raw material costs	Share	***	***	***	***	***
Direct labor costs	Share	***	***	***	***	***
Other factory costs	Share	***	***	***	***	***
Cost of goods sold	Share	***	***	***	***	***
Commercial sales	Unit value	***	***	***	***	***
Internal consumption	Unit value	***	***	***	***	***
Transfers to related firms	Unit value	***	***	***	***	***
Total net sales	Unit value	***	***	***	***	***
Raw material costs	Unit value	***	***	***	***	***
Direct labor costs	Unit value	***	***	***	***	***
Other factory costs	Unit value	***	***	***	***	***
Cost of goods sold	Unit value	***	***	***	***	***
Gross profit or (loss)	Unit value	***	***	***	***	***
SG&A expenses	Unit value	***	***	***	***	***
Operating income or (loss)	Unit value	***	***	***	***	***
Net income or (loss)	Unit value	***	***	***	***	***
Operating losses	Count	***	***	***	***	***
Net losses	Count	***	***	***	***	***
Data	Count	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Ratios represent the ratio to net sales value and shares represent the share of COGS.

Table IV-4
CSPV modules: Changes in total market AUVs between comparison periods

Changes in percent

Item	2018-20	2018-19	2019-20	Jan-Jun 2020-21
Commercial sales	***	***	***	***
Internal consumption	***	***	***	***
Transfers to related firms	***	***	***	***
Total net sales	***	***	***	***
Raw material costs	***	***	***	***
Direct labor costs	***	***	***	***
Other factory costs	***	***	***	***
Cost of goods sold	***	***	***	***

Table continued.

Table IV-4 Continued
CSPV modules: Changes in total market AUVs between comparison periods

Changes in dollars per kilowatt

Item	2018-20	2018-19	2019-20	Jan-Jun 2020-21
Commercial sales	***	***	***	***
Internal consumption	***	***	***	***
Transfers to related firms	***	***	***	***
Total net sales	***	***	***	***
Raw material costs	***	***	***	***
Direct labor costs	***	***	***	***
Other factory costs	***	***	***	***
Cost of goods sold	***	***	***	***
Gross profit or (loss)	***	***	***	***
SG&A expenses	***	***	***	***
Operating income or (loss)	***	***	***	***
Net income or (loss)	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Net sales

Sales of U.S.-produced cells were classified primarily as commercial sales.[6] Transfer sales were reported *** in 2018, reflecting a single company ***, which began and ended its U.S. cell operations in that year. *** cell activity was also limited to 2018.[7] ***, which began cell operations prior to the period examined (early

[6] As noted previously, the financial results for U.S.-produced cells reflect commercial sales and transfer sales to related firms. Internal consumption of U.S.-produced cells to produce modules is included as a component of module COGS. ***. Email from ***, September 27, 2021. ***.

[7] ***. Email from ***, October 12, 2021.

2017) reported cell sales throughout most of the period, terminating its cell operations in June 2020.

In contrast with cells, the composition of module sales varied over the period, commercial sales being the primary category in 2018 with only a relatively small amount of transfer sales reported in that year. The shift to a substantially larger share of module transfer sales after 2018 reflects several factors: *** entered the market in 2019 and its sales were primarily classified as ***;[8] *** module sales in 2019 and 2020 were primarily classified as ***; ***, which had operations throughout the period, reported a large increase in its transfer sales in 2019.[9] While ***, whose operations began in late 2018, contributed to this pattern inasmuch as it also reported transfer sales beginning in 2019, its total sales were primarily commercial.[10] With the exception of ***, which reported primarily commercial sales but also a small amount of internal consumption,[11] and ***, whose sales were classified entirely as internal consumption,[12] the remaining U.S. module producers reported *** commercial sales.

[8] ***. Submission by ***, September 29, 2021.
[9] ***. Submission by ***, September 28, 2021.
[10] ***. Email from ***, October 4, 2021.
[11] ***. Email from ***, September 27, 2021.
[12] USITC auditor notes (posthearing).

Quantity

The sales quantity of U.S.-produced cells increased to its highest level in 2019, reflecting *** transition to higher sales volumes in that year as compared to its smaller volume operations in 2018. As noted above, the other U.S. cell producers (***) discontinued their cell operations in 2018. The subsequent decline in 2020 cell sales quantity reflects *** termination of U.S. cell operations in June of that year. With all cell operations discontinued, cell sales were zero in January-June 2021.

Module sales quantity increased in 2019 reflecting, in large part, the entry of ***, whose sales quantities, for the most part, increased throughout the rest of the period with the exception being ***, whose sales were notably lower in January-June 2021 compared to January-June 2020. U.S. module producers with operations throughout the period (***) reported a mixed directional pattern of sales quantity with some remaining within a relatively narrow range (***) while others reported more variability (***).[13] *** and ***, whose module operations covered most, but not all, of the period, reported their highest sales quantities in 2019 and 2020, respectively.[14] [15]

[13] ***. *** U.S. producer questionnaire, response to III-16.

[14] ***.

[15] As presented in table C-2 and with respect to overall module activity in January-June 2021 compared to January-June 2020, the deviation in the directional pattern of total trade shipment quantities (higher) and financial sales quantities (lower), as well as the larger decline in total trade shipment value compared to financial sales value, primarily reflects *** in the January-June 2021 financial results (see footnote 2).

Value

The average sales value of U.S.-produced cells was lowest in 2018, the *** year in which multiple U.S. producers reported cell operations.[16] In conjunction with the highest level of sales quantity, average cell sales value was highest in 2019 and then declined somewhat in 2020. As noted previously, ***, the only U.S. producer reporting cell sales in 2019 and 2020, ended its cell operations in June 2020.

Most U.S. module producers reported average module sales values that were in a broadly similar range, generally occupying either the higher part of that range (***) or the lower part (***).[17] For the periods when individual module producers reported sales activity, ***, reported declines in their average sales values. ***, whose module sales ended in June 2020, was the *** U.S. module producer to report increasing average sales values for the entire period that it reported operations. ***, which had module operations throughout the period, reported a relatively large decline in its average sales value in 2019 followed by increases throughout the rest of the period.

For module operations as a whole and in conjunction with the largest percentage decline in average raw material cost, average module sales value declined most notably in 2019 (see table IV-4). By smaller amounts, this decline continued through the remainder of the period.

Cost of goods sold

Raw materials

The share of cell COGS accounted for by total raw material costs ranged from *** percent (2018) to *** percent (2020).[18] The cost of wafers, as a share of total cell raw material cost, ranged from co-equal at *** percent (2018) to *** percent (2019).[19] ***

[16] ***.

[17] ***.

[18] With regard to the relatively low share of cell raw material costs compared to conversion costs (combined direct labor and other factory costs), particularly in 2018, this largely reflects *** limited cell production, reflecting cell operations that began in early 2017.

[19] USITC auditor notes (prehearing).

U.S. cell producer reported polysilicon and/or ingots as a raw material cost. Average cell raw material cost declined from its highest level in 2018 to its lowest level in 2019, and then increased marginally in 2020.

With respect to module operations, the share of COGS accounted for by total raw material costs ranged from *** percent (January-June 2020) to *** percent (2018). The cost of purchased cells (foreign-produced) was the largest component of module raw material cost, ranging from *** percent of total raw material cost (2018) to *** percent (2020).[20] Costs associated with purchased cells (domestically-produced) were *** reported, while costs associated with internal consumption of U.S.-produced cells were limited to 2018 (see footnote 6). The share of module raw material costs accounted for by total other raw material costs (back sheets, encapsulants (e.g., EVA), framing, junction boxes, solar glass, other) ranged from *** percent (2018) to *** percent (January-June 2021). On a unitized basis, the average cost of purchased cells (foreign-produced), as well as a number of the underlying components of other raw material costs, fluctuated but generally declined over the period.[21] [22]

Direct labor cost and other factory costs

For cell operations, direct labor cost ranged from *** percent (2018) to *** percent (2019) of total COGS, while other factory costs ranged from *** percent (2020) to ***

[20] USITC auditor notes (posthearing). These cost shares, as well as observations regarding the trend of corresponding average costs, are based on U.S.-producer questionnaire responses reporting usable information at this level of detail.

[21] Ibid. With regard to the underlying components of other raw material costs and corresponding share of total raw material cost, the smallest cost shares were accounted for by backsheets (*** percent (2018) to *** percent (January-June 2021)) and junction boxes (*** percent (January-June 2021) to *** percent (2019)); intermediate cost shares were accounted for by encapsulants (e.g., EVA) (*** percent (2018, January-June 2020) to *** percent (January-June 2021)) and other inputs *** percent (2019) to *** percent (January-June 2021)); the largest cost shares alternated during the period between framing (*** percent (2018) to *** percent (2019)) and solar glass (*** percent (2018) to *** percent (January-June 2021)). Ibid.

[22] U.S. cell producers reported *** input purchases from related suppliers. With regard to module operations, *** were the *** producers to report input purchases from related suppliers: ***. *** U.S. producer questionnaire, response to III-7. Email from ***, October 4, 2021. ***. *** U.S. producer questionnaire, response to III-7. Email from ***, September 27, 2021. ***. *** U.S. producer questionnaire, response to III-7. Email from ***, September 27, 2021.

percent (2018). The notably higher level of other factory costs in 2018 appears to reflect several factors, including the ***. In 2019 and 2020, the cost structure of U.S.-produced cells reflects a single U.S. producer (***), which ended cell operations in June 2020.

For module operations, direct labor cost ranged from *** percent of total COGS (2018) to *** percent (2020) and other factory costs ranged from *** percent (2019) to *** percent (January-June 2020). Module average direct labor cost and average other factory costs both declined in 2019, increased in 2020, and were lower in January-June 2021 compared to January-June 2020.

As noted previously, three module producers (***) entered the market in 2019. While *** reported that they transitioned from start-up to commercial-scale operations at about the same time in early 2019, [23] [24] *** reported that it considers itself to *** be in start-up.[25] Of these three producers, *** average other factory costs were *** and also *** than those of *** U.S. module producers with existing operations. All things being equal, the weighting effect of the large share of total module sales progressively accounted for by *** would generally yield declines in overall average other factory costs.

In 2020, most U.S. producers, including ***, reported higher average other factory costs of varying magnitudes. While likely not the only factor, this increase is generally

[23] ***. Email from ***, October 4, 2021.
[24] ***. Email from ***, September 27, 2021.
[25] ***. Submission by ***, September 29, 2021.

consistent with COVID-19 quarantine and related-measures that disrupted production,[26] and increased overhead costs in that year.[27] In addition to cancelled orders and the impact of employee-related issues,[28] supply chains and related lead-times were also reportedly affected.[29]

As shares of total COGS, direct labor cost and other factory costs were not uniform on a company-specific basis and reflect differences such as start-up and exit activity, cost structure, and accounting classification.[30] [31] While declines in average raw material costs played the most important role in explaining declines in average module COGS during the full-year period, the effect was less pronounced between the interim periods: in January-June 2021 compared to

[26] ***. *** U.S. producer questionnaire, response to III-15. ***. *** U.S. producer questionnaire, response to III-15. ***. *** U.S. producer questionnaire, response to III-15.

[27] *** U.S. producer questionnaire, response to III-15.

[28] ***. *** U.S. producer questionnaire, response to III-15.

[29] ***. *** U.S. producer questionnaire, response to III-15. ***. *** U.S. producer questionnaire, response to III-15.

[30] The relative decline in *** other factory costs reflects the net effect of ***, which the company included in COGS and assigned to reported other factory costs. ***. *** U.S. producer questionnaire, response to III-10. Email from ***, September 24, 2021. While amplifying its profitability in those years, *** would have reported positive gross and operating results, in the absence ***.

[31] In some instances, where higher levels of direct labor and other factory costs as a share of COGS, as well on an average basis, might have been expected due to start-up activity, company-specific cost shares remained within a relatively narrow range; e.g., ***.

January-June 2020, lower average direct labor and other factory cost played a somewhat larger role compared to average raw material costs.

Gross profit or loss

Commercial sales and transfers of U.S.-produced cells generated gross losses of varying magnitude throughout the period that activity was reported. The largest gross loss was reported in 2018, when *** was still operating at a relatively low level of production. The 2019 and 2020 declines in cell gross losses, generally reflect *** higher production and sales quantity, peaking in 2019, in conjunction with corresponding lower average COGS, which amplified the positive impact of higher average sales value in 2019 and more than offset the decline in average sales value in 2020 (see table IV-2).

Overall module operations generated a positive gross profit in *** year (2019) with total gross losses highest in 2020. On a company-specific basis, module producers reported a range of gross results: several (***) reporting gross losses throughout the period for which sales were reported; others reporting gross profit for all (***) or most (***) of the period for which sales were reported; and several (***) reporting a more mixed pattern of gross profit and gross losses.

To the extent that average module sales value declined throughout the period, the source of relative improvements in overall module gross results was lower average COGS, largely reflecting declines in average raw material cost during the full-year period and a mix of lower average raw material, direct labor and other factory costs between the interim periods. As shown in the percentage declines in table IV-4, the positive impact of lower average module COGS more than offset the decline in average sales value in 2019 and the lower average sales value between the interim periods. In contrast, the lower average COGS in 2020 only partially offset the corresponding decline in average module sales value.

SG&A expenses and operating income or loss

SG&A expense ratios (total SG&A expenses divided by total sales) for cell operations declined from their highest level in 2018 to their lowest level in 2020. Relatively low sales in 2018, as opposed to unusually high SG&A expenses in that year, generally explains the high company-specific SG&A expense ratios reported by ***

***.[32] ***, the *** U.S. cell producer to report sales after 2018, reported lower SG&A expense ratios for 2019 and 2020, generally reflecting an increase in sales. To the extent that cell operations did not generate gross profit, on an *** basis, corresponding operating losses were essentially unavoidable with the absolute amounts determined by the level of corresponding SG&A expenses.

For module operations, the increase in total SG&A expenses in 2019 primarily reflects the entry of new producers (***) and, in conjunction with higher sales, the increases in SG&A expenses reported by several existing producers (***). While many (***) reported company-specific SG&A expense ratios that remained within a medium-to-narrow range, others (***) reported a relatively wide range of SG&A expense ratios.[33] [34]

With the exception of ***, module producers reported operating losses for all or most of the period for which module sales were reported.[35] [36] The module

[32] ***. Email from ***, October 12, 2021.

[33] In some instances, notable variations in company-specific SG&A expense ratios reflect declines in sales that were proportionately greater than corresponding declines in SG&A expenses. ***.

[34] ***.

[35] *** reported operating income in 2019 and 2020, and an operating loss in January-June 2021. ***. Submission by ***, September 29, 2021.

[36] *** reported an operating loss in 2018, operating income in 2019 and 2020, and an operating loss in January-June 2021. ***. Email from ***, September 24, 2021.

producers noted previously, that reported gross losses throughout the period (***), by default also reported operating losses.[37] [38] [39] [40] ***, while reporting gross profit for

[37] ***. Email from ***, October 4, 2021.
[38] ***. Email from ***, September 27, 2021.
[39] ***. Email from ***, September 27, 2021.
[40] ***.

all or most of the period, generally reported corresponding operating losses with *** reporting operating income only in 2018.[41] [42] [43]

Interest expense, other expenses and income, and net income or loss

Cell financial results reflect minimal interest expense and other expenses, which were reported only in 2018. No other income was reported for cell operations during the period (see table IV-1). As such and with the exception of 2018, cell operating results and net results were the same amounts. The absolute levels of cell operating losses and net losses were highest in 2018 and then declined through 2020 after which cell operations ceased.

In contrast with cell financial results, module financial results reflect interest expense of varying magnitude throughout the period (see table IV-3). Most module producers reported at least some level of interest expense with *** (2018) and *** (2019 through January-June 2021) accounting for the largest company-specific shares, respectively. While other expenses tended to be sporadic or not reported at all by some companies, *** reported relatively low levels of recurring other expenses throughout the period. The notably large level of module other expenses in 2018 primarily reflects ***.[44] In January-

[41] ***. Submission by ***, September 29, 2021.
[42] ***.
[43] ***. *** U.S. producer questionnaire, response to III-16.
[44] Email from ***, September 21, 2021.

June 2021, the elevated level of other expenses primarily reflects ***.[45] Minimal module other income was reported in 2018 and then was substantially higher for the rest of the period, primarily reflecting other income reported by ***.[46]

Module operating results and net results were negative throughout the period with the net effect of interest expense, other expenses, and other income yielding somewhat higher net losses compared to operating losses. Directionally, the relative improvement in module operating and net results (reductions in the level of operating losses and net losses in 2019 and between the interim periods) and deterioration (increases in the level of operating losses and net losses in 2020) were the same.

Capital expenditures and research and development expenses

Table IV-5 and table IV-6, respectively, present the U.S. producers' capital expenditures related to cells and modules and each firm's category-specific narrative description regarding capital expenditures. Table IV-7 and table IV-8, respectively, present total R&D expenses related to cells and modules and each firm's category-specific narrative description regarding R&D expenses.[47]

[45] *** U.S. producer questionnaire, responses to II-2a and III-10.

[46] ***. Submission by ***, September 28, 2021.

[47] As shown in table IV-7, *** reported a *** level of R&D expenses in both 2018 and 2019. As described in Part III of this report, this *** level of R&D expenses took place in conjunction with ***.

Table IV-5
CSPV products: U.S. producers' capital expenditures, by firm and by period

Value in 1,000 dollars

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers (commercial sales and transfers)	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Suniva	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***
CSPV products	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Table IV-6
CSPV products: Narrative descriptions of U.S. producers' capital expenditures, by firm

Firm	Narrative
Panasonic (cell operations)	***
SunPower (pre-acquisition) (cell operations)	***
SunPower (post-acquisition) (cell operations)	***
Yingli (cell operations)	***
Auxin (module operations)	***
Hanwha (module operations)	***
Heliene (module operations)	***
Jinko (module operations)	***
LG (module operations)	***
Mission (module operations)	***
Panasonic (module operations)	***
PowerFilm (module operations)	***
SBM (module operations)	***
Silfab (module operations)	***
SunPower (pre-acquisition) (module operations)	***
SunPower (post-acquisition) (module operations)	***
Tesla (module operations)	***

Source: Compiled from data submitted in response to Commission questionnaires.

Table IV-7
CSPV products: U.S. producers' R&D expenses, by firm and by period

Value in 1,000 dollars

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers (commercial sales and transfers)	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Suniva	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
Yingli	***	***	***	***	***
All module producers	***	***	***	***	***
CSPV products	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Table IV-8
CSPV products: Narrative descriptions of U.S. producers' R&D expenses, by firm

Firm	Narrative
Panasonic (cell operations)	***
SunPower (pre-acquisition) (cell operations)	***
SunPower (post-acquisition) (cell operations)	***
Yingli (cell operations)	***
Auxin (module operations)	***
Hanwha (module operations)	***
Heliene (module operations)	***
Jinko (module operations)	***
LG (module operations)	***
Mission (module operations)	***
Panasonic (module operations)	***
PowerFilm (module operations)	***
SBM (module operations)	***
Silfab (module operations)	***
SunPower (pre-acquisition) (module operations)	***
SunPower (post-acquisition) (module operations)	***
Tesla (module operations)	***

Source: Compiled from data submitted in response to Commission questionnaires.

Assets and return on assets

Table IV-9 presents data on total net assets by category (commercial and transfer sales of cells, internal consumption of cells, and module operations). Table IV-10 presents corresponding ROA by category of financial results.[48]

Table IV-9
CSPV products: U.S. producers' total net assets, by period

Value in 1,000 dollars

Firm	2018	2019	2020
All firms (commercial and transfer sales of cells)	***	***	***
All firms (internal consumption of cells)	***	***	***
All firms (modules)	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: ***. Email from ***, September 27, 2021.

Table IV-10
CSPV products: U.S. producers' ROA, by period

Ratio in percent

Firm	2018	2019	2020
All firms (commercial and transfer sales of cells)	***	***	***
All firms (modules)	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: The total 2018 module assets of new entrants that reported total assets for 2018 but no financial results are excluded from the denominator in calculating 2018 ROA. Assets reported for cell internal consumption to produce modules are included in the module asset denominator.

[48] ROA is calculated as operating income divided by total assets. With respect to a firm's overall operations, the total asset value reflects an aggregation of a number of assets which are generally not product specific. High-level allocation factors are therefore often required in order to report a total asset amount on a product-specific basis.

Part V: U.S. imports, apparent U.S. consumption, and market shares

U.S. imports

The import data presented in this part of the report are compiled from data submitted in response to Commission questionnaires. Import data compiled from official U.S. import statistics using HTS statistical reporting numbers 8541.40.6015, 8541.40.6020, 8541.40.6025, 8541.40.6030, 8541.40.6035, and 8541.40.6045 are presented separately in appendix H.[1]

U.S. imports of CSPV cells

Table V-1 and figure V-1 present data for U.S. imports of CSPV cells based on the country of origin of the cells.[2] Total U.S. imports of CSPV cells increased by 187.7 percent from 754.9 MW in 2018 to 2,172.2 MW in 2020. Total U.S. imports of CSPV cells were lower at 1,145.8 MW during January-June 2021 compared with 1,290.3 MW during January-June 2020. The average unit value ("AUV") of U.S. imports of CSPV cells declined from a high of $307 per kW in 2018 to $197 per kW in 2019, before increasing to $215 per kW in 2020. The average unit value was $212 per kW in January-June 2020 and was at its lowest point at $191 per kW during January-June 2021.[3]

The leading suppliers of foreign CSPV cells to the United States during 2018 were Korea and Malaysia, representing *** percent and *** percent of all imports by quantity, respectively. By 2020, the leading individual suppliers of foreign CSPV cells to the United States were Korea, China, and Malaysia, representing *** percent, *** percent, and *** percent of all imports, respectively. The growth in imports of cells from Korea was driven by increased imports from ***. Imports

[1] Official U.S. import statistics may be overstated by certain items that are outside the scope of this investigation, such as thin film photovoltaic products.

[2] The import data presented in this part of the report are compiled from data submitted in response to Commission questionnaires. In addition to *** submitted since release of the prehearing report, import data in this staff report also includes updated information from ***.

[3] The *** quantity of imports from "all other sources" were reported by ***.

from China were due to increases reported by ***.[4] The leading suppliers of foreign CSPV cells to the United States in January-June 2020 were Korea and China, representing *** percent and *** percent of all imports, respectively. However, imports from Malaysia as a share of quantity were *** percentage points higher in interim 2021 than in interim 2020, as the country became the second biggest source of supply in interim 2021.

[4] ***.

Table V-1
CSPV cells: U.S. imports, by source and period

Quantity in kilowatts; value in 1,000 dollars; unit values in dollars per kilowatt

Source	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
China	Quantity	***	***	***	***	***
Japan	Quantity	***	***	***	***	***
Korea	Quantity	***	***	***	***	***
Malaysia	Quantity	***	***	***	***	***
Philippines	Quantity	***	***	***	***	***
Taiwan	Quantity	***	***	***	***	***
Thailand	Quantity	***	***	***	***	***
Vietnam	Quantity	***	***	***	***	***
All other sources	Quantity	***	***	***	***	***
All import sources	Quantity	754,939	2,189,237	2,172,166	1,290,324	1,145,810
China	Value	***	***	***	***	***
Japan	Value	***	***	***	***	***
Korea	Value	***	***	***	***	***
Malaysia	Value	***	***	***	***	***
Philippines	Value	***	***	***	***	***
Taiwan	Value	***	***	***	***	***
Thailand	Value	***	***	***	***	***
Vietnam	Value	***	***	***	***	***
All other sources	Value	***	***	***	***	***
All import sources	Value	231,554	430,197	467,648	273,794	218,858
China	Unit value	***	***	***	***	***
Japan	Unit value	***	***	***	***	***
Korea	Unit value	***	***	***	***	***
Malaysia	Unit value	***	***	***	***	***
Philippines	Unit value	***	***	***	***	***
Taiwan	Unit value	***	***	***	***	***
Thailand	Unit value	***	***	***	***	***
Vietnam	Unit value	***	***	***	***	***
All other sources	Unit value	***	***	***	***	***
All import sources	Unit value	307	197	215	212	191

Table continued.

Table V-1 Continued
CSPV cells: U.S. imports, by source and period

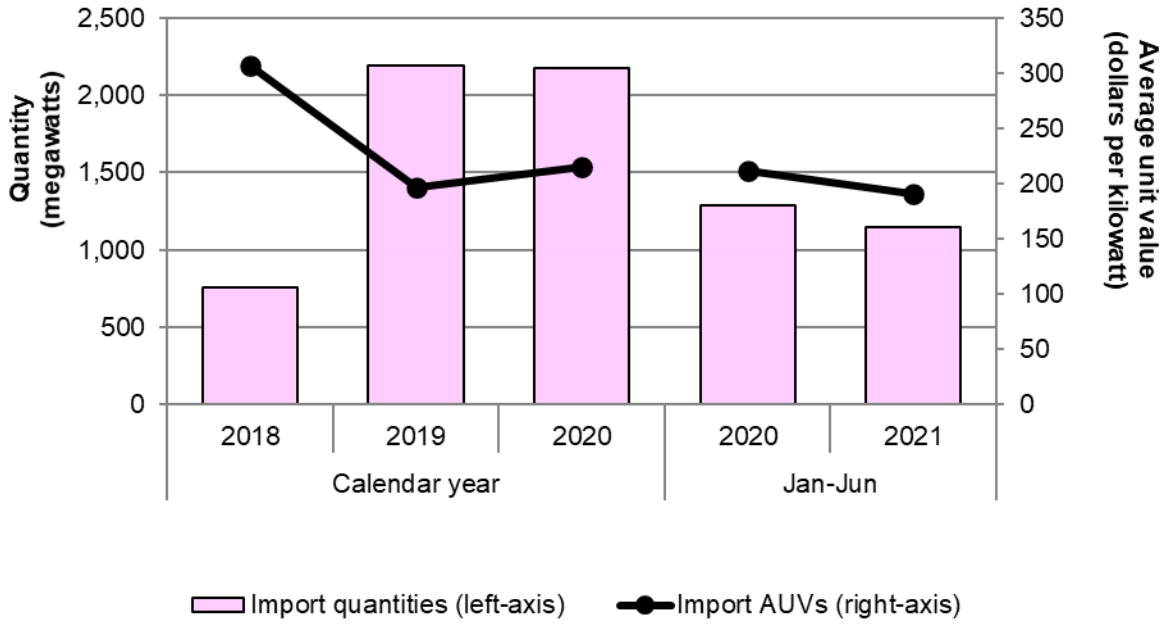
Shares and ratio in percent

Source	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
China	Share of quantity	***	***	***	***	***
Japan	Share of quantity	***	***	***	***	***
Korea	Share of quantity	***	***	***	***	***
Malaysia	Share of quantity	***	***	***	***	***
Philippines	Share of quantity	***	***	***	***	***
Taiwan	Share of quantity	***	***	***	***	***
Vietnam	Share of quantity	***	***	***	***	***
Thailand	Share of quantity	***	***	***	***	***
All other sources	Share of quantity	***	***	***	***	***
All import sources	Share of quantity	100.0	100.0	100.0	100.0	100.0
China	Share of value	***	***	***	***	***
Japan	Share of value	***	***	***	***	***
Korea	Share of value	***	***	***	***	***
Malaysia	Share of value	***	***	***	***	***
Philippines	Share of value	***	***	***	***	***
Taiwan	Share of value	***	***	***	***	***
Thailand	Share of value	***	***	***	***	***
Vietnam	Share of value	***	***	***	***	***
All other sources	Share of value	***	***	***	***	***
All import sources	Share of value	100.0	100.0	100.0	100.0	100.0
China	Ratio	***	***	***	***	***
Japan	Ratio	***	***	***	***	***
Korea	Ratio	***	***	***	***	***
Malaysia	Ratio	***	***	***	***	***
Philippines	Ratio	***	***	***	***	***
Taiwan	Ratio	***	***	***	***	***
Thailand	Ratio	***	***	***	***	***
Vietnam	Ratio	***	***	***	***	***
All other sources	Ratio	***	***	***	***	***
All import sources	Ratio	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“. Ratio represents ratio to U.S. cell production.

Figure V-1
CSPV cells: U.S. import quantities and average unit values, by period



Source: Compiled from data submitted in response to Commission questionnaires.

Table V-2 presents data for U.S. imports of CSPV cells by type of cell (i.e., bifacial cells or all other cell types). While most imports of CSPV cells were of non-bifacial cell types in any given period, imports of bifacial CSPV cells increased by *** percentage points to their highest level in any period in 2019, accounting for *** percent of all CSPV cell imports in that year. In 2020, the share of imports accounted for by bifacial cells fell to *** percent. Though the AUV of bifacial cells started out higher than the AUV for all other cell types in 2018 and 2019, in 2020 and in January-June 2021, bifacial cell AUV was lower than the AUV for all other cell types. Overall, the AUV for each category of cell was lower in 2020 than in 2018, and was lower in January-June 2021 than in the same period of 2020.

Table V-2
CSPV cells: U.S. importers' U.S imports, by type of cell and period

Quantity in kilowatts; Value in 1,000 dollars; Unit values in dollars per kilowatt; Shares in percent

Cell type of cell imports	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Bifacial cells	Quantity	***	***	***	***	***
All other cell types	Quantity	***	***	***	***	***
All cell types	Quantity	754,939	2,189,237	2,172,166	1,290,324	1,145,810
Bifacial cells	Value	***	***	***	***	***
All other cell types	Value	***	***	***	***	***
All cell types	Value	231,554	430,197	467,648	273,794	218,858
Bifacial cells	Unit value	***	***	***	***	***
All other cell types	Unit value	***	***	***	***	***
All cell types	Unit value	307	197	215	212	191
Bifacial cells	Share of quantity	***	***	***	***	***
All other cell types	Share of quantity	***	***	***	***	***
All cell types	Share of quantity	100.0	100.0	100.0	100.0	100.0
Bifacial cells	Share of value	***	***	***	***	***
All other cell types	Share of value	***	***	***	***	***
All cell types	Share of value	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---".

Tables V-3 and V-4 present data for counts of responses from U.S. importers regarding imports by cell type and by form factor.[5]

[5] Counts in these tables may not equal the count of total importers as importers could select importing more than one cell type or cell form factor. See Part I for additional information concerning these cell types and form factors.

Table V-3
CSPV cells: Count of U.S. importers' responses regarding imports by cell type

Count in number of firms reporting

Cell type	Imported product
Mono	29
Multi	16
PERC	24
Heterojunction	4
Bifacial	20
P-type	16
N-type	6
Greater than 162 by 162 millimeter cells	5
All other cell types	6

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Responses are for imported product since January 1, 2018.

Table V-4
CSPV cells: Count of U.S. importers' responses regarding imports by cell form factor

Count in number of firms reporting

Cell form factor	Imported product
M0	4
G1	24
M2	20
M4	8
M6	18
Larger than M6	2
All other cell form factors	12

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Responses are for imported product since January 1, 2018.

U.S. imports of CSPV modules

Table V-5 and figure V-2 present data for U.S. imports of CSPV modules, by source of imports.[6] Total U.S. imports of CSPV modules increased by 283.7 percent from 4.9 GW in 2018 to 18.9 GW in 2020. Total U.S. imports of CSPV modules were higher at 10.5 GW during January-June 2021 compared with 9.7 GW during January-June 2020. The AUV of U.S. imports of CSPV modules declined from $410 per kW in 2018 to $301 per kW in 2020 and was lower at $276 per kW during January-June 2021 than at $307 per kW during the same period in 2020. The leading suppliers of foreign CSPV modules to the United States during 2020 were Malaysia, Vietnam, and Thailand, representing *** percent, *** percent, and *** percent, respectively, of all imports of CSPV modules by quantity in that year.

[6] Except where otherwise discussed, most data in this report concerning imports of modules use the country where the cells in the modules were produced as the country of origin.

Table V-5
CSPV modules: U.S. imports based on the country of origin of the cells, by source and period

Quantity in kilowatts; Value in 1,000 dollars; Unit values in dollars per kilowatt

Source	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cambodia	Quantity	***	***	***	***	***
China	Quantity	***	***	***	***	***
India	Quantity	***	***	***	***	***
Indonesia	Quantity	***	***	***	***	***
Japan	Quantity	***	***	***	***	***
Korea	Quantity	***	***	***	***	***
Malaysia	Quantity	***	***	***	***	***
Philippines	Quantity	***	***	***	***	***
Singapore	Quantity	***	***	***	***	***
Taiwan	Quantity	***	***	***	***	***
Thailand	Quantity	***	***	***	***	***
Turkey	Quantity	***	***	***	***	***
Vietnam	Quantity	***	***	***	***	***
All other sources	Quantity	***	***	***	***	***
All import sources	Quantity	4,921,483	11,696,707	18,882,847	9,731,910	10,500,717
Cambodia	Value	***	***	***	***	***
China	Value	***	***	***	***	***
India	Value	***	***	***	***	***
Indonesia	Value	***	***	***	***	***
Japan	Value	***	***	***	***	***
Korea	Value	***	***	***	***	***
Malaysia	Value	***	***	***	***	***
Philippines	Value	***	***	***	***	***
Singapore	Value	***	***	***	***	***
Taiwan	Value	***	***	***	***	***
Thailand	Value	***	***	***	***	***
Turkey	Value	***	***	***	***	***
Vietnam	Value	***	***	***	***	***
All other sources	Value	***	***	***	***	***
All import sources	Value	2,018,133	3,633,775	5,676,766	2,990,435	2,894,517

Table continued.

Table V-5 Continued
CSPV modules: U.S. imports based on the country of origin of the cells, by source and period

Unit values in dollars per kilowatt; Shares in percent.

Source	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cambodia	Unit value	***	***	***	***	***
China	Unit value	***	***	***	***	***
India	Unit value	***	***	***	***	***
Indonesia	Unit value	***	***	***	***	***
Japan	Unit value	***	***	***	***	***
Korea	Unit value	***	***	***	***	***
Malaysia	Unit value	***	***	***	***	***
Philippines	Unit value	***	***	***	***	***
Singapore	Unit value	***	***	***	***	***
Taiwan	Unit value	***	***	***	***	***
Thailand	Unit value	***	***	***	***	***
Turkey	Unit value	***	***	***	***	***
Vietnam	Unit value	***	***	***	***	***
All other sources	Unit value	***	***	***	***	***
All import sources	Unit value	410	311	301	307	276
Cambodia	Share of quantity	***	***	***	***	***
China	Share of quantity	***	***	***	***	***
India	Share of quantity	***	***	***	***	***
Indonesia	Share of quantity	***	***	***	***	***
Japan	Share of quantity	***	***	***	***	***
Korea	Share of quantity	***	***	***	***	***
Malaysia	Share of quantity	***	***	***	***	***
Philippines	Share of quantity	***	***	***	***	***
Singapore	Share of quantity	***	***	***	***	***
Taiwan	Share of quantity	***	***	***	***	***
Thailand	Share of quantity	***	***	***	***	***
Turkey	Share of quantity	***	***	***	***	***
Vietnam	Share of quantity	***	***	***	***	***
All other sources	Share of quantity	***	***	***	***	***
All import sources	Share of quantity	100.0	100.0	100.0	100.0	100.0

Table continued.

Table V-5 Continued
CSPV modules: U.S. imports based on the country of origin of the cells, by source and period

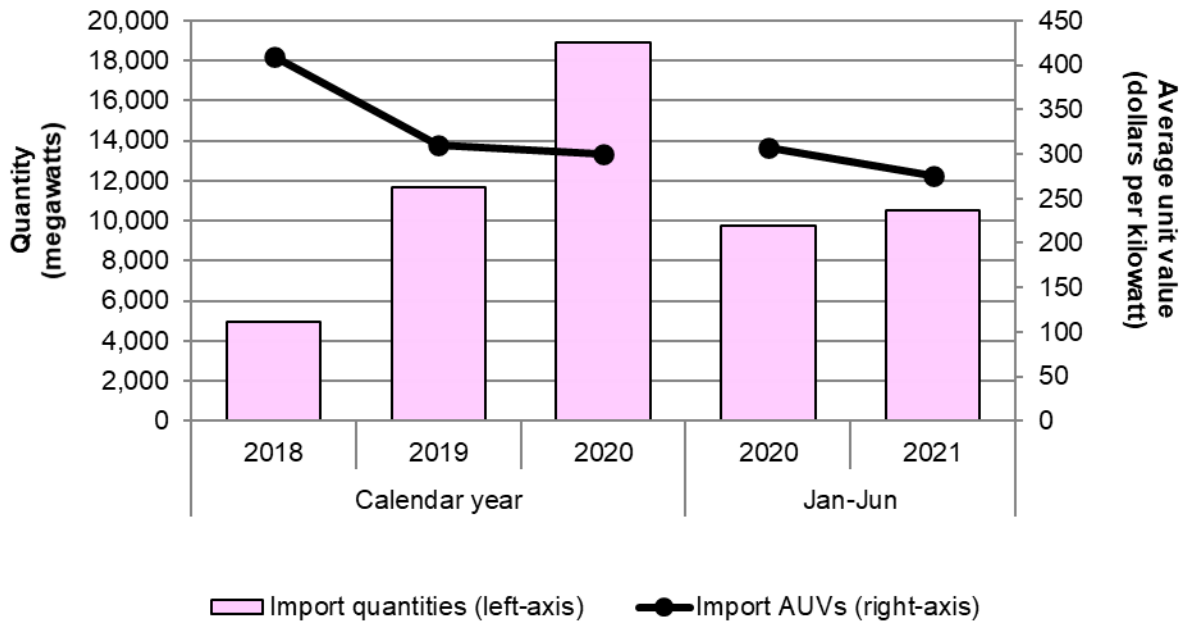
Ratios and shares in percent.

Source	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cambodia	Share of value	***	***	***	***	***
China	Share of value	***	***	***	***	***
India	Share of value	***	***	***	***	***
Indonesia	Share of value	***	***	***	***	***
Japan	Share of value	***	***	***	***	***
Korea	Share of value	***	***	***	***	***
Malaysia	Share of value	***	***	***	***	***
Philippines	Share of value	***	***	***	***	***
Singapore	Share of value	***	***	***	***	***
Taiwan	Share of value	***	***	***	***	***
Thailand	Share of value	***	***	***	***	***
Turkey	Share of value	***	***	***	***	***
Vietnam	Share of value	***	***	***	***	***
All other sources	Share of value	***	***	***	***	***
All import sources	Share of value	100.0	100.0	100.0	100.0	100.0
Cambodia	Ratio	***	***	***	***	***
China	Ratio	***	***	***	***	***
India	Ratio	***	***	***	***	***
Indonesia	Ratio	***	***	***	***	***
Japan	Ratio	***	***	***	***	***
Korea	Ratio	***	***	***	***	***
Malaysia	Ratio	***	***	***	***	***
Philippines	Ratio	***	***	***	***	***
Singapore	Ratio	***	***	***	***	***
Taiwan	Ratio	***	***	***	***	***
Thailand	Ratio	***	***	***	***	***
Turkey	Ratio	***	***	***	***	***
Vietnam	Ratio	***	***	***	***	***
All other sources	Ratio	***	***	***	***	***
All import sources	Ratio	1,047.5	563.1	851.8	838.3	940.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“. Ratio represents the ratio to U.S. module production.

Figure V-2
CSPV modules: U.S. import quantities and average unit values, by period



Source: Compiled from data submitted in response to Commission questionnaires.

Table V-6 presents data for U.S. imports of CSPV modules by type of cell (i.e., bifacial cells or all other cell types). While most imports of CSPV modules were of non-bifacial cell types before 2021, imports of modules using bifacial CSPV cells increased by 40.8 percentage points to their highest level in any period in 2020, accounting for 41.5 percent of all CSPV module imports in that year. In January-June 2021, modules using bifacial cells accounted for 67.7 percent of total imports of CSPV modules. The AUV of modules using bifacial cells started out lower than the AUV for modules using all other cell types in 2018, but by 2020 the AUV of modules using bifacial cells was slightly higher than the AUV of modules using other cell types. Overall, the AUV for each category of cell was lower in 2020 than in 2018. While the AUV of modules using bifacial cells was lower in January-June 2021 than in the same period of 2020, the AUV of modules using all other cell types was slightly higher in January-June 2021 than in the same period of 2020.

Table V-6
CSPV modules: U.S. importers' U.S imports, by type of cell and period

Quantity in kilowatts; Value in 1,000 dollars; Unit values in dollars per kilowatt; Shares in percent

Cell type	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Modules using bifacial cells	Quantity	37,389	2,264,778	7,842,735	3,238,266	7,106,993
Modules using all other cell types	Quantity	4,884,094	9,431,929	11,040,112	6,493,644	3,393,724
Modules using all cell types	Quantity	4,921,483	11,696,707	18,882,847	9,731,910	10,500,717
Modules using bifacial cells	Value	13,368	692,012	2,387,605	1,042,719	1,868,484
Modules using all other cell types	Value	2,004,765	2,941,763	3,289,161	1,947,716	1,026,033
Modules using all cell types	Value	2,018,133	3,633,775	5,676,766	2,990,435	2,894,517
Modules using bifacial cells	Unit value	358	306	304	322	263
Modules using all other cell types	Unit value	410	312	298	300	302
Modules using all cell types	Unit value	410	311	301	307	276
Modules using bifacial cells	Share of quantity	0.8	19.4	41.5	33.3	67.7
Modules using all other cell types	Share of quantity	99.2	80.6	58.5	66.7	32.3
Modules using all cell types	Share of quantity	100.0	100.0	100.0	100.0	100.0
Modules using bifacial cells	Share of value	0.7	19.0	42.1	34.9	64.6
Modules using all other cell types	Share of value	99.3	81.0	57.9	65.1	35.4
Modules using all cell types	Share of value	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

U.S. imports of CSPV modules by assembly location of module

The Commission requested that importing firms also separately report their U.S. imports of CSPV modules from Canada and Mexico using the assembly location of the modules to determine the country of origin.[7] These data are presented in table V-7. According to these data, U.S. imports of CSPV modules from Canada increased from *** ($***) in 2018 to *** ($***) in 2020. U.S. imports of CSPV modules from Canada were higher in January-June 2021 at *** ($***) compared with January-June 2020. The average unit value of U.S. imports of modules from Canada declined from $*** per kW in 2018 to $*** per kW in 2020. The average unit value of U.S. imports of modules from Canada was lower at $*** per kW in January-June 2021 compared with January-June 2020. The share of the total quantity of U.S. imports held by Canadian imports decreased from *** percent of total U.S. imports in 2018 to *** percent in 2020, and was higher at *** percent in January-June 2021 compared to January-June 2020.

U.S. imports of CSPV modules from Mexico declined from *** ($***) in 2018 to *** ($***) in 2020. U.S. imports of CSPV modules from Mexico were lower in January-June 2021 at *** ($***) compared with January-June 2020. The average unit value of U.S. imports of modules from Mexico declined irregularly from $*** per kW in 2018 to a low of $*** per kW in 2020. The share of the total quantity of U.S. imports held by imports from Mexico fell from *** percent of total U.S. imports in 2018 to *** percent in 2020. The share of the total quantity of U.S. imports held by imports from Mexico was *** percent in January-June 2021, a lower figure than in January-June 2020.

[7] Alternative U.S. import data from Canada and Mexico with country-of-origin based on the assembly location of the modules were requested in accordance with the U.S.-Mexico-Canada Agreement ("USMCA") rules of origin.

Table V-7
CSPV modules: Select U.S. imports based on the country of origin of the module assembly, by source and period

Quantity in kilowatts; Value in 1,000 dollars; Unit values in dollars per kilowatt; Shares and ratios in percent

Source	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Canada	Quantity	***	***	***	***	***
Mexico	Quantity	***	***	***	***	***
Canada	Value	***	***	***	***	***
Mexico	Value	***	***	***	***	***
Canada	Unit value	***	***	***	***	***
Mexico	Unit value	***	***	***	***	***
Canada	Share of quantity	***	***	***	***	***
Mexico	Share of quantity	***	***	***	***	***
Canada	Share of value	***	***	***	***	***
Mexico	Share of value	***	***	***	***	***
Canada	Ratio	***	***	***	***	***
Mexico	Ratio	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“. Share of quantity is the share of total U.S. imports of CSPV modules by quantity; share of value is the share of total U.S. imports of CSPV modules by value. Ratio represents the ratio to U.S. module production.

U.S. imports of CSPV products

Table V-8 and figure V-3 present data for U.S. imports of CSPV products. Total U.S. imports of all CSPV products increased by 270.9 percent from 5.7 GW in 2018 to 21.1 GW in 2020, and were 5.7 percent higher at 11.6 GW during January-June 2021 compared with 11.0 GW during January-June 2020. The average unit value of U.S. imports of CSPV products declined from a high of $396 per kW in 2018 to $292 per kW in 2020. The average unit value was $296 per kW in January-June 2020 and was at its lowest point at $267 per kW during January-June 2021. Based on the country of origin of cells, the leading suppliers of foreign CSPV products to the United States during 2020 were Malaysia and Vietnam, representing *** percent and *** percent, respectively, of all imports by quantity.

Table V-8
CSPV products: U.S. imports based on the country of origin of the cells, by source and period

Quantity in kilowatts; value in 1,000 dollars; unit values in dollars per kilowatt

Source	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cambodia	Quantity	***	***	***	***	***
China	Quantity	***	***	***	***	***
India	Quantity	***	***	***	***	***
Indonesia	Quantity	***	***	***	***	***
Japan	Quantity	***	***	***	***	***
Korea	Quantity	***	***	***	***	***
Malaysia	Quantity	***	***	***	***	***
Philippines	Quantity	***	***	***	***	***
Singapore	Quantity	***	***	***	***	***
Taiwan	Quantity	***	***	***	***	***
Thailand	Quantity	***	***	***	***	***
Turkey	Quantity	***	***	***	***	***
Vietnam	Quantity	***	***	***	***	***
All other sources	Quantity	***	***	***	***	***
All import sources	Quantity	5,676,422	13,885,944	21,055,013	11,022,234	11,646,527
Cambodia	Value	***	***	***	***	***
China	Value	***	***	***	***	***
India	Value	***	***	***	***	***
Indonesia	Value	***	***	***	***	***
Japan	Value	***	***	***	***	***
Korea	Value	***	***	***	***	***
Malaysia	Value	***	***	***	***	***
Philippines	Value	***	***	***	***	***
Singapore	Value	***	***	***	***	***
Taiwan	Value	***	***	***	***	***
Thailand	Value	***	***	***	***	***
Turkey	Value	***	***	***	***	***
Vietnam	Value	***	***	***	***	***
All other sources	Value	***	***	***	***	***
All import sources	Value	2,249,687	4,063,972	6,144,414	3,264,229	3,113,375

Table continued.

Table V-8 Continued
CSPV products: U.S. imports based on the country of origin of the cells, by source and period

Unit values in dollars per kilowatt; shares in percent.

Source	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cambodia	Unit value	***	***	***	***	***
China	Unit value	***	***	***	***	***
India	Unit value	***	***	***	***	***
Indonesia	Unit value	***	***	***	***	***
Japan	Unit value	***	***	***	***	***
Korea	Unit value	***	***	***	***	***
Malaysia	Unit value	***	***	***	***	***
Philippines	Unit value	***	***	***	***	***
Singapore	Unit value	***	***	***	***	***
Taiwan	Unit value	***	***	***	***	***
Thailand	Unit value	***	***	***	***	***
Turkey	Unit value	***	***	***	***	***
Vietnam	Unit value	***	***	***	***	***
All other sources	Unit value	***	***	***	***	***
All import sources	Unit value	396	293	292	296	267
Cambodia	Share of quantity	***	***	***	***	***
China	Share of quantity	***	***	***	***	***
India	Share of quantity	***	***	***	***	***
Indonesia	Share of quantity	***	***	***	***	***
Japan	Share of quantity	***	***	***	***	***
Korea	Share of quantity	***	***	***	***	***
Malaysia	Share of quantity	***	***	***	***	***
Philippines	Share of quantity	***	***	***	***	***
Singapore	Share of quantity	***	***	***	***	***
Taiwan	Share of quantity	***	***	***	***	***
Thailand	Share of quantity	***	***	***	***	***
Turkey	Share of quantity	***	***	***	***	***
Vietnam	Share of quantity	***	***	***	***	***
All other sources	Share of quantity	***	***	***	***	***
All import sources	Share of quantity	100.0	100.0	100.0	100.0	100.0

Table continued.

Table V-8 Continued
CSPV products: U.S. imports based on the country of origin of the cells, by source and period

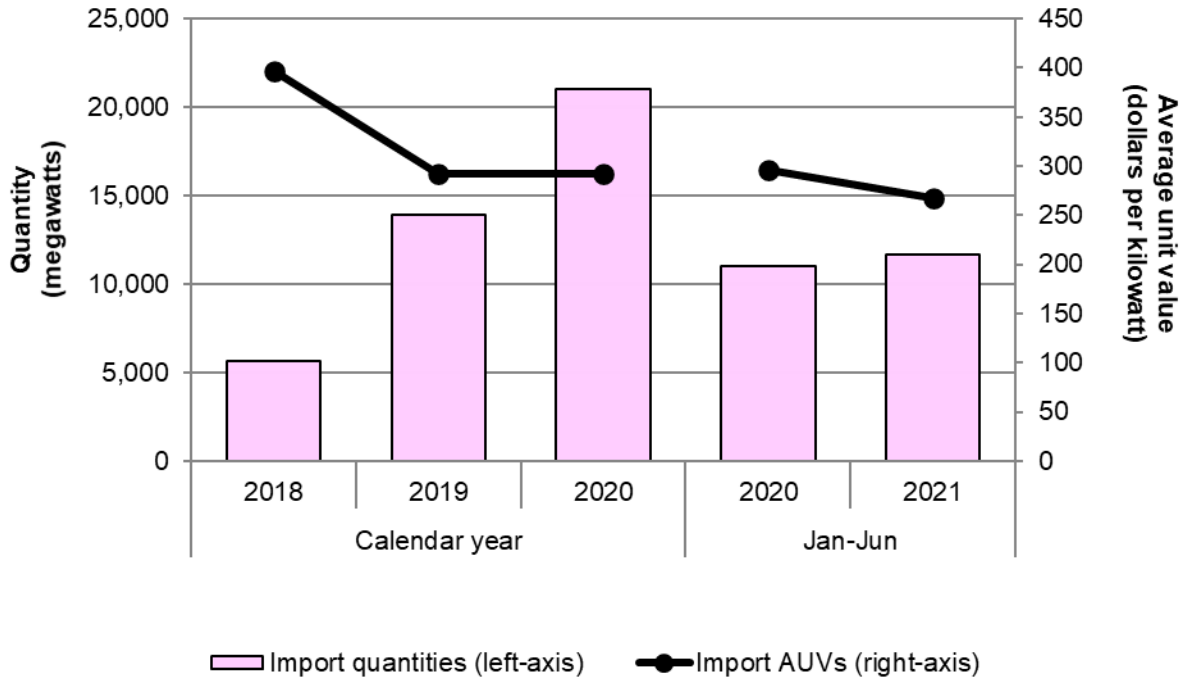
Shares in percent.

Source	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cambodia	Share of value	***	***	***	***	***
China	Share of value	***	***	***	***	***
India	Share of value	***	***	***	***	***
Indonesia	Share of value	***	***	***	***	***
Japan	Share of value	***	***	***	***	***
Korea	Share of value	***	***	***	***	***
Malaysia	Share of value	***	***	***	***	***
Philippines	Share of value	***	***	***	***	***
Singapore	Share of value	***	***	***	***	***
Taiwan	Share of value	***	***	***	***	***
Thailand	Share of value	***	***	***	***	***
Turkey	Share of value	***	***	***	***	***
Vietnam	Share of value	***	***	***	***	***
All other sources	Share of value	***	***	***	***	***
All import sources	Share of value	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---".

Figure V-3
CSPV products: U.S. import quantities and average unit values, by period



Source: Compiled from data submitted in response to Commission questionnaires.

Table V-9 presents data for U.S. imports of CSPV products by type of cell (i.e., bifacial cells or all other cell types). While most imports of CSPV products were of non-bifacial cell types before 2021, imports of bifacial CSPV cells as a share of all imports increased by *** percentage points to their highest level in any period in 2020, accounting for *** percent of all CSPV module imports in that year. In January-June 2021, modules using bifacial cells accounted for *** percent of total imports of CSPV products. The AUV of products using bifacial cells started out lower than the AUV for products using all other cell types in 2018, but by 2020 the AUV of products using bifacial cells was higher than for products using other cell types. Overall, the AUV for each category of cell was lower in 2020 than in 2018, and was lower in January-June 2021 than in the same period of 2020.

Table V-9
CSPV products: U.S. importers' U.S imports, by type of cell and period

Quantity in kilowatts; Value in 1,000 dollars; Unit values in dollars per kilowatt; Shares in percent

Cell type	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Products using bifacial cells	Quantity	***	***	***	***	***
Products using all other cell types	Quantity	***	***	***	***	***
Products using all cell types	Quantity	5,676,422	13,885,944	21,055,013	11,022,234	11,646,527
Products using bifacial cells	Value	***	***	***	***	***
Products using all other cell types	Value	***	***	***	***	***
Products using all cell types	Value	2,249,687	4,063,972	6,144,414	3,264,229	3,113,375
Products using bifacial cells	Unit value	***	***	***	***	***
Products using all other cell types	Unit value	***	***	***	***	***
Products using all cell types	Unit value	396	293	292	296	267
Products using bifacial cells	Share of quantity	***	***	***	***	***
Products using all other cell types	Share of quantity	***	***	***	***	***
Products using all cell types	Share of quantity	100.0	100.0	100.0	100.0	100.0
Products using bifacial cells	Share of value	***	***	***	***	***
Products using all other cell types	Share of value	***	***	***	***	***
Products using all cell types	Share of value	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Monthly imports

Table V-10 and figure V-4 present monthly import data for U.S. imports of CSPV modules by type of cell (i.e., bifacial cells or all other cell types).[8] The share of imports in each month attributable to bifacial cells has steadily grown from 2018 to June 2021. While initially nearly all imports were of non-bifacial cells in the first half of 2018, modules containing bifacial cells comprised at least 50 percent of the share of total imports in each monthly period from October 2020 to June 2021.

[8] Bifacial modules (i.e., "bifacial solar panels that absorb light and generate electricity on each side of the panel and that consist of only bifacial solar cells that absorb light and generate electricity on each side of the cells") were excluded from the safeguard measure from June 13, 2019 to October 24, 2020. The exclusion was revoked for articles entered for consumption, or withdrawn from a warehouse for consumption, on or after October 25, 2020. On November 16, 2021, the Court of International Trade ("CIT") issued a decision setting aside Proclamation 10101 as null and void, on the grounds that it was outside the President's delegated statutory authority. *Solar Energy Industry Associations v. United States*, Slip Op. 21-154 (Ct. Int'l Trade Nov. 16, 2021).

Table V-10
CSPV modules using bifacial cells: U.S. importers' U.S. imports, by month and cell input type

Quantity in kilowatts; Value in 1,000 dollars; Unit values in dollars per kilowatt; Shares in percent

Product type	Year	Month	Quantity	Value	Unit value	Share
Modules using bifacial cells	2018	January	***	***	***	0.0
Modules using bifacial cells	2018	February	***	***	***	---
Modules using bifacial cells	2018	March	***	***	***	---
Modules using bifacial cells	2018	April	***	***	***	0.7
Modules using bifacial cells	2018	May	***	***	***	0.1
Modules using bifacial cells	2018	June	***	***	***	0.3
Modules using bifacial cells	2018	July	***	***	***	---
Modules using bifacial cells	2018	August	***	***	***	1.0
Modules using bifacial cells	2018	September	***	***	***	2.2
Modules using bifacial cells	2018	October	***	***	***	1.4
Modules using bifacial cells	2018	November	***	***	***	2.6
Modules using bifacial cells	2018	December	***	***	***	0.5
Modules using bifacial cells	2019	January	***	***	***	7.1
Modules using bifacial cells	2019	February	***	***	***	12.7
Modules using bifacial cells	2019	March	***	***	***	16.9
Modules using bifacial cells	2019	April	***	***	***	17.9
Modules using bifacial cells	2019	May	***	***	***	19.0
Modules using bifacial cells	2019	June	***	***	***	13.7
Modules using bifacial cells	2019	July	***	***	***	14.8
Modules using bifacial cells	2019	August	***	***	***	16.8
Modules using bifacial cells	2019	September	***	***	***	22.1
Modules using bifacial cells	2019	October	***	***	***	18.5
Modules using bifacial cells	2019	November	***	***	***	28.9
Modules using bifacial cells	2019	December	***	***	***	21.6

Table continued.

Table V-10 Continued
CSPV modules using bifacial cells: U.S. importers' U.S. imports, by month and cell input type

Quantity in kilowatts; value in 1,000 dollars; unit values in dollars per kilowatt; shares in percent

Product type	Year	Month	Quantity	Value	Unit value	Share
Modules using bifacial cells	2020	January	***	***	***	29.1
Modules using bifacial cells	2020	February	***	***	***	23.8
Modules using bifacial cells	2020	March	***	***	***	25.0
Modules using bifacial cells	2020	April	***	***	***	43.2
Modules using bifacial cells	2020	May	***	***	***	41.4
Modules using bifacial cells	2020	June	***	***	***	34.7
Modules using bifacial cells	2020	July	***	***	***	46.2
Modules using bifacial cells	2020	August	***	***	***	47.3
Modules using bifacial cells	2020	September	***	***	***	44.5
Modules using bifacial cells	2020	October	***	***	***	51.9
Modules using bifacial cells	2020	November	***	***	***	54.6
Modules using bifacial cells	2020	December	***	***	***	56.4
Modules using bifacial cells	2021	January	***	***	***	59.7
Modules using bifacial cells	2021	February	***	***	***	62.7
Modules using bifacial cells	2021	March	***	***	***	69.3
Modules using bifacial cells	2021	April	***	***	***	72.3
Modules using bifacial cells	2021	May	***	***	***	68.5
Modules using bifacial cells	2021	June	***	***	***	70.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“. Shares represent the share of modules using bifacial cells out of modules using all cell types within the specified month.

Table V-11
CSPV modules using all other cells: U.S. importers' U.S. imports, by month and cell input type

Quantity in kilowatts; value in 1,000 dollars; unit values in dollars per kilowatt; shares in percent

Product type	Year	Month	Quantity	Value	Unit value	Share
Modules using all other cells	2018	January	***	***	***	100.0
Modules using all other cells	2018	February	***	***	***	100.0
Modules using all other cells	2018	March	***	***	***	100.0
Modules using all other cells	2018	April	***	***	***	99.3
Modules using all other cells	2018	May	***	***	***	99.9
Modules using all other cells	2018	June	***	***	***	99.7
Modules using all other cells	2018	July	***	***	***	100.0
Modules using all other cells	2018	August	***	***	***	99.0
Modules using all other cells	2018	September	***	***	***	97.8
Modules using all other cells	2018	October	***	***	***	98.6
Modules using all other cells	2018	November	***	***	***	97.4
Modules using all other cells	2018	December	***	***	***	99.5
Modules using all other cells	2019	January	***	***	***	92.9
Modules using all other cells	2019	February	***	***	***	87.3
Modules using all other cells	2019	March	***	***	***	83.1
Modules using all other cells	2019	April	***	***	***	82.1
Modules using all other cells	2019	May	***	***	***	81.0
Modules using all other cells	2019	June	***	***	***	86.3
Modules using all other cells	2019	July	***	***	***	85.2
Modules using all other cells	2019	August	***	***	***	83.2
Modules using all other cells	2019	September	***	***	***	77.9
Modules using all other cells	2019	October	***	***	***	81.5
Modules using all other cells	2019	November	***	***	***	71.1
Modules using all other cells	2019	December	***	***	***	78.4

Table continued.

Table V-11 Continued
CSPV modules using all other cells: U.S. importers' U.S. imports, by month and cell input type

Quantity in kilowatts; Value in 1,000 dollars; Unit values in dollars per kilowatt; Shares in percent

Product type	Year	Month	Quantity	Value	Unit value	Share
Modules using all other cells	2020	January	***	***	***	70.9
Modules using all other cells	2020	February	***	***	***	76.2
Modules using all other cells	2020	March	***	***	***	75.0
Modules using all other cells	2020	April	***	***	***	56.8
Modules using all other cells	2020	May	***	***	***	58.6
Modules using all other cells	2020	June	***	***	***	65.3
Modules using all other cells	2020	July	***	***	***	53.8
Modules using all other cells	2020	August	***	***	***	52.7
Modules using all other cells	2020	September	***	***	***	55.5
Modules using all other cells	2020	October	***	***	***	48.1
Modules using all other cells	2020	November	***	***	***	45.4
Modules using all other cells	2020	December	***	***	***	43.6
Modules using all other cells	2021	January	***	***	***	40.3
Modules using all other cells	2021	February	***	***	***	37.3
Modules using all other cells	2021	March	***	***	***	30.7
Modules using all other cells	2021	April	***	***	***	27.7
Modules using all other cells	2021	May	***	***	***	31.5
Modules using all other cells	2021	June	***	***	***	30.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“. Shares represent the share of modules using all other cells (i.e., other than bifacial) out of modules using all cell types within the specified month.

Figure V-4
CSPV modules: U.S. importers' U.S. imports, by month and cell input type

* * * * * * *

Source: Compiled from data submitted in response to Commission questionnaires.

U.S. importers' inventories

Tables V-12 through V-14 present data for inventories of U.S. imports of CSPV products held in the United States.[9]

*** of 50 responding importers indicated in their questionnaire responses that they maintained CSPV cell inventories during at least part of the full-year periods from 2018 to 2020. U.S. importers' end-of-period inventories decreased from *** MW in 2018 to 136 MW in 2020, and were lower at 117 MW during January-June 2021 than reported in the comparable period in 2020 (table V-12). The ratios of inventories to imports and shipments steadily declined from 2018 to 2020, and were lower at 5.1-5.5 percent each during January-June 2021 compared with 12.8-16.2 percent during January-June 2020.

Table V-12
CSPV cells: U.S. importers' end-of-period inventories of imports, by source and period

Quantity in kilowatts; Ratios in percent

Measure	Source	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Inventories quantity	All sources	***	227,175	135,681	330,766	116,684
Ratio to imports	All sources	***	10.4	6.2	12.8	5.1
Ratio to U.S. shipments of imports	All sources	***	11.0	6.8	16.2	5.5
Ratio to total shipments of imports	All sources	***	11.0	6.8	16.2	5.5

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---".

Twenty-five of 50 responding importers indicated in their questionnaire responses that they maintained CSPV module inventories during at least part of the full-year periods from 2018 to 2020. U.S. importers' end-of-period inventories increased from 705 MW in 2018 to 2,982 MW in 2020, and were higher at 4,018 MW during January-June 2021 than reported in the comparable period in 2020 (table V-13). The ratios of inventories to imports and shipments

[9] ***.

increased irregularly from 2018 to 2020, and were higher at 19.1-20.8 percent during January-June 2021 compared with 13.6-15.6 percent during January-June 2020.

Table V-13
CSPV modules: U.S. importers' end-of-period inventories of imports, by source and period

Quantity in kilowatts; Ratios in percent

Measure	Source	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Inventories quantity	All sources	705,383	1,484,393	2,981,932	2,637,410	4,018,433
Ratio to imports	All sources	14.3	12.7	15.8	13.6	19.1
Ratio to U.S. shipments of imports	All sources	14.5	12.5	17.0	15.6	20.8
Ratio to total shipments of imports	All sources	14.5	12.5	17.0	15.6	20.8

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Zeroes, null values, and undefined calculations are suppressed and shown as "---".

*** of 50 responding importers indicated in their questionnaire responses that they maintained CSPV product inventories during at least part of the full-year periods from 2018 to 2020. Due to increases in module inventories, U.S. importers' end-of-period inventories increased from *** MW in 2018 to 3,118 MW in 2020, and were higher at 4,135 MW during January-June 2021 than reported in the comparable period in 2020 (table V-14). The ratios of inventories to imports and shipments decreased irregularly from 2018 to 2020, and were higher at 17.8-19.2 percent during January-June 2021 compared with 13.5-15.7 percent during January-June 2020.

Table V-14
CSPV products: U.S. importers' end-of-period inventories of imports, by source and period

Quantity in kilowatts; Ratios in percent

Measure	Source	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Inventories quantity	All sources	***	1,711,568	3,117,613	2,968,176	4,135,117
Ratio to imports	All sources	***	12.3	14.8	13.5	17.8
Ratio to U.S. shipments of imports	All sources	***	12.3	15.9	15.7	19.2
Ratio to total shipments of imports	All sources	***	12.3	15.9	15.7	19.2

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Zeroes, null values, and undefined calculations are suppressed and shown as "---".

U.S. importers' imports subsequent to June 30, 2021

Tables V-15 through V-17 contain data for importers' arranged imports after June 30, 2021. *** firms reported arranged imports of CSPV cells after June 30, 2021. The leading sources of arranged imports of foreign CSPV cells to the United States during July 2021-June 2022 are Malaysia, Korea, and Vietnam, representing *** percent, *** percent, and *** percent of all arranged imports of cells by quantity, respectively (table V-15). The total quantity of arranged U.S. imports of CSPV cells for the first half of 2022 (890 MW) is 22.9 percent lower than the arranged U.S. import level reported for the second half of 2021 (1,154 MW).

Table V-15
CSPV cells: Arranged imports, by source and period

Quantity in kilowatts

Source	Jul-Sep 2021	Oct-Dec 2021	Jan-Mar 2022	Apr-Jun 2022	Total
China	***	***	***	***	***
Korea	***	***	***	***	***
Malaysia	***	***	***	***	***
Philippines	***	***	***	***	***
Taiwan	***	***	***	***	***
Thailand	***	***	***	***	***
Vietnam	***	***	***	***	***
All sources	599,926	554,458	414,000	476,000	2,044,384

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Zeroes, null values, and undefined calculations are suppressed and shown as "---".

*** firms reported arranged imports of CSPV modules after June 30, 2021. The leading sources of arranged foreign CSPV modules to the United States during July 2021-June 2022 are Vietnam, Thailand, and Malaysia, representing *** percent, *** percent, and *** percent of all arranged imports of modules by quantity, respectively (table V-16). The total quantity of arranged U.S. imports of modules for the first half of 2022 (9,417 MW) is 12.6 percent higher than the arranged U.S. import level reported for the second half of 2021 (8,362 MW).

Table V-16
CSPV modules: Arranged imports, by source and period

Quantity in kilowatts

Source	Jul-Sep 2021	Oct-Dec 2021	Jan-Mar 2022	Apr-Jun 2022	Total
Cambodia	***	***	***	***	***
Canada	***	***	***	***	***
China	***	***	***	***	***
India	***	***	***	***	***
Korea	***	***	***	***	***
Malaysia	***	***	***	***	***
Philippines	***	***	***	***	***
Singapore	***	***	***	***	***
Taiwan	***	***	***	***	***
Thailand	***	***	***	***	***
Vietnam	***	***	***	***	***
All other sources	***	***	***	***	***
All sources	4,331,725	4,030,698	4,149,184	5,267,418	17,779,025

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

*** firms in total reported arranged imports of CSPV products after June 30, 2021. The leading sources of arranged foreign CSPV products to the United States during July 2021-June 2022 are Vietnam, Thailand, and Malaysia, representing *** percent, *** percent, and *** percent of all arranged imports of modules by quantity, respectively (table V-17). The total quantity of arranged U.S. imports for the first half of 2022 (10,307 MW) is 8.3 percent higher than the arranged U.S. import level reported for the second half of 2021 (9,517 MW).

Table V-17
CSPV products: Arranged imports, by source and period

Quantity in kilowatts

Source	Jul-Sep 2021	Oct-Dec 2021	Jan-Mar 2022	Apr-Jun 2022	Total
Cambodia	***	***	***	***	***
Canada	***	***	***	***	***
China	***	***	***	***	***
India	***	***	***	***	***
Korea	***	***	***	***	***
Malaysia	***	***	***	***	***
Philippines	***	***	***	***	***
Singapore	***	***	***	***	***
Taiwan	***	***	***	***	***
Thailand	***	***	***	***	***
Vietnam	***	***	***	***	***
All other sources	***	***	***	***	***
All sources	4,931,651	4,585,156	4,563,184	5,743,418	19,823,409

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Zeroes, null values, and undefined calculations are suppressed and shown as “---“..

Apparent U.S. consumption and market shares

Tables V-18 through V-21, and figures V-5 and V-6, present data on apparent U.S. consumption and U.S. market shares for CSPV cells and CSPV modules.

Apparent U.S. consumption of CSPV cells, by quantity, increased by *** percent from 2018 to 2020, but was *** percent lower in January-June 2021 compared with January-June 2020. By value, apparent U.S. consumption of CSPV cells increased by *** percent from $*** in 2018 to $*** in 2020, but was *** percent lower during January-June 2021 compared with January-June 2020. U.S. producers' share of apparent U.S. consumption of CSPV cells declined overall by *** percentage points from 2018 to 2020 as cell production ceased in the U.S. Accordingly, the share of apparent U.S. consumption held by imports increased by *** percentage points from *** percent to a total share of the market for CSPV cells from 2019 onward.

Apparent U.S. consumption of CSPV modules, by quantity, increased by 290.9 percent from 2018 to 2020, and was 7.1 percent higher in January-June 2021 compared with January-June 2020. By value, apparent U.S. consumption of CSPV modules increased by 189.7 percent from $2.3 billion in 2018 to $6.6 billion in 2020, but was 3.4 percent lower during January-June 2021 compared with January-June 2020.

U.S. producers' share of apparent U.S. consumption of CSPV modules increased overall by 1.7 percentage points from 2018 to 2020, and was 0.7 percentage points lower in January-June 2021 compared with the same period in 2020.

Table V-18
CSPV cells: Apparent U.S. consumption, by source and period

Quantity in kilowatts; Value in 1,000 dollars; Unit values in dollars per kilowatt

Source	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
U.S. producers	Quantity	***	***	***	***	***
China	Quantity	***	***	***	***	***
Japan	Quantity	***	***	***	***	***
Korea	Quantity	***	***	***	***	***
Malaysia	Quantity	***	***	***	***	***
Philippines	Quantity	***	***	***	***	***
Taiwan	Quantity	***	***	***	***	***
Vietnam	Quantity	***	***	***	***	***
Thailand	Quantity	***	***	***	***	***
All other sources	Quantity	***	***	***	***	***
All import sources	Quantity	754,939	2,189,237	2,172,166	1,290,324	1,145,810
All sources	Quantity	***	***	***	***	***
U.S. producers	Value	***	***	***	***	***
China	Value	***	***	***	***	***
Japan	Value	***	***	***	***	***
Korea	Value	***	***	***	***	***
Malaysia	Value	***	***	***	***	***
Philippines	Value	***	***	***	***	***
Taiwan	Value	***	***	***	***	***
Thailand	Value	***	***	***	***	***
Vietnam	Value	***	***	***	***	***
All other sources	Value	***	***	***	***	***
All import sources	Value	231,554	430,197	467,648	273,794	218,858
All sources	Value	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Figure IV-5
CSPV cells: Apparent U.S. consumption, by source and period

* * * * * * *

Source: Compiled from data submitted in response to Commission questionnaires.

Table V-19
CSPV cells: Market shares, by source and period

Shares in percent

Source	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
U.S. producers	Share of quantity	***	***	***	***	***
China	Share of quantity	***	***	***	***	***
Japan	Share of quantity	***	***	***	***	***
Korea	Share of quantity	***	***	***	***	***
Malaysia	Share of quantity	***	***	***	***	***
Philippines	Share of quantity	***	***	***	***	***
Taiwan	Share of quantity	***	***	***	***	***
Thailand	Share of quantity	***	***	***	***	***
Vietnam	Share of quantity	***	***	***	***	***
All other sources	Share of quantity	***	***	***	***	***
All import sources	Share of quantity	***	***	***	***	***
All sources	Share of quantity	***	***	***	***	***
U.S. producers	Share of value	***	***	***	***	***
China	Share of value	***	***	***	***	***
Japan	Share of value	***	***	***	***	***
Korea	Share of value	***	***	***	***	***
Malaysia	Share of value	***	***	***	***	***
Philippines	Share of value	***	***	***	***	***
Taiwan	Share of value	***	***	***	***	***
Thailand	Share of value	***	***	***	***	***
Vietnam	Share of value	***	***	***	***	***
All other sources	Share of value	***	***	***	***	***
All import sources	Share of value	***	***	***	***	***
All sources	Share of value	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Table V-20
CSPV modules: Apparent U.S. consumption, by source and period

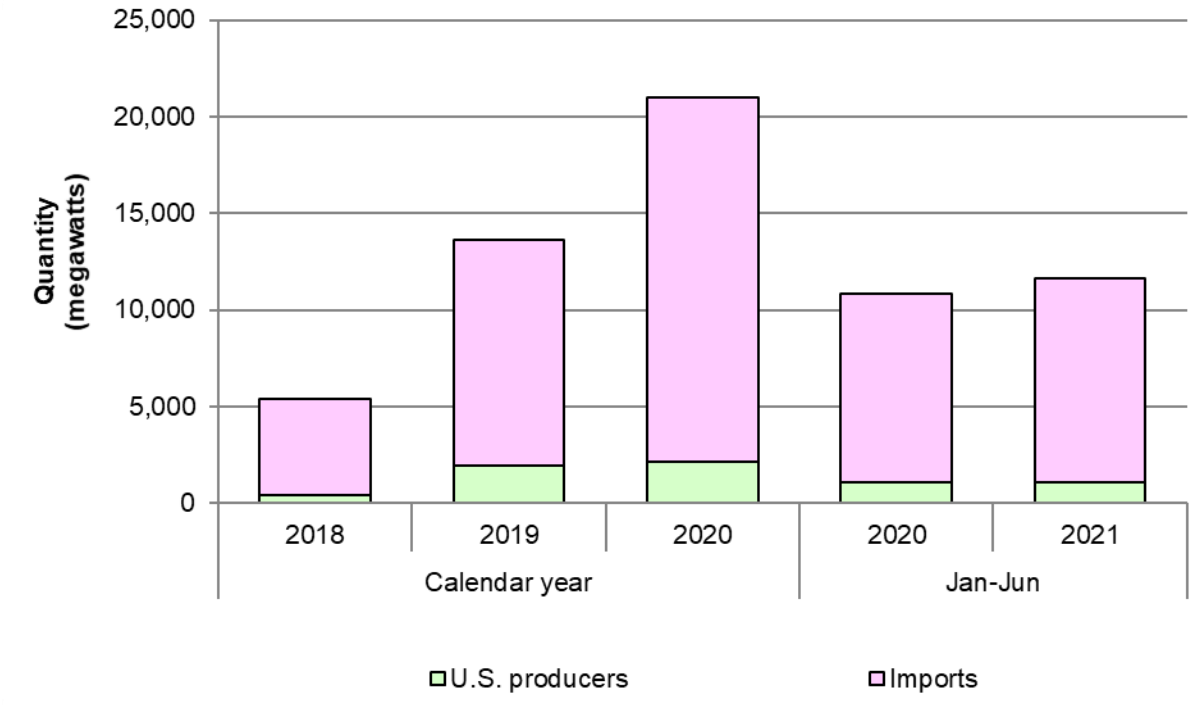
Quantity in kilowatts; Value in 1,000 dollars; Unit values in dollars per kilowatt

Source	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
U.S. producers	Quantity	456,839	1,930,230	2,143,308	1,116,366	1,116,751
Cambodia	Quantity	***	***	***	***	***
China	Quantity	***	***	***	***	***
India	Quantity	***	***	***	***	***
Indonesia	Quantity	***	***	***	***	***
Japan	Quantity	***	***	***	***	***
Korea	Quantity	***	***	***	***	***
Malaysia	Quantity	***	***	***	***	***
Philippines	Quantity	***	***	***	***	***
Singapore	Quantity	***	***	***	***	***
Taiwan	Quantity	***	***	***	***	***
Thailand	Quantity	***	***	***	***	***
Turkey	Quantity	***	***	***	***	***
Vietnam	Quantity	***	***	***	***	***
All other sources	Quantity	***	***	***	***	***
All import sources	Quantity	4,921,483	11,696,707	18,882,847	9,731,910	10,500,717
All sources	Quantity	5,378,322	13,626,937	21,026,155	10,848,276	11,617,468
U.S. producers	Value	251,392	870,390	897,107	476,851	454,524
Cambodia	Value	***	***	***	***	***
China	Value	***	***	***	***	***
India	Value	***	***	***	***	***
Indonesia	Value	***	***	***	***	***
Japan	Value	***	***	***	***	***
Korea	Value	***	***	***	***	***
Malaysia	Value	***	***	***	***	***
Philippines	Value	***	***	***	***	***
Singapore	Value	***	***	***	***	***
Taiwan	Value	***	***	***	***	***
Thailand	Value	***	***	***	***	***
Turkey	Value	***	***	***	***	***
Vietnam	Value	***	***	***	***	***
All other sources	Value	***	***	***	***	***
All import sources	Value	2,018,133	3,633,775	5,676,766	2,990,435	2,894,517
All sources	Value	2,269,525	4,504,165	6,573,873	3,467,286	3,349,041

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Figure V-6
CSPV modules: Apparent U.S. consumption, by source and period



Source: Compiled from data submitted in response to Commission questionnaires.

Table V-21
CSPV modules: Market shares, by source and period

Shares in percent

Source	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
U.S. producers	Share of quantity	8.5	14.2	10.2	10.3	9.6
Cambodia	Share of quantity	***	***	***	***	***
China	Share of quantity	***	***	***	***	***
India	Share of quantity	***	***	***	***	***
Indonesia	Share of quantity	***	***	***	***	***
Japan	Share of quantity	***	***	***	***	***
Korea	Share of quantity	***	***	***	***	***
Malaysia	Share of quantity	***	***	***	***	***
Philippines	Share of quantity	***	***	***	***	***
Singapore	Share of quantity	***	***	***	***	***
Taiwan	Share of quantity	***	***	***	***	***
Thailand	Share of quantity	***	***	***	***	***
Turkey	Share of quantity	***	***	***	***	***
Vietnam	Share of quantity	***	***	***	***	***
All other sources	Share of quantity	***	***	***	***	***
All import sources	Share of quantity	91.5	85.8	89.8	89.7	90.4
All sources	Share of quantity	100.0	100.0	100.0	100.0	100.0
U.S. producers	Share of value	11.1	19.3	13.6	13.8	13.6
Cambodia	Share of value	***	***	***	***	***
China	Share of value	***	***	***	***	***
India	Share of value	***	***	***	***	***
Indonesia	Share of value	***	***	***	***	***
Japan	Share of value	***	***	***	***	***
Korea	Share of value	***	***	***	***	***
Malaysia	Share of value	***	***	***	***	***
Philippines	Share of value	***	***	***	***	***
Singapore	Share of value	***	***	***	***	***
Taiwan	Share of value	***	***	***	***	***
Thailand	Share of value	***	***	***	***	***
Turkey	Share of value	***	***	***	***	***
Vietnam	Share of value	***	***	***	***	***
All other sources	Share of value	***	***	***	***	***
All import sources	Share of value	88.9	80.7	86.4	86.2	86.4
All sources	Share of value	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Table V-22 presents data on apparent U.S. consumption and U.S. market shares for Canada and Mexico under the USMCA rules of origin for CSPV modules (i.e., origin is determined by the location of the assembly of the module). Market shares for Canada and Mexico respectively were at their highest in 2018 before declining to full-year period lows in 2020. Market share held by imports of CSPV modules from Canada under USMCA rules of origin never exceeded *** percent in any period, while market share held by imports of CSPV modules from Mexico under USMCA rules of origin never exceeded *** percent in any period.[10]

Table V-22
CSPV modules: Apparent U.S. consumption and market shares for Canada and Mexico under the USMCA rules of origin, by source and period

Quantity in kilowatts; Shares in percent.

Source	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Canada	Quantity	***	***	***	***	***
Mexico	Quantity	***	***	***	***	***
Canada	Share of quantity	***	***	***	***	***
Mexico	Share of quantity	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---". Share of quantity is the share of total apparent U.S. consumption of CSPV modules by quantity; share of value is the share of total apparent U.S. consumption of CSPV modules by value.

[10] The vast majority of imports from Canada were reported by ***. The imports from Mexico were reported by ***.

Part VI: The foreign industry

Overview

Table VI-1 presents information on overall CSPV cells and CSPV modules production by country.

Table VI-1
CSPV products: Overview of production and share of production in 2020, by country and product type

Country	Cell production (kilowatts)	Share of reported cell production (percent)	Module production (kilowatts)	Share of reported module production (percent)
Canada	***	***	***	***
China	***	***	***	***
Korea	***	***	***	***
Malaysia	***	***	***	***
Mexico	***	***	***	***
Singapore	***	***	***	***
Thailand	***	***	***	***
Vietnam	***	***	***	***
All other countries	***	***	***	***
All countries	69,901,473	100.0	83,635,793	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

The industry in North America

The industry in Canada

The Commission issued foreign producers' or exporters' questionnaires to twelve firms believed to produce and/or export CSPV products from Canada.[1] Usable responses to the Commission's questionnaire were received from four firms: Canadian Solar Solutions Inc. ("Canadian Solar Canada"), Hanwha Q Cells Canada Corp ("Hanwha Canada"), Heliene Inc. ("Heliene"), and Silfab Solar Inc. ("Silfab"). These firms *** report the production or exportation of CSPV cells. These firms accounted for approximately *** percent of CSPV module capacity in Canada in 2020.[2] Table VI-2 presents information on the CSPV modules operations of the responding producers and exporters in Canada.

Table VI-2
CSPV modules: Summary data for producers in Canada, 2020

Firm	Production (kilowatts)	Share of reported production (percent)	Exports to the United States (kilowatts)	Share of reported exports to the United States (percent)	Total shipments (kilowatts)	Share of firm's total shipments exported to the United States (percent)
Canadian Solar	***	***	***	***	***	***
Hanwha Canada	***	***	***	***	***	***
Heliene	***	***	***	***	***	***
Silfab Solar	***	***	***	***	***	***
All firms	***	100.0	***	100.0	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: ***. Email from ***, September 27, 2021.

[1] These firms were identified through a review of information submitted in the petitions and presented in third-party sources.

[2] Stace, "Solutions Solaires," February 6, 2020, p. 3, https://aqper.com/images/AQPER/Colloque2020/7_SebastienArcand.pdf, retrieved October 2, 2021.

Changes in operations

As presented in table VI-3, producers in Canada reported several operational and organizational changes since January 1, 2018.

Table VI-3
CSPV products: Reported changes in operations by producers in Canada, since January 1, 2018

Item	Firm name and accompanying narrative response
Expansions	***
Prolonged shutdowns or curtailments	***
Technology	***

Source: Compiled from data submitted in response to Commission questionnaires.

Operations on CSPV cells

There is no known CSPV cell production in Canada.[3]

Operations on CSPV modules

Table VI-4 presents information on the CSPV module operations of the responding producers in Canada. During 2018-19, responding Canadian producers' production capacity decreased by *** percent, then increased by *** percent from 2019 to 2020. Overall, during 2018-20, Canadian producers' production capacity decreased by *** percent. In November 2018 until July 2019, *** temporarily shut down production.[4] *** capacity remained the same during 2018-20. Canadian producers' reported capacity was the same in interim 2021 interim compared to interim 2020.

During 2018-20, Canadian producers' production increased by *** percent and production was *** percent higher in interim 2021 compared to interim 2020. During 2018-20, interim 2020, and interim 2021, over *** percent of shipments were exports to the United states.

[3] IEA PVPS, *National Survey Report of PV Power Applications in Canada 2019*, n.d., p. 28, https://iea-pvps.org/wp-content/uploads/2021/03/NSR_Canada_2019.pdf, retrieved September 2021.

[4] *** foreign producer questionnaire response, section II-2a.

Table VI-4
CSPV modules: Data on industry in Canada, by period

Quantity in kilowatts

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity	***	***	***	***	***
Production	***	***	***	***	***
End-of-period inventories	***	***	***	***	***
Internal consumption	***	***	***	***	***
Commercial home market shipments	***	***	***	***	***
Home market shipments	***	***	***	***	***
Exports to the United States	***	***	***	***	***
Exports to Mexico	***	***	***	***	***
Exports to the European Union	***	***	***	***	***
Exports to all other markets	***	***	***	***	***
Export shipments	***	***	***	***	***
Total shipments	***	***	***	***	***

Table continued.

Table VI-4 Continued
CSPV modules: Data on industry in Canada, by period

Shares and ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity utilization ratio	***	***	***	***	***
Inventory ratio to production	***	***	***	***	***
Inventory ratio to total shipments	***	***	***	***	***
Internal consumption share	***	***	***	***	***
Commercial home market shipments share	***	***	***	***	***
Home market shipments share	***	***	***	***	***
Exports to the United States share	***	***	***	***	***
Exports to Mexico share	***	***	***	***	***
Exports to the European Union share	***	***	***	***	***
Exports to all other markets share	***	***	***	***	***
Export shipments share	***	***	***	***	***
Total shipments share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-5 presents Canadian producers' reported production of CSPV modules using bifacial cells and all other cells. During 2018-20, interim 2020, and interim 2021, over *** percent of Canadian CSPV modules were produced using other cells.

Table VI-5
CSPV modules: Production in Canada, by product type and period

Quantity in kilowatts; shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Modules using bifacial cells	Quantity	***	***	***	***	***
Modules using all other cells	Quantity	***	***	***	***	***
Modules using all cells	Quantity	***	***	***	***	***
Modules using bifacial cells	Share	***	***	***	***	***
Modules using all other cells	Share	***	***	***	***	***
Modules using all cells	Share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-6 presents Canadian producers' reported projections for CSPV module operations during 2021-23. During 2020-23, Canadian producers' capacity and production of CSPV modules are projected to increase by *** percent and by *** percent, respectively.[5]

Table VI-6
CSPV modules: Projected experience of industry in Canada, by period

Quantity in kilowatts

Item	Projection 2021	Projection 2022	Projection 2023
Capacity	***	***	***
Production	***	***	***
End-of-period inventories	***	***	***
Internal consumption	***	***	***
Commercial home market shipments	***	***	***
Home market shipments	***	***	***
Exports to the United States	***	***	***
Exports to Canada	***	***	***
Exports to Mexico	***	***	***
Exports to the European Union	***	***	***
Exports to all other markets	***	***	***
Export shipments	***	***	***
Total shipments	***	***	***

Table continued.

[5] The projected increases in Canadian CSPV modules capacity and production are driven by ***. ***. *** foreign producer questionnaire response, section II-15.

Table VI-6 Continued
CSPV modules: Projected experience of industry in Canada, by period

Shares and ratios in percent

Item	Projection 2021	Projection 2022	Projection 2023
Capacity utilization ratio	***	***	***
Inventory ratio to production	***	***	***
Inventory ratio to total shipments	***	***	***
Internal consumption share	***	***	***
Commercial home market shipments share	***	***	***
Home market shipments share	***	***	***
Exports to the United States share	***	***	***
Exports to Canada share	***	***	***
Exports to Mexico share	***	***	***
Exports to the European Union share	***	***	***
Exports to all other markets share	***	***	***
Export shipments share	***	***	***
Total shipments share	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Alternative products

Canadian producers *** report the production of other products on the same machinery used to produce CSPV products.

Exports

According to GTA, the leading export markets for CSPV products from Canada are the United States, Hong Kong, and Germany (table VI-7). During 2020, the United States was the top export market for CSPV products from Canada, accounting for 77.5 percent, followed by Hong Kong, accounting for 3.5 percent.

Table VI-7
CSPV products: Exports from Canada, by period

Value in 1,000 dollars; shares in percent

Destination market	Measure	2018	2019	2020
United States	Value	129,521	105,416	177,091
Hong Kong	Value	4,371	8,812	7,948
Germany	Value	10,171	12,042	7,202
Israel	Value	5,029	3,241	4,898
Korea	Value	2,756	6,705	4,390
United Kingdom	Value	4,921	5,222	3,761
China	Value	2,411	2,338	2,196
Singapore	Value	1,348	2,063	1,951
Malaysia	Value	1,489	1,693	1,936
All other destination markets	Value	25,062	22,035	17,115
All destination markets	Value	187,079	169,567	228,487
United States	Share of value	69.2	62.2	77.5
Hong Kong	Share of value	2.3	5.2	3.5
Germany	Share of value	5.4	7.1	3.2
Israel	Share of value	2.7	1.9	2.1
Korea	Share of value	1.5	4.0	1.9
United Kingdom	Share of value	2.6	3.1	1.6
China	Share of value	1.3	1.4	1.0
Singapore	Share of value	0.7	1.2	0.9
Malaysia	Share of value	0.8	1.0	0.8
All other destination markets	Share of value	13.4	13.0	7.5
All destination markets	Share of value	100.0	100.0	100.0

Source: Official exports statistics under HS subheading 8541.40 as reported by Canada Statistics in the Global Trade Atlas database, accessed October 1, 2021.

Note: Share of value is the share of total exports by value. United States is shown at the top. All remaining top export destinations are shown in descending order of 2020 data. These data may be overstated as HS subheading 8541.40 may contain products outside the scope of this investigation including photosensitive semiconductor devices and light-emitting diodes.

The industry in Mexico

The Commission issued foreign producers' or exporters' questionnaires to 14 firms believed to produce and/or export CSPV products from Mexico.[6] Usable responses to the Commission's questionnaire were received from one firm: Sun Power Corporation Mexico S. de R.L. de C.V. ("Sun Power Mexico"). Sun Power Mexico *** report the production or exportation of CSPV cells. Sun Power Mexico accounts for approximately *** percent of CSPV module capacity in Mexico in 2020.[7] Table VI-8 presents information on the CSPV modules operations of the responding producer and exporter in Mexico.

Table VI-8
CSPV modules: Summary data for producers in Mexico, 2020

Firm	Production (kilowatts)	Share of reported production (percent)	Exports to the United States (kilowatts)	Share of reported exports to the United States (percent)	Total shipments (kilowatts)	Share of firm's total shipments exported to the United States (percent)
Sun Power Mexico	***	100.0	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

[6] These firms were identified through a review of information submitted in the petitions and presented in third-party sources.

[7] IEA, PVPS, Annual Report 2017, 2018, p. 91, https://iea-pvps.org/wp-content/uploads/2020/01/IEA-PVPS_Annual_Report_2017.pdf, accessed September 1, 2020; IEA, PVPS, National Survey Report of PV Power Applications in France 2019, 2020, p. 31, https://iea-pvps.org/wp-content/uploads/2020/09/NSR_France_2019.pdf, accessed September 1, 2021; Solarsol Website, https://www.solarsol.mx/nosotros (accessed September 1, 2021); SunPower, Form 10-K, Annual filing to the Securities and Exchange Commission For the fiscal year ended December 29, 2019, 2020, pp. 13-14, 55, https://investors.sunpower.com/static-files/de58c644-290f-4f2e-861c-e6d841a12880; Castro, Diana, "Solarever Inaugurates the Largest Solar Panel Plant in the Country; Had an Investment of 20 Million Dollars," InvestInMX, n.d., https://investinmx.com/en/article/solarever-inaugurates-the-largest-solar-panel-plant-in-the-country-had-an-investment-of-20-million-dollars (accessed September 1, 2021); Gante, Diana, "Crece La Industria de Paneles Solares," Reforma, April 21, 2019, https://busquedas.gruporeforma.com/buscador/reforma/documentos/VisorArticulos.aspx?sIdIdentificadorParm=3614408|3|11|2|ArticulosCMS&idproducto=3&id=1659699&tipoElemento=/articulo/; ERDM Solar SA de CV, Facebook, https://www.facebook.com/erdm.solar.sa.de.cv/, accessed September 2, 2021.

Changes in operations

As presented in table VI-9 *** reported several operational and organizational changes since January 1, 2018.

Table VI-9
CSPV products: Reported changes in operations by producers in Mexico, since January 1, 2018

Item	Firm name and accompanying narrative response
Technology	***
Other	***

Source: Compiled from data submitted in response to Commission questionnaires.

Operations on CSPV cells

There was no CSPV cell production in Mexico identified in staff research. *** CSPV cell production capacity in Mexico.[8]

[8] ***.

Operations on CSPV modules

According to publicly available data, there are at least nine CSPV module producers in Mexico, with a production capacity of more than 2.3 GW in 2020. The largest producer is Sun Power Mexico, followed by Solarever.[9] Sun Power Mexico is shifting interdigitated back contact (IBC) module production for the European and Asian markets from its plant in Mexico to Malaysia. The firm then plans to add 1.8 GW of shingled module production capacity at its plant in Mexico. When fully ramped, combined production at the new and old production lines in Mexico is expected to total 2.6 GW.[10] Solarever opened a new module plant in 2021 with 500 MW of capacity, bringing its total production capacity to 650 MW. The plant has the space to add up to two additional production lines of 500 MW each.[11]

Table VI-10 presents information on the CSPV module operations of Sun Power Mexico. During 2018-20, Sun Power Mexico's production capacity decreased by *** percent.[12] Sun

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[9] IEA, PVPS, *Annual Report 2017*, 2018, p. 91, https://iea-pvps.org/wp-content/uploads/2020/01/IEA-PVPS_Annual_Report_2017.pdf, accessed September 1, 2020; IEA, PVPS, *National Survey Report of PV Power Applications in France 2019*, 2020, p. 31, https://iea-pvps.org/wp-content/uploads/2020/09/NSR_France_2019.pdf, retrieved September 1, 2021; Solarsol Website, https://www.solarsol.mx/nosotros, retrieved September 1, 2021; Sun Power, Form 10-K, Annual filing to the Securities and Exchange Commission for the fiscal year ended December 29, 2019, 2020, pp. 13-14, 55, https://investors.Sun Power.com/static-files/de58c644-290f-4f2e-861c-e6d841a12880; Castro, Diana, "Solarever Inaugurates the Largest Solar Panel Plant in the Country; Had an Investment of 20 Million Dollars," InvestInMX, n.d., https://investinmx.com/en/article/solarever-inaugurates-the-largest-solar-panel-plant-in-the-country-had-an-investment-of-20-million-dollars, retrieved September 1, 2021; Gante, Diana, "Crece La Industria de Paneles Solares," Reforma, April 21, 2019, https://busquedas.gruporeforma.com/buscador/reforma/documentos/VisorArticulos.aspx?sIdIdentificadorParm=3614408|3|11|2|ArticulosCMS&idproducto=3&id=1659699&tipoElemento=/articulo/; ERDM Solar SA de CV, Facebook, https://www.facebook.com/erdm.solar.sa.de.cv/,retreived September 2, 2021.

[10] Maxeon Solar, Investor Presentation, August 2021, https://corp.maxeon.com/static-files/616bda26-3d2f-430b-9a5b-9969c5d3183b, retrieved October 5, 2021; Maxeon Solar, "Q4 2020 Maxeon Solar Technologies Ltd. Earnings Call—Final," FD (Fair Disclosure) Wire, April 6, 2021, https://advance.lexis.com/., retrieved September 2, 2021; Bellini, Emilliano, "Maxeon Refurbishes Mexican Factory to Set Up 1.8 GW Module Manufacturing Hub for Us Market," PV Magazine, October 8, 2021, https://www.pv-magazine.com/2021/10/08/maxeon-refurbishes-mexican-factories-to-set-up-2-6-gw-module-manufacturing-hub-for-us-market/, retrieved October 8, 2021.

[11] Castro, Diana, "Solarever Inaugurates the Largest Solar Panel Plant in the Country; Had an Investment of 20 Million Dollars," InvestInMX, n.d., https://investinmx.com/en/article/solarever-inaugurates-the-largest-solar-panel-plant-in-the-country-had-an-investment-of-20-million-dollars, retrieved September 1, 2021.

[12] ***. *** foreign producer questionnaire response, section II-2a.

Power Mexico's reported capacity was *** percent lower in interim 2021 compared to interim 2020.

During 2018-20, Sun Power Mexico's production decreased by *** percent and was *** percent lower in interim 2021 compared to interim 2020. During 2018-20 interim 2020, and interim 2021, Sun Power Mexico's shipments to the United States were the largest share of shipments, ranging from *** percent to *** percent.

Table VI-10
CSPV modules: Data on industry in Mexico, by period

Quantity in kilowatts

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity	***	***	***	***	***
Production	***	***	***	***	***
End-of-period inventories	***	***	***	***	***
Internal consumption	***	***	***	***	***
Commercial home market shipments	***	***	***	***	***
Home market shipments	***	***	***	***	***
Exports to the United States	***	***	***	***	***
Exports to Canada	***	***	***	***	***
Exports to the European Union	***	***	***	***	***
Exports to all other markets	***	***	***	***	***
Export shipments	***	***	***	***	***
Total shipments	***	***	***	***	***

Table continued.

Table VI-10 Continued
CSPV modules: Data on industry in Mexico, by period

Shares and ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity utilization ratio	***	***	***	***	***
Inventory ratio to production	***	***	***	***	***
Inventory ratio to total shipments	***	***	***	***	***
Internal consumption share	***	***	***	***	***
Commercial home market shipments share	***	***	***	***	***
Home market shipments share	***	***	***	***	***
Exports to the United States share	***	***	***	***	***
Exports to Canada share	***	***	***	***	***
Exports to the European Union share	***	***	***	***	***
Exports to all other markets share	***	***	***	***	***
Export shipments share	***	***	***	***	***
Total shipments share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-11 presents Sun Power Mexico's reported production of CSPV modules using bifacial cells and all other cells. During 2018-20, interim 2020, and interim 2021, Sun Power Mexico produced CSPV modules using ***.

Table VI-11
CSPV modules: Production in Mexico, by product type and by period

Quantity in kilowatts; shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Modules using bifacial cells	Quantity	***	***	***	***	***
Modules using all other cells	Quantity	***	***	***	***	***
Modules using all cells	Quantity	***	***	***	***	***
Modules using bifacial cells	Share	***	***	***	***	***
Modules using all other cells	Share	***	***	***	***	***
Modules using all cells	Share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-12 presents Sun Power Mexico's reported projections for CSPV module operations during 2021-23. During 2020-23, Sun Power Mexico projects capacity and production of CSPV modules to increase by *** percent[13] and by *** percent, respectively. Sun Power Mexico projects the *** of its shipment increase in 2022 and 2023 to be ***.

Table VI-12
CSPV modules: Projected experience of industry in Mexico

Quantity in kilowatts

Item	Projection 2021	Projection 2022	Projection 2023
Capacity	***	***	***
Production	***	***	***
End-of-period inventories	***	***	***
Internal consumption	***	***	***
Commercial home market shipments	***	***	***
Home market shipments	***	***	***
Exports to the United States	***	***	***
Exports to Canada	***	***	***
Exports to Mexico	***	***	***
Exports to the European Union	***	***	***
Exports to all other markets	***	***	***
Export shipments	***	***	***
Total shipments	***	***	***

Table continued.

[13] Sun Power Mexico indicated its capacity to produce CSPV modules to ***. Sun Power Mexico's foreign producer questionnaire response, section II-15.

Table VI-12 Continued
CSPV modules: Projected experience of industry in Mexico

Quantity in kilowatts

Item	Projection 2021	Projection 2022	Projection 2023
Capacity utilization ratio	***	***	***
Inventory ratio to production	***	***	***
Inventory ratio to total shipments	***	***	***
Internal consumption share	***	***	***
Commercial home market shipments share	***	***	***
Home market shipments share	***	***	***
Exports to the United States share	***	***	***
Exports to Canada share	***	***	***
Exports to Mexico share	***	***	***
Exports to the European Union share	***	***	***
Exports to all other markets share	***	***	***
Export shipments share	***	***	***
Total shipments share	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---".

Alternative products

Responding Mexican producers *** report the production of other products on the same machinery used to produce CSPV products.

Exports

According to GTA, the leading export markets for CSPV products from Mexico are the United States, the Netherlands, and Hong Kong (table VI-13). During 2020, the United States was the top export market for CSPV products from Mexico, accounting for 89.3 percent, followed by the Netherlands, accounting for 3.7 percent.

Table VI-13
CSPV products: Exports from Mexico, by period

Value in 1,000 dollars; shares in percent

Destination market	Measure	2018	2019	2020
United States	Value	110,758	99,269	51,490
Netherlands	Value	11,318	9,840	2,140
Hong Kong	Value	1,124	863	1,331
Canada	Value	545	182	796
Brazil	Value	138	266	414
Costa Rica	Value	48	282	394
China	Value	1,450	386	343
Korea	Value	252	26	227
Japan	Value	311	5	156
All other destination markets	Value	6,712	574	380
All destination markets	Value	132,657	111,693	57,672
United States	Share of value	83.5	88.9	89.3
Netherlands	Share of value	8.5	8.8	3.7
Hong Kong	Share of value	0.8	0.8	2.3
Canada	Share of value	0.4	0.2	1.4
Brazil	Share of value	0.1	0.2	0.7
Costa Rica	Share of value	0.0	0.3	0.7
China	Share of value	1.1	0.3	0.6
Korea	Share of value	0.2	0.0	0.4
Japan	Share of value	0.2	0.0	0.3
All other destination markets	Share of value	5.1	0.5	0.7
All destination markets	Share of value	100.0	100.0	100.0

Source: Official exports statistics under HS subheading 8541.40 as reported by INEGI in the Global Trade Atlas database, accessed October 1, 2021.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Share of value is the share of total exports by value. United States is shown at the top, all remaining top export destinations shown in descending order of 2020 data. These data may be overstated as HS subheading 8541.40 may contain products outside the scope of this investigation including photosensitive semiconductor devices and light-emitting diodes. In addition, a significant share of CSPV exports from Mexico are under HS heading 8501 and are not captured in these data.

The industry in Asia

The industry in China

The Commission issued foreign producers' or exporters' questionnaires to 299 firms believed to produce and/or export CSPV products from China.[14] Usable responses to the Commission's questionnaire were received from nine firms: Canadian Solar Inc. ("Canadian Solar China"), GCL System Integration Technology Co. Ltd ("GCL System"), Hanwha Q CELLS (Qidong) Co., Ltd. ("Hanwha China"), JingAo Solar Co., Ltd. ("JingAo Solar"), LONGi Solar Technology Co., Ltd. ("LONGi China"), Mysolar Manufacturing (Shanghai) Co.,Ltd. ("Mysolar"), PT. Adyawinsa ("PT. Adyawinsa China"), Risen Energy Co., Ltd. ("Risen"), and Trina Solar Co. ("Trina Solar China"). These firms accounted for approximately 31 percent of CSPV cell capacity and 30 percent of CSPV module capacity in China in 2020.[15] Table VI-14 and VI-15 present information on the CSPV cell and CSPV modules operations of the responding producers and exporters in China, respectively.

[14] These firms were identified through a review of information submitted in the petitions and presented in third-party sources.

[15] IEA PVPS, *National Survey Report of PV Power Applications in China 2020*, 2021, pp. 23-25, https://iea-pvps.org/national-survey-reports/, retrieved September 10, 2020.

Table VI-14
CSPV cells: Summary data for producers in China, 2020

Firm	Production (kilowatts)	Share of reported production (percent)	Exports to the United States (kilowatts)	Share of reported exports to the United States (percent)	Total shipments (kilowatts)	Share of firm's total shipments exported to the United States (percent)
Canadian Solar China	***	***	***	***	***	***
GCL System	***	***	***	***	***	***
Hanwha China	***	***	***	***	***	***
JingAo Solar	***	***	***	***	***	***
LONGi China	***	***	***	***	***	***
Mysolar	***	***	***	***	***	***
PT. Adyawinsa China	***	***	***	***	***	***
Risen	***	***	***	***	***	***
Trina Solar China	***	***	***	***	***	***
All firms	43,534,224	100.0	57,516	100.0	43,551,196	0.1

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-15
CSPV modules: Summary data for producers in China, 2020

Firm	Production (kilowatts)	Share of reported production (percent)	Exports to the United States (kilowatts)	Share of reported exports to the United States (percent)	Total shipments (kilowatts)	Share of firm's total shipments exported to the United States (percent)
Canadian Solar China	***	***	***	***	***	***
GCL System	***	***	***	***	***	***
Hanwha China	***	***	***	***	***	***
JingAo Solar	***	***	***	***	***	***
LONGi China	***	***	***	***	***	***
Mysolar	***	***	***	***	***	***
PT. Adyawinsa China	***	***	***	***	***	***
Risen	***	***	***	***	***	***
Trina Solar China	***	***	***	***	***	***
All firms	58,982,901	100.0	939,713	100.0	58,660,773	1.6

Source: Compiled from data submitted in response to Commission questionnaires.

Changes in operations

As presented in table VI-16, producers in China reported several operational and organizational changes since January 1, 2018.

Table VI-16
CSPV products: Reported changes in operations by producers in China, since January 1, 2018

Item	Firm name and reported change in operations
Plant openings	***
Plant openings	***
Plant openings	***
Plant openings	***
Plant openings	***
Plant openings	***
Plant closings	***
Plant closings	***
Expansions	***
Expansions	***
Expansions	***
Expansions	***
Consolidations	***
Technology	***
Technology	***

Table continued.

Table VI-16 Continued
CSPV products: Reported changes in operations by producers in China, since January 1, 2018

Item	Firm name and reported change in operations
Technology	***
Technology	***
Other	***

Source: Compiled from data submitted in response to Commission questionnaires.

Operations on CSPV cells

According to publicly available data, PV cell (including out-of-scope thin film) production capacity in China increased from 128 GW in 2018 to 201 GW in 2020. PV cell production in China increased from 85 GW in 2018 to 135 GW in 2020. Capacity utilization was 66 percent in 2018 and 67 percent in 2020.[16] In the first half of 2021, PV cell production in China totaled 92 GW.[17]

Table VI-17 presents information on the CSPV cell operations of the responding producers in China. During 2018-20, Chinese producers' production capacity increased by 109.3 percent and was 77.6 percent higher in interim 2021 compared to interim 2020. During 2018-20, Chinese producers' production increased by 84.0 percent and production was 78.9 percent higher in interim 2021 compared to interim 2020. During 2018-20, *** responding Chinese producers' of CSPV cells reported increases in capacity and production of CSPV cells. While all firms reported increases in capacity and production of CSPV cells, *** capacity and production increases accounted for the majority of China's reported CSPV cells capacity and production increases during 2018-20. During 2018-20, interim 2020, and interim 2021 over 90 percent of shipments were internal consumption and *** percent or less of shipments of CSPV cells were to the United States.

[16] China's National Bureau of Statistics reports that production of photovoltaic cells increased from 96 GW in 2018 to 157 GW in 2020. However, it is not clear if these data are only cells or also include modules. IEA PVPS, *National Survey Report of PV Power Applications in China 2020*, 2021, p. 23, https://iea-pvps.org/national-survey-reports/, retrieved September 10, 2020; IEA PVPS, *National Survey Report of PV Power Applications in China 2018*, 2019, p. 19, https://iea-pvps.org/wp-content/uploads/2020/01/NSR_China_2018.pdf; National Bureau of Statistics of China, http://www.stats.gov.cn/english/, retrieved October 2, 2021.

[17] *Taiyang News*, "China May Exit 2021 With Up To 65 GW New PV: CPIA," July 23, 2021, http://taiyangnews.info/business/china-may-exit-2021-with-up-to-65-gw-new-pv-cpia/, retrieved October 2, 2021.

Table VI-17
CSPV cells: Data on industry in China, by period

Quantity in kilowatts

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity	29,613,885	40,873,178	61,980,043	20,903,124	37,118,802
Production	23,656,649	30,213,399	43,534,224	17,421,315	31,164,266
End-of-period inventories	788,032	1,140,489	1,155,486	900,058	3,299,838
Internal consumption	21,233,142	27,121,436	40,978,741	16,411,183	28,136,553
Commercial home market shipments	1,407,095	1,704,522	1,501,264	722,691	672,443
Home market shipments	22,640,237	28,825,958	42,480,005	17,133,874	28,808,996
Exports to the United States	***	***	***	***	***
Exports to Canada	***	***	***	***	***
Exports to Mexico	***	***	***	***	***
Exports to the European Union	***	***	***	***	***
Exports to all other markets	***	***	***	***	***
Export shipments	897,329	1,087,930	1,071,191	622,840	307,876
Total shipments	23,537,566	29,913,888	43,551,196	17,756,714	29,116,872

Table continued.

Table VI-17 Continued
CSPV cells: Data on industry in China, by period

Shares and ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity utilization ratio	79.9	73.9	70.2	83.3	84.0
Inventory ratio to production	3.3	3.8	2.7	2.6	5.3
Inventory ratio to total shipments	3.3	3.8	2.7	2.5	5.7
Internal consumption share	90.2	90.7	94.1	92.4	96.6
Commercial home market shipments share	6.0	5.7	3.4	4.1	2.3
Home market shipments share	96.2	96.4	97.5	96.5	98.9
Exports to the United States share	***	***	***	***	***
Exports to Canada share	***	***	***	***	***
Exports to Mexico share	***	***	***	***	***
Exports to the European Union share	***	***	***	***	***
Exports to all other markets share	***	***	***	***	***
Export shipments share	3.8	3.6	2.5	3.5	1.1
Total shipments share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Table VI-18 presents Chinese producers' reported production of CSPV cells by product type: bifacial cells and all other cells. During 2018-19, the majority of CSPV cells produced were all other cells (83.4 percent and 69.7 percent, respectively). In 2020, the majority of CSPV cells produced were bifacial (77.2 percent). In interim 2020 and interim 2021, the majority of CSPV cells produced were bifacial cells (65.6 percent and 97.9 percent, respectively).

Table VI-18
CSPV cells: Production in China, by product type and period

Quantity in kilowatts; shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Bifacial cells	Quantity	3,938,681	9,154,628	33,616,346	11,434,006	30,503,602
All other cells	Quantity	19,717,968	21,058,771	9,917,878	5,987,309	660,664
All cells	Quantity	23,656,649	30,213,399	43,534,224	17,421,315	31,164,266
Bifacial cells	Share	16.6	30.3	77.2	65.6	97.9
All other cells	Share	83.4	69.7	22.8	34.4	2.1
All cells	Share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-19 presents Chinese producers' reported projections for CSPV cells operations during 2021-23. During 2020-23, Chinese producers' capacity and production of CSPV cells are projected to increase by 101.7 percent and by 155.5 percent, respectively.

Table VI-19
CSPV cells: Projected experience of industry in China

Quantity in kilowatts

Item	Projection 2021	Projection 2022	Projection 2023
Capacity	88,202,365	112,916,015	125,026,466
Production	75,970,608	97,351,534	111,246,648
End-of-period inventories	3,113,041	2,948,366	2,903,658
Internal consumption	72,147,935	90,367,773	102,083,139
Commercial home market shipments	1,491,527	2,281,017	2,765,401
Home market shipments	73,639,462	92,648,790	104,848,540
Exports to the United States	***	***	***
Exports to Canada	***	***	***
Exports to Mexico	***	***	***
Exports to the European Union	***	***	***
Exports to all other markets	***	***	***
Export shipments	371,673	4,867,419	6,452,816
Total shipments	74,011,135	97,516,209	111,301,356

Table continued.

Table VI-19 Continued
CSPV cells: Projected experience of industry in China

Shares and ratios in percent

Item	Projection 2021	Projection 2022	Projection 2023
Capacity utilization ratio	86.1	86.2	89.0
Inventory ratio to production	4.1	3.0	2.6
Inventory ratio to total shipments	4.2	3.0	2.6
Internal consumption share	97.5	92.7	91.7
Commercial home market shipments share	2.0	2.3	2.5
Home market shipments share	99.5	95.0	94.2
Exports to the United States share	***	***	***
Exports to Canada share	***	***	***
Exports to Mexico share	***	***	***
Exports to the European Union share	***	***	***
Exports to all other markets share	***	***	***
Export shipments share	0.5	5.0	5.8
Total shipments share	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---". ***. *** foreign producer questionnaire response, section II-14.

Operations on CSPV modules

According to publicly available data, PV module (including out-of-scope thin film) production capacity in China increased from 130 GW in 2018 to 244 GW in 2020. PV module production increased from 83 GW in 2018 to 125 GW in 2020. Capacity utilization declined from 64 percent in 2018 to 51 percent in 2020.[18] In the first half of 2021, Chinese PV module production totaled 80 GW.[19]

Table VI-20 presents information on the CSPV module operations of the responding producers in China. During 2018-20, Chinese producers' production capacity increased by 121.4 percent. During 2018-20, seven out of nine responding Chinese producers reported capacity increases of CSPV modules, while one firm reported a decrease in capacity[20] and the remaining firm's reported capacity remained the same. Chinese producers' reported capacity was 71.3 percent greater in interim 2021 interim compared to interim 2020.

During 2018-20, Chinese producers' production increased by 110.9 percent and production was 57.5 percent higher in interim 2021 compared to interim 2020. During 2018-20 eight out of nine responding Chinese producers reported increased production of CSPV modules. During 2018-19, the greatest share of shipments of CSPV modules produced in China was to markets other than the United States, Canada, Mexico, or the European Union.[21] In 2020 the largest share of shipments was to the home market (45.2 percent) followed by all other markets (*** percent). During 2018-20, less than *** percent of shipments were to the United States.

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[18] IEA PVPS, *National Survey Report of PV Power Applications in China 2020*, 2021, p. 23, https://iea-pvps.org/national-survey-reports/, retrieved September 10, 2020; IEA PVPS, *National Survey Report of PV Power Applications in China 2018*, 2019, p. 20, https://iea-pvps.org/wp-content/uploads/2020/01/NSR_China_2018.pdf.

[19] *Taiyang News*, "China May Exit 2021 With Up To 65 GW New PV: CPIA," July 23, 2021, http://taiyangnews.info/business/china-may-exit-2021-with-up-to-65-gw-new-pv-cpia/, retrieved October 2, 2021.

[20] During 2018-20, *** capacity to produce CSPV modules decreased by *** percent due to the installation of production line upgrades in 2020. In 2021, production capacity of CSPV modules increased as a result of the production line upgrades. Email from ***, November 19, 2021.

[21] Other export markets include Asia, the Middle East, and South America.

Table VI-20
CSPV modules: Data on industry in China, by period

Quantity in kilowatts

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity	32,453,097	48,976,482	71,851,102	30,921,004	52,978,800
Production	27,972,988	40,560,607	58,982,901	23,336,381	36,747,953
End-of-period inventories	1,729,983	1,889,609	2,211,738	2,412,839	3,032,401
Internal consumption	2,969,210	5,942,734	8,436,499	2,863,844	5,154,711
Commercial home market shipments	7,545,308	6,042,189	18,079,186	5,974,540	8,815,551
Home market shipments	10,514,518	11,984,923	26,515,685	8,838,384	13,970,262
Exports to the United States	***	***	***	***	***
Exports to Canada	***	***	***	***	***
Exports to Mexico	***	***	***	***	***
Exports to the European Union	***	***	***	***	***
Exports to all other markets	***	***	***	***	***
Export shipments	17,219,508	28,416,057	32,145,088	13,974,767	21,957,027
Total shipments	27,734,026	40,400,980	58,660,773	22,813,151	35,927,289

Table continued.

Table VI-20 Continued
CSPV modules: Data on industry in China, by period

Shares and ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity utilization ratio	86.2	82.8	82.1	75.5	69.4
Inventory ratio to production	6.2	4.7	3.7	5.2	4.1
Inventory ratio to total shipments	6.2	4.7	3.8	5.3	4.2
Internal consumption share	10.7	14.7	14.4	12.6	14.3
Commercial home market shipments share	27.2	15.0	30.8	26.2	24.5
Home market shipments share	37.9	29.7	45.2	38.7	38.9
Exports to the United States share	***	***	***	***	***
Exports to Canada share	***	***	***	***	***
Exports to Mexico share	***	***	***	***	***
Exports to the European Union share	***	***	***	***	***
Exports to all other markets share	***	***	***	***	***
Export shipments share	62.1	70.3	54.8	61.3	61.1
Total shipments share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05"

Table VI-21 presents Chinese producers' reported production of CSPV modules using bifacial cells and all other cells. During 2018-19, over 91 percent of Chinese CSPV modules were produced using other cells. In 2020, over 55 percent of Chinese CSPV modules were produced using bifacial cells. In interim 2020, over 51 percent of Chinese CSPV modules were produced using all other cells compared to interim 2021 were over 63 percent of Chinese CSPV modules were produced using bifacial cells. During 2018-19, all other cells accounted for the majority or entirety of eight out of nine Chinese producers' CSPV modules. During 2020, bifacial cells accounted for the majority of four out of nine Chinese producers' CSPV modules.

Table VI-21
CSPV modules: Production in China, by product type and by period

Quantity in kilowatts; shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Modules using bifacial cells	Quantity	1,499,286	3,401,336	33,526,435	11,238,306	23,313,957
Modules using all other cells	Quantity	26,473,702	37,159,271	25,456,466	12,098,075	13,433,996
Modules using all cells	Quantity	27,972,988	40,560,607	58,982,901	23,336,381	36,747,953
Modules using bifacial cells	Share	5.4	8.4	56.8	48.2	63.4
Modules using all other cells	Share	94.6	91.6	43.2	51.8	36.6
Modules using all cells	Share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-22 presents Chinese producers' reported projections for CSPV module operations during 2021-23. During 2020-23, Chinese producers' capacity and production of CSPV modules are projected to increase by 6.9 percent and by 59.5 percent, respectively. The increase in projected production is largely driven by *** who project their production to increase by *** percent, *** percent, and *** percent, respectively during 2020-23.

Table VI-22
CSPV modules: Projected experience of industry in China

Quantity in kilowatts

Item	Projection 2021	Projection 2022	Projection 2023
Capacity	125,298,800	154,226,000	176,775,000
Production	83,773,350	102,276,000	120,110,000
End-of-period inventories	2,616,949	2,680,498	2,532,353
Internal consumption	9,732,312	12,871,679	15,321,095
Commercial home market shipments	27,217,001	33,691,107	39,035,860
Home market shipments	36,949,313	46,562,786	54,356,955
Exports to the United States	***	***	***
Exports to Canada	***	***	***
Exports to Mexico	***	***	***
Exports to the European Union	***	***	***
Exports to all other markets	***	***	***
Export shipments	46,420,243	55,649,665	65,901,190
Total shipments	83,369,556	102,212,451	120,258,145

Table continued.

Table VI-22 Continued
CSPV modules: Projected experience of industry in China

Quantity in kilowatts; shares and ratios in percent

Item	Projection 2021	Projection 2022	Projection 2023
Capacity utilization ratio	66.9	66.3	67.9
Inventory ratio to production	3.1	2.6	2.1
Inventory ratio to total shipments	3.1	2.6	2.1
Internal consumption share	11.7	12.6	12.7
Commercial home market shipments share	32.6	33.0	32.5
Home market shipments share	44.3	45.6	45.2
Exports to the United States share	***	***	***
Exports to Canada share	***	***	***
Exports to Mexico share	***	***	***
Exports to the European Union share	***	***	***
Exports to all other markets share	***	***	***
Export shipments share	55.7	54.4	54.8
Total shipments share	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---". ***. *** foreign producer questionnaire response, section II-15.

Alternative products

Responding Chinese producers *** report the production of other products on the same machinery used to produce CSPV products.

Exports

The volume of Chinese PV cell (including out of scope thin film) exports, according to the China Photovoltaic Industry Association ("CPIA"), increased from 5 GW in 2018 to 9 GW in 2020. The volume of PV module exports increased from 42 GW in 2018 to 79 GW in 2020.[22] CPIA data on the value of PV cell and module exports combined were only 91 percent of the value as recorded in China Customs statistics, indicating that CPIA data may understate the volume of PV cell and module exports.[23] In the first half of 2021, CPIA estimates that PV module exports totaled 44 to 46 GW.[24]

According to GTA, the leading export markets for CSPV products from China are the Netherlands, Vietnam, and Japan (table VI-23). During 2020, the Netherlands was the top export market for CSPV products from China, accounting for 15.0 percent, followed by Vietnam, accounting for 14.8 percent. The United States accounted for 2.2 percent of all exports of CSPV products from China in 2020.

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[22] IEA PVPS, *National Survey Report of PV Power Applications in China 2020*, 2021, p. 23, https://iea-pvps.org/national-survey-reports/, retrieved September 10, 2020; IEA PVPS, *National Survey Report of PV Power Applications in China 2018*, 2019, pp. 19–20, https://iea-pvps.org/wp-content/uploads/2020/01/NSR_China_2018.pdf.

[23] In 2018, CPIA export value data were much closer to China Customs statistics, with CPIA's value of exports exceeding export values from China Customs statistics by 1.5 percent. Global Trade Information Services, Inc., Global Trade Atlas, Chinese statistical reporting number 8541.40.20, retrieved September 13, 2021. IEA PVPS, *National Survey Report of PV Power Applications in China 2020*, 2021, p. 23, https://iea-pvps.org/national-survey-reports/, retrieved September 10, 2020; IEA PVPS, *National Survey Report of PV Power Applications in China 2018*, 2019, pp. 19–20, https://iea-pvps.org/wp-content/uploads/2020/01/NSR_China_2018.pdf.

7304.39, 7304.51, and 7304.59 accessed April 22, 2021.

[24] *Taiyang News*, "China May Exit 2021 With Up To 65 GW New PV: CPIA," July 23, 2021, http://taiyangnews.info/business/china-may-exit-2021-with-up-to-65-gw-new-pv-cpia/, retrieved October 2, 2021.

Table VI-23
CSPV products: Exports from China, by period

Value in 1,000 dollars; shares in percent

Destination market	Measure	2018	2019	2020
United States	Value	40,831	193,186	444,611
Netherlands	Value	426,546	2,250,769	2,971,418
Vietnam	Value	466,042	1,647,024	2,937,972
Japan	Value	1,825,262	1,828,578	1,564,363
India	Value	2,195,413	1,528,568	1,339,461
Brazil	Value	577,840	1,131,293	1,072,527
Australia	Value	1,288,059	1,235,135	990,946
Spain	Value	291,994	942,766	873,217
Germany	Value	148,041	537,368	712,854
All other destination markets	Value	6,318,361	7,886,955	6,896,033
All destination markets	Value	13,578,389	19,181,643	19,803,401
United States	Share of value	0.3	1.0	2.2
Netherlands	Share of value	3.1	11.7	15.0
Vietnam	Share of value	3.4	8.6	14.8
Japan	Share of value	13.4	9.5	7.9
India	Share of value	16.2	8.0	6.8
Brazil	Share of value	4.3	5.9	5.4
Australia	Share of value	9.5	6.4	5.0
Spain	Share of value	2.2	4.9	4.4
Germany	Share of value	1.1	2.8	3.6
All other destination markets	Share of value	46.5	41.1	34.8
All destination markets	Share of value	100.0	100.0	100.0

Source: Official exports statistics under HS subheading 8541.40.20 as reported by China Customs in the Global Trade Atlas database, accessed September 13, 2021.

Note: Share of value is the share of total exports by value. United States is shown at the top. All remaining top export destinations are shown in descending order of 2020 data.

The industry in Korea

The Commission issued foreign producers' or exporters' questionnaires to 24 firms believed to produce and/or export CSPV products from Korea.[25] Usable responses to the Commission's questionnaire were received from two firms: Hanwha Solutions Corporation ("Hanwha Korea") and LG Electronics Inc ("LG Electronics"). These firms accounted for approximately *** percent of CSPV cell capacity and *** percent of CSPV module capacity in Korea in 2019.[26] Table VI-24 and VI-25 present information on the CSPV cell and CSPV modules operations of the responding producers and exporters in Korea, respectively.

Table VI-24
CSPV cells: Summary data for producers in Korea, 2020

Firm	Production (kilowatts)	Share of reported production (percent)	Exports to the United States (kilowatts)	Share of reported exports to the United States (percent)	Total shipments (kilowatts)	Share of firm's total shipments exported to the United States (percent)
Hanwha Korea	***	***	***	***	***	***
LG Electronics	***	***	***	***	***	***
All firms	***	100.0	***	100.0	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-25
CSPV modules: Summary data for producers in Korea, 2020

Firm	Production (kilowatts)	Share of reported production (percent)	Exports to the United States (kilowatts)	Share of reported exports to the United States (percent)	Total shipments (kilowatts)	Share of firm's total shipments exported to the United States (percent)
Hanwha Korea	***	***	***	***	***	***
LG Electronics	***	***	***	***	***	***
All firms	***	100.0	***	100.0	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

[25] These firms were identified through a review of information submitted in the petitions and presented in third-party sources.

[26] Source: IEA PVPS, *National Survey Report of PV Power Applications in Korea 2019*, p. 27, https://iea-pvps.org/wp-content/uploads/2021/01/NSR_Korea_2019.pdf, retrieved October 2, 2019.

Changes in operations

As presented in table VI-26 producers in Korea reported several operational and organizational changes since January 1, 2018.

Table VI-26
CSPV products: Reported changes in operations by producers in Korea, since January 1, 2018

Item	Firm name and accompanying narrative response
Plant closings	***
Acquisitions	***
Technology	***
Other	***

Source: Compiled from data submitted in response to Commission questionnaires.

Operations on CSPV cells

According to publicly available data, CSPV cell production capacity in Korea increased from 6.9 GW in 2018 to 7.7 GW in 2019. CSPV cell production increased from 5.7 GW in 2018 to 6.9 GW in 2019. Capacity utilization was 82 percent in 2018 and 90 percent in 2019.[27]

Table VI-27 presents information on the CSPV cell operations of the responding producers in Korea. During 2018-19, Korean producers' production capacity increased by *** percent than decreased by *** percent from 2019 to 2020. Overall, during 2018-20 Korean producers' capacity to produce CSPV cells increased by *** percent and was *** percent lower in interim 2021 compared to interim 2020. During 2018-20, Korean producers' production of CSPV cells decreased by *** percent while production was *** percent higher in interim 2021 compared to interim 2020. During 2018-20, interim 2020, and interim 2021 internal consumption accounted for the largest share of total shipments of CSPV cells. Overall, during 2018-20, exports of CSPV cells to the United States increased by *** percent, meanwhile exports to the United States were *** percent higher in interim 2021 compared to interim 2020.

[27] IEA PVPS, *National Survey Report of PV Power Applications in Korea 2019*, p. 27, https://iea-pvps.org/wp-content/uploads/2021/01/NSR_Korea_2019.pdf, retrieved October 2, 2019; IEA PVPS, *National Survey Report of PV Power Applications in Korea 2018*, p. 22, https://iea-pvps.org/wp-content/uploads/2020/03/NSR_Korea_2018.pdf, retrieved October 2, 2019.

Table VI-27
CSPV cells: Data on industry in Korea, by period

Quantity in kilowatts

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity	***	***	***	***	***
Production	***	***	***	***	***
End-of-period inventories	***	***	***	***	***
Internal consumption	***	***	***	***	***
Commercial home market shipments	***	***	***	***	***
Home market shipments	***	***	***	***	***
Exports to the United States	***	***	***	***	***
Exports to Canada	***	***	***	***	***
Exports to Mexico	***	***	***	***	***
Exports to the European Union	***	***	***	***	***
Exports to all other markets	***	***	***	***	***
Export shipments	***	***	***	***	***
Total shipments	***	***	***	***	***

Table continued.

Table VI-27 Continued
CSPV cells: Data on industry in Korea, by period

Shares and ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity utilization ratio	***	***	***	***	***
Inventory ratio to production	***	***	***	***	***
Inventory ratio to total shipments	***	***	***	***	***
Internal consumption share	***	***	***	***	***
Commercial home market shipments share	***	***	***	***	***
Home market shipments share	***	***	***	***	***
Exports to the United States share	***	***	***	***	***
Exports to Canada share	***	***	***	***	***
Exports to Mexico share	***	***	***	***	***
Exports to the European Union share	***	***	***	***	***
Exports to all other markets share	***	***	***	***	***
Export shipments share	***	***	***	***	***
Total shipments share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Table VI-28 presents data on Korean producers' reported production of CSPV cells by product type: bifacial cells and all other cells. During 2018-20, the majority of CSPV cells produced were all other cells (between *** percent and *** percent). In interim 2020 and interim 2021 the majority of CSPV cells produced were other cells; however, the share of bifacial cells was *** percentage points higher in interim 2021 compared to interim 2020.

Table VI-28
CSPV cells: Production in Korea, by product type and by period

Quantity in kilowatts; shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Bifacial cells	Quantity	***	***	***	***	***
All other cells	Quantity	***	***	***	***	***
All cells	Quantity	***	***	***	***	***
Bifacial cells	Share	***	***	***	***	***
All other cells	Share	***	***	***	***	***
All cells	Share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-29 presents Korean producers' reported projections for CSPV cells operations during 2021-23. During 2020-23, Korean producers' capacity and production of CSPV cells are projected to decrease by *** percent and by *** percent, respectively.

Table VI-29
CSPV cells: Projected experience of industry in Korea

Quantity in kilowatts

Item	Projection 2021	Projection 2022	Projection 2023
Capacity	***	***	***
Production	***	***	***
End-of-period inventories	***	***	***
Internal consumption	***	***	***
Commercial home market shipments	***	***	***
Home market shipments	***	***	***
Exports to the United States	***	***	***
Exports to Canada	***	***	***
Exports to Mexico	***	***	***
Exports to the European Union	***	***	***
Exports to all other markets	***	***	***
Export shipments	***	***	***
Total shipments	***	***	***

Table continued.

Table VI-29 Continued
CSPV cells: Projected experience of industry in Korea

Shares and ratios in percent

Item	Projection 2021	Projection 2022	Projection 2023
Capacity utilization ratio	***	***	***
Inventory ratio to production	***	***	***
Inventory ratio to total shipments	***	***	***
Internal consumption share	***	***	***
Commercial home market shipments share	***	***	***
Home market shipments share	***	***	***
Exports to the United States share	***	***	***
Exports to Canada share	***	***	***
Exports to Mexico share	***	***	***
Exports to the European Union share	***	***	***
Exports to all other markets share	***	***	***
Export shipments share	***	***	***
Total shipments share	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---".

Operations on CSPV modules

According to publicly available data, CSPV module production capacity in Korea increased from 9.1 GW in 2018 to 10.6 GW in 2019. CSPV module production increased from 8.1 GW in 2018 to 8.7 in 2019 and ***. Capacity utilization declined from 89 percent in 2018 to 82 percent in 2019.[28]

Table VI-30 presents information on the CSPV module operations of the responding producers in Korea. During 2018-20, responding Korean producers' production capacity fluctuated but overall decreased by *** percent. Korean producers' reported capacity was *** percent lower in interim 2021 interim compared to interim 2020.

During 2018-19, Korean producers' CSPV module production increased by *** percent then decreased by *** percent from 2019 to 2020. Overall, Korean producers' CSPV module production increased by *** percent. Meanwhile CSPV module production was *** percent lower in interim 2021 compared to interim 2020. During 2018-20, export shipments to the United States increased by *** percent. In 2018, 2019, and interim 2021 home market shipments accounted for the largest share of CSPV module shipments; meanwhile, in 2020 and interim 2020 exports to the United States accounted for the largest share of shipments.

[28] IEA PVPS, *National Survey Report of PV Power Applications in Korea 2019*, p. 27, https://iea-pvps.org/wp-content/uploads/2021/01/NSR_Korea_2019.pdf, retrieved October 2, 2019; IEA PVPS, *National Survey Report of PV Power Applications in Korea 2018*, p. 22, https://iea-pvps.org/wp-content/uploads/2020/03/NSR_Korea_2018.pdf, retrieved October 2, 2019; ***.

Table VI-30
CSPV modules: Data on industry in Korea, by period

Quantity in kilowatts

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity	***	***	***	***	***
Production	***	***	***	***	***
End-of-period inventories	***	***	***	***	***
Internal consumption	***	***	***	***	***
Commercial home market shipments	***	***	***	***	***
Home market shipments	***	***	***	***	***
Exports to the United States	***	***	***	***	***
Exports to Canada	***	***	***	***	***
Exports to Mexico	***	***	***	***	***
Exports to the European Union	***	***	***	***	***
Exports to all other markets	***	***	***	***	***
Export shipments	***	***	***	***	***
Total shipments	***	***	***	***	***

Table continued.

Table VI-30 Continued
CSPV modules: Data on industry in Korea, by period

Shares and ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity utilization ratio	***	***	***	***	***
Inventory ratio to production	***	***	***	***	***
Inventory ratio to total shipments	***	***	***	***	***
Internal consumption share	***	***	***	***	***
Commercial home market shipments share	***	***	***	***	***
Home market shipments share	***	***	***	***	***
Exports to the United States share	***	***	***	***	***
Exports to Canada share	***	***	***	***	***
Exports to Mexico share	***	***	***	***	***
Exports to the European Union share	***	***	***	***	***
Exports to all other markets share	***	***	***	***	***
Export shipments share	***	***	***	***	***
Total shipments share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-31 presents Korean producers' reported production of CSPV modules using bifacial cells and all other cells. During 2018-20, interim 2020, and interim 2021, over *** percent of Korean CSPV modules were produced using other cells.

Table VI-31
CSPV modules: Production in Korea, by product type and by period

Quantity in kilowatts; shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Modules using bifacial cells	Quantity	***	***	***	***	***
Modules using all other cells	Quantity	***	***	***	***	***
Modules using all cells	Quantity	***	***	***	***	***
Modules using bifacial cells	Share	***	***	***	***	***
Modules using all other cells	Share	***	***	***	***	***
Modules using all cells	Share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-32 presents Korean producers' reported projections for CSPV module operations during 2021-23. During 2020-23, Korean producers' capacity and production of CSPV modules are projected to increase by *** percent and by *** percent, respectively.

Table VI-32
CSPV modules: Projected experience of industry in Korea

Quantity in kilowatts

Item	Projection 2021	Projection 2022	Projection 2023
Capacity	***	***	***
Production	***	***	***
End-of-period inventories	***	***	***
Internal consumption	***	***	***
Commercial home market shipments	***	***	***
Home market shipments	***	***	***
Exports to the United States	***	***	***
Exports to Canada	***	***	***
Exports to Mexico	***	***	***
Exports to the European Union	***	***	***
Exports to all other markets	***	***	***
Export shipments	***	***	***
Total shipments	***	***	***

Table continued.

Table VI-32 Continued
CSPV modules: Projected experience of industry in Korea

Shares and ratios in percent

Item	Projection 2021	Projection 2022	Projection 2023
Capacity utilization ratio	***	***	***
Inventory ratio to production	***	***	***
Inventory ratio to total shipments	***	***	***
Internal consumption share	***	***	***
Commercial home market shipments share	***	***	***
Home market shipments share	***	***	***
Exports to the United States share	***	***	***
Exports to Canada share	***	***	***
Exports to Mexico share	***	***	***
Exports to the European Union share	***	***	***
Exports to all other markets share	***	***	***
Export shipments share	***	***	***
Total shipments share	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---".

Alternative products

Responding Korean producers *** report the production of other products on the same machinery used to produce CSPV products.

Exports

According to GTA, the leading export markets for CSPV products from Korea are the United States, the Netherlands, and Japan (table VI-33). During 2020, the United States was the top export market for CSPV products from Korea, accounting for 64.7 percent, followed by the Netherlands, accounting for 12.9 percent.

Table VI-33
CSPV products: Exports from Korea, by period

Value in 1,000 dollars; shares in percent

Destination market	Measure	2018	2019	2020
United States	Value	551,685	765,392	894,355
Netherlands	Value	358,738	242,393	177,725
Japan	Value	263,563	232,566	99,011
Australia	Value	73,266	68,715	78,173
Angola	Value	---	---	25,021
Vietnam	Value	44,161	65,023	23,175
Germany	Value	175,968	92,208	18,802
Spain	Value	15,475	36,895	11,363
Slovenia	Value	636	4,489	11,294
All other destination markets	Value	121,325	84,385	43,126
All destination markets	Value	1,604,816	1,592,065	1,382,046
United States	Share of value	34.4	48.1	64.7
Netherlands	Share of value	22.4	15.2	12.9
Japan	Share of value	16.4	14.6	7.2
Australia	Share of value	4.6	4.3	5.7
Angola	Share of value	---	---	1.8
Vietnam	Share of value	2.8	4.1	1.7
Germany	Share of value	11.0	5.8	1.4
Spain	Share of value	1.0	2.3	0.8
Slovenia	Share of value	0.0	0.3	0.8
All other destination markets	Share of value	7.6	5.3	3.1
All destination markets	Share of value	100.0	100.0	100.0

Source: Official exports statistics under HS subheading 8541.40.9021 and 8541.40.9022 as reported by Korea Trade Statistics Promotion Institute (KTSPI) in the Global Trade Atlas database, accessed September 13, 2021.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Share of value is the share of total exports by value. United States is shown at the top, all remaining top export destinations shown in descending order of 2020 data.

The industry in Malaysia

The Commission issued foreign producers' or exporters' questionnaires to 22 firms believed to produce and/or export CSPV products from Malaysia.[29] Usable responses to the Commission's questionnaire were received from six firms: JinkoSolar Technology Sdn. Bhd. ("JinkoSolar Malaysia"), Sun Power Malaysia Manufacturing Sdn. Bhd. ("Sun Power Malaysia"), Hanwha Q Cells Malaysia Sdn. Bhd. ("Hanwha Malaysia"), TS Solartech Sdn Bhd ("TS Solartech"), LONGi (Kuching) Sdn Bhd ("LONGi Malaysia"), and Flex Ltd. ("Flex"). These firms accounted for approximately *** percent of CSPV cell capacity and 84 percent of CSPV module capacity in Malaysia in 2020.[30] Table VI-34 and VI-35 present information on the CSPV cell and CSPV modules operations of the responding producers and exporters in Malaysia, respectively.

[29] These firms were identified through a review of information submitted in the petitions and presented in third-party sources.

[30] ***; and PV HiTech Website, https://www.pvhitechsolar.com.my/Solar-Module-Manufacturing-Plant/, retrieved October 3, 2021; Toenergy Technology Website, www.toensolar.com/aboutus.html, retrieved November 8, 2019; Mak, Gladys, "Solar PV: Policy, Market & Industry in Malaysia," April 7, 2018, p. 14, https://unef.es/wp-content/uploads/dlm_uploads/2018/04/presentation-task-1_malaysia-april-2018.pdf, retrieved November 2, 201.

Table VI-34
CSPV cells: Summary data for producers in Malaysia, 2020

Firm	Production (kilowatts)	Share of reported production (percent)	Exports to the United States (kilowatts)	Share of reported exports to the United States (percent)	Total shipments (kilowatts)	Share of firm's total shipments exported to the United States (percent)
Flex	***	***	***	***	***	***
Hanwha Malaysia	***	***	***	***	***	***
JinkoSolar Malaysia	***	***	***	***	***	***
LONGi Malaysia	***	***	***	***	***	***
Sun Power Malaysia	***	***	***	***	***	***
TS Solartech	***	***	***	***	***	***
All firms	9,062,596	100.0	***	100.0	8,825,852	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: ***. *** foreign producer questionnaire response, sections II-2a and II-14.

Table VI-35
CSPV modules: Summary data for producers in Malaysia, 2020

Firm	Production (kilowatts)	Share of reported production (percent)	Exports to the United States (kilowatts)	Share of reported exports to the United States (percent)	Total shipments (kilowatts)	Share of firm's total shipments exported to the United States (percent)
Flex	***	***	***	***	***	***
Hanwha Malaysia	***	***	***	***	***	***
JinkoSolar Malaysia	***	***	***	***	***	***
LONGi Malaysia	***	***	***	***	***	***
Sun Power Malaysia	***	***	***	***	***	***
TS Solartech	***	***	***	***	***	***
All firms	4,921,936	100.0	***	***	4,891,597	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: ***. *** foreign producer questionnaire response, sections II-2a and II-15.

Changes in operations

As presented in table VI-36, producers in Malaysia reported several operational and organizational changes since January 1, 2018.

Table VI-36
CSPV products: Reported changes in operations by producers in Malaysia, since January 1, 2018

Item	Firm name and reported change in operation
Plant openings	***
Plant closings	***
Plant closings	***
Expansions	***
Expansions	***
Prolonged shutdowns or curtailments	***
Prolonged shutdowns or curtailments	***
Technology	***
Technology	***
Technology	***

Source: Compiled from data submitted in response to Commission questionnaires.

Operations on CSPV cells

Malaysian CSPV cell shipments totaled *** in 2020, according to ***.[31] There have been a number of announcements of investments in new cell manufacturing capacity in Malaysia. In June 2021, Risen Energy announced plans to open a 3 GW cell plant in Malaysia that is expected to come online in the first quarter of 2022.[32] In September 2021, Tianjin Zhonghuan Semiconductor (TZS) and its parent company TCL Technology announced plans to open a cell plant in Malaysia.[33] Maxeon Solar announced plans to add 1.8 GW of PERC cell production capacity.[34] On the other hand, in early 2021 Panasonic announced plans to close its cell plant in Malaysia by January 2022.[35]

Table VI-37 presents information on the CSPV cell operations of the responding producers in Malaysia. During 2018-20, Malaysian producers' capacity to produce CSPV cells increased by 70.3 percent and was 9.6 percent higher in interim 2021 compared to interim 2020. During 2018-20, Malaysian producers' production of CSPV cells increased by 67.3 percent and production was 18.8 percent higher in interim 2021 compared to interim 2020. During 2018-20, interim 2020, and interim 2021, home market shipments accounted for the largest share of total shipments of CSPV cells. Overall, during 2018-20, exports of CSPV cells from Malaysia to the United States increased by *** percent. During 2018-20 exports of CSPV cells to the United States accounted for *** percent or less of total shipments.

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[31] ***.

[32] Scully, Jules, "Risen Energy to Set Up Us$10.2bn Solar Manufacturing Plant in Malaysia," *PV Tech*, June 28, 2021, https://www.pv-tech.org/risen-energy-to-set-up-us10-2bn-solar-manufacturing-plant-in-malaysia/, retrieved October 2, 2021.

[33] Information on the annual production capacity at the plant was not available. Xiao, Carrie, "TCL to Partner Zhonghuan Semiconductor for Malaysian Cell Facility as G12 Wafer Output Soars," *PV Tech*, September 29, 2021.

[34] Maxeon Solar, "Investor Presentation," August 2021, https://corp.maxeon.com/static-files/616bda26-3d2f-430b-9a5b-9969c5d3183b, retrieved October 5, 2021; Maxeon Solar, "Q4 2020 Maxeon Solar Technologies Ltd. Earnings Call—Final," FD (Fair Disclosure) Wire, April 6, 2021, https://advance.lexis.com/, retrieved September 2, 2021.

[35] Hall, Max, "Panasonic Says It Will Exit Solar Manufacturing," *PV Magazine*, February 1, 2021, https://pv-magazine-usa.com/2021/02/01/panasonic-says-it-will-exit-solar-manufacturing/, retrieved October 2, 2021.

Table VI-37
CSPV cells: Data on industry in Malaysia, by period

Quantity in kilowatts

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity	5,882,798	7,840,479	10,019,703	4,673,521	5,123,752
Production	5,418,475	7,610,586	9,062,596	4,084,697	4,854,486
End-of-period inventories	***	***	***	***	***
Internal consumption	***	***	***	***	***
Commercial home market shipments	***	***	***	***	***
Home market shipments	***	***	***	***	***
Exports to the United States	***	***	***	***	***
Exports to Canada	***	***	***	***	***
Exports to Mexico	***	***	***	***	***
Exports to the European Union	***	***	***	***	***
Exports to all other markets	***	***	***	***	***
Export shipments	***	***	***	***	***
Total shipments	5,274,741	7,576,169	8,825,852	3,930,542	4,776,747

Table continued.

Table VI-37 Continued
CSPV cells: Data on industry in Malaysia, by period

Shares and ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity utilization ratio	92.1	97.1	90.4	87.4	94.7
Inventory ratio to production	***	***	***	***	***
Inventory ratio to total shipments	***	***	***	***	***
Internal consumption share	***	***	***	***	***
Commercial home market shipments share	***	***	***	***	***
Home market shipments share	***	***	***	***	***
Exports to the United States share	***	***	***	***	***
Exports to Canada share	***	***	***	***	***
Exports to Mexico share	***	***	***	***	***
Exports to the European Union share	***	***	***	***	***
Exports to all other markets share	***	***	***	***	***
Export shipments share	***	***	***	***	***
Total shipments share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Table VI-38 presents data on Malaysian producers reported production of CSPV cells by product type: bifacial cells and all other cells. During 2018-20 the majority of CSPV cells produced were all other cells (between *** percent and *** percent). In interim 2020 the majority of CSPV cells produced were other cells (*** percent), meanwhile in interim 2021 the majority of CSPV cells produced were bifacial (*** percent).

Table VI-38
CSPV cells: Production in Malaysian, by product type and by period

Quantity in kilowatts; shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Bifacial cells	Quantity	***	***	***	***	***
All other cells	Quantity	***	***	***	***	***
All cells	Quantity	***	***	***	***	***
Bifacial cells	Share	***	***	***	***	***
All other cells	Share	***	***	***	***	***
All cells	Share	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-39 presents Malaysian producers reported projections for CSPV cells operations during 2021-23. During 2020-23, Malaysian producers' capacity and production of CSPV cells are projected to decrease by 72.4 percent and by 84.1 percent, respectively.

Table VI-39
CSPV cells: Projected experience of industry in Malaysia

Quantity in kilowatts

Item	Projection 2021	Projection 2022	Projection 2023
Capacity	10,463,251	15,882,138	17,269,346
Production	8,847,091	14,570,876	16,688,296
End-of-period inventories	***	***	***
Internal consumption	***	***	***
Commercial home market shipments	***	***	***
Home market shipments	***	***	***
Exports to the United States	***	***	***
Exports to Canada	***	***	***
Exports to Mexico	***	***	***
Exports to the European Union	***	***	***
Exports to all other markets	***	***	***
Export shipments	***	***	***
Total shipments	8,708,112	14,605,279	16,616,230

Table continued.

Table VI-39 Continued
CSPV cells: Projected experience of industry in Malaysia

Shares and ratios in percent

Item	Projection 2021	Projection 2022	Projection 2023
Capacity utilization ratio	84.6	91.7	96.6
Inventory ratio to production	***	***	***
Inventory ratio to total shipments	***	***	***
Internal consumption share	***	***	***
Commercial home market shipments share	***	***	***
Home market shipments share	***	***	***
Exports to the United States share	***	***	***
Exports to Canada share	***	***	***
Exports to Mexico share	***	***	***
Exports to the European Union share	***	***	***
Exports to all other markets share	***	***	***
Export shipments share	***	***	***
Total shipments share	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---".

Operations on CSPV modules

CSPV module production in Malaysia totaled about *** in 2019, according to available data sources.[36] There have been a number of announcements of investments in new module manufacturing capacity in Malaysia. In June 2021, Risen Energy announced plans to open a 3 GW module plant in Malaysia that is expected to come online in the first quarter of 2022.[37] Maxeon is moving IBC module assembly for the European and Asian markets from Mexico to Malaysia.[38] On the other hand, in early 2021 Panasonic announced plans to close its module plant in Malaysia by January 2022.[39]

Table VI-40 presents information on the CSPV module operations of the responding producers in Malaysia. During 2018-20, responding Malaysian producers' production capacity increased by 23.1 percent. Malaysian producers' reported capacity was 12.9 percent lower in interim 2021 interim compared to interim 2020.

During 2018-20, Malaysian producers' CSPV module production increased by 21.9 percent. Meanwhile CSPV module production was 4.8 percent lower in interim 2021 compared to interim 2020. During 2018-20, export shipments to the United States increased by *** percent. During 2018-20, interim 2020, and interim 2021 exports to the United States accounted for the largest share of total shipments of CSPV modules produced in Malaysia.

[36] IEA PVPS, *Trends in Photovoltaic Applications 2020*, pp. 42–43, https://iea-pvps.org/trends-reports/, retrieved September 14, 2021; ***.

[37] Scully, Jules, "Risen Energy to Set Up US$10.2bn Solar Manufacturing Plant in Malaysia," *PV Tech*, June 28, 2021, https://www.pv-tech.org/risen-energy-to-set-up-us10-2bn-solar-manufacturing-plant-in-malaysia/, retrieved October 2, 2021.

[38] Maxeon Solar, "Investor Presentation," August 2021, https://corp.maxeon.com/static-files/616bda26-3d2f-430b-9a5b-9969c5d3183b, retrieved October 5, 2021; Maxeon Solar, "Q4 2020 Maxeon Solar Technologies Ltd. Earnings Call—Final," FD (Fair Disclosure) Wire, April 6, 2021, https://advance.lexis.com/, retrieved September 2, 2021.

[39] Hall, Max, "Panasonic Says It Will Exit Solar Manufacturing," *PV Magazine*, February 1, 2021, https://pv-magazine-usa.com/2021/02/01/panasonic-says-it-will-exit-solar-manufacturing/, retrieved October 2, 2021.

Table VI-40
CSPV modules: Data on industry in Malaysia, by period

Quantity in kilowatts

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity	4,473,000	4,882,239	5,507,660	2,811,464	2,448,873
Production	4,038,644	4,737,781	4,921,936	2,410,691	2,295,001
End-of-period inventories	***	***	***	***	***
Internal consumption	***	***	***	***	***
Commercial home market shipments	***	***	***	***	***
Home market shipments	***	***	***	***	***
Exports to the United States	***	***	***	***	***
Exports to Canada	***	***	***	***	***
Exports to Mexico	***	***	***	***	***
Exports to the European Union	***	***	***	***	***
Exports to all other markets	***	***	***	***	***
Export shipments	***	***	***	***	***
Total shipments	3,849,976	4,735,844	4,891,597	2,427,401	2,338,793

Table continued.

Table VI-40 Continued
CSPV modules: Data on industry in Malaysia, by period

Shares and ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity utilization ratio	90.3	97.0	89.4	85.7	93.7
Inventory ratio to production	***	***	***	***	***
Inventory ratio to total shipments	***	***	***	***	***
Internal consumption share	***	***	***	***	***
Commercial home market shipments share	***	***	***	***	***
Home market shipments share	***	***	***	***	***
Exports to the United States share	***	***	***	***	***
Exports to Canada share	***	***	***	***	***
Exports to Mexico share	***	***	***	***	***
Exports to the European Union share	***	***	***	***	***
Exports to all other markets share	***	***	***	***	***
Export shipments share	***	***	***	***	***
Total shipments share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-41 presents Malaysian producers' reported production of CSPV modules using bifacial cells and all other cells. During 2018-20, over *** percent of Malaysian CSPV modules were produced using other cells. In interim 2021, *** percent of CSPV modules were produced using bifacial cells, meanwhile in interim 2020 *** percent of CSPV modules were produced using bifacial cells.

Table VI-41
CSPV modules: Production in Malaysia, by product type and by period

Quantity in kilowatts; shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Modules using bifacial cells	Quantity	***	***	***	***	***
Modules using all other cells	Quantity	***	***	***	***	***
Modules using all cells	Quantity	***	***	***	***	***
Modules using bifacial cells	Share	***	***	***	***	***
Modules using all other cells	Share	***	***	***	***	***
Modules using all cells	Share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-42 presents Malaysian producers' reported projections for CSPV module operations during 2021-23. Overall during 2020-23, Malaysian producers' capacity and production of CSPV modules are projected to increase by 13.1 percent and by 17.1 percent, respectively.

Table VI-42
CSPV modules: Projected experience of industry in Malaysia

Quantity in kilowatts

Item	Projection 2021	Projection 2022	Projection 2023
Capacity	5,332,057	6,487,581	6,230,392
Production	3,706,136	5,957,689	5,765,778
End-of-period inventories	***	***	***
Internal consumption	***	***	***
Commercial home market shipments	***	***	***
Home market shipments	***	***	***
Exports to the United States	***	***	***
Exports to Canada	***	***	***
Exports to Mexico	***	***	***
Exports to the European Union	***	***	***
Exports to all other markets	***	***	***
Export shipments	***	***	***
Total shipments	3,519,803	6,005,959	5,724,268

Table continued.

Table VI-42 Continued
CSPV modules: Projected experience of industry in Malaysia

Shares and ratios in percent

Item	Projection 2021	Projection 2022	Projection 2023
Capacity utilization ratio	69.5	91.8	92.5
Inventory ratio to production	***	***	***
Inventory ratio to total shipments	***	***	***
Internal consumption share	***	***	***
Commercial home market shipments share	***	***	***
Home market shipments share	***	***	***
Exports to the United States share	***	***	***
Exports to Canada share	***	***	***
Exports to Mexico share	***	***	***
Exports to the European Union share	***	***	***
Exports to all other markets share	***	***	***
Export shipments share	***	***	***
Total shipments share	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Alternative products

Responding Malaysian producers *** report the production of other products on the same machinery used to produce CSPV products.

Exports

According to GTA, the leading export markets for CSPV products from Malaysia are the United States, Vietnam, and Japan (table VI-43). During 2020, the United States was the top export market for CSPV products from Malaysia, accounting for 60.6 percent, followed by Vietnam, accounting for 23.5 percent.

Table VI-43
CSPV products: Exports from Malaysia, by period

Value in 1,000 dollars; shares in percent

Destination market	Measure	2018	2019	2020
United States	Value	409,586	2,121,512	1,553,675
Vietnam	Value	101,665	348,000	601,756
Japan	Value	218,451	200,727	91,724
Germany	Value	160,966	101,820	83,401
China	Value	95,839	61,647	51,127
France	Value	8,469	57,888	48,645
Turkey	Value	49,609	16,901	44,093
Hong Kong	Value	26,388	33,196	19,998
Canada	Value	36,837	11,280	15,001
All other destination markets	Value	224,730	134,857	54,847
All destination markets	Value	1,332,540	3,087,829	2,564,266
United States	Share of value	30.7	68.7	60.6
Vietnam	Share of value	7.6	11.3	23.5
Japan	Share of value	16.4	6.5	3.6
Germany	Share of value	12.1	3.3	3.3
China	Share of value	7.2	2.0	2.0
France	Share of value	0.6	1.9	1.9
Turkey	Share of value	3.7	0.5	1.7
Hong Kong	Share of value	2.0	1.1	0.8
Canada	Share of value	2.8	0.4	0.6
All other destination markets	Share of value	16.9	4.4	2.1
All destination markets	Share of value	100.0	100.0	100.0

Source: Official exports statistics under HS subheading 8541.40.2100 and 8541.40.2200 as reported by Department of Statistics Malaysia in the Global Trade Atlas database, accessed September 13, 2021.

Note: Share of value is the share of total exports by value. United States is shown at the top. All remaining top export destinations are shown in descending order of 2020 data.

The industry in Singapore

The Commission issued foreign producers' or exporters' questionnaires to one firm believed to produce and/or export CSPV products from Singapore.[40] Usable responses to the Commission's questionnaire were received from one firm: REC Solar Pte. Ltd. ("REC Solar"). This firm accounted for *** CSPV cell capacity and CSPV module capacity in Singapore in 2020. Table VI-44 and VI-45 present information on the CSPV cell and CSPV modules operations of REC Solar in Singapore, respectively.

Table VI-44
CSPV cells: Summary data for producers in Singapore, 2020

Firm	Production (kilowatts)	Share of reported production (percent)	Exports to the United States (kilowatts)	Share of reported exports to the United States (percent)	Total shipments (kilowatts)	Share of firm's total shipments exported to the United States (percent)
REC Solar	***	100.0	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-45
CSPV modules: Summary data for producers in Singapore, 2020

Firm	Production (kilowatts)	Share of reported production (percent)	Exports to the United States (kilowatts)	Share of reported exports to the United States (percent)	Total shipments (kilowatts)	Share of firm's total shipments exported to the United States (percent)
REC Solar	***	100.0	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

[40] These firms were identified through a review of information submitted in the petitions and presented in third-party sources.

Changes in operations

As presented in table VI-46, *** reported several operational and organizational changes since January 1, 2018.

Table VI-46
CSPV products: Reported changes in operations by producers in Singapore, since January 1, 2018

Item	Firm name and accompanying narrative response
Expansions	***
Technology	***

Source: Compiled from data submitted in response to Commission questionnaires.

Operations on CSPV cells

Table VI-47 presents information on the CSPV cell operations of the responding producer in Singapore. During 2018-20 the Singaporean producer's capacity to produce CSPV cells increased by *** percent and was *** percent lower in interim 2021 compared to interim 2020. During 2018-20, the Singaporean producer's production of CSPV cells fluctuated but overall increased by *** percent and production was *** percent lower in interim 2021 compared to interim 2020. In 2018, *** percent of CSPV cells produced in Singapore were internally consumed. During 2019-20, interim 2020, and interim 2021 *** CSPV cells were shipped in the home market.

Table VI-47
CSPV cells: Data on industry in Singapore, by period

Quantity in kilowatts

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity	***	***	***	***	***
Production	***	***	***	***	***
End-of-period inventories	***	***	***	***	***
Internal consumption	***	***	***	***	***
Commercial home market shipments	***	***	***	***	***
Home market shipments	***	***	***	***	***
Exports to the United States	***	***	***	***	***
Exports to Canada	***	***	***	***	***
Exports to Mexico	***	***	***	***	***
Exports to the European Union	***	***	***	***	***
Exports to all other markets	***	***	***	***	***
Export shipments	***	***	***	***	***
Total shipments	***	***	***	***	***

Table continued.

Table VI-47 Continued
CSPV cells: Data on industry in Singapore, by period

Shares and ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity utilization ratio	***	***	***	***	***
Inventory ratio to production	***	***	***	***	***
Inventory ratio to total shipments	***	***	***	***	***
Internal consumption share	***	***	***	***	***
Commercial home market shipments share	***	***	***	***	***
Home market shipments share	***	***	***	***	***
Exports to the United States share	***	***	***	***	***
Exports to Canada share	***	***	***	***	***
Exports to Mexico share	***	***	***	***	***
Exports to the European Union share	***	***	***	***	***
Exports to all other markets share	***	***	***	***	***
Export shipments share	***	***	***	***	***
Total shipments share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Table VI-48 presents data on the Singaporean producer's reported production of CSPV cells by product type: bifacial cells and all other cells. During 2018-19 the majority of CSPV cells produced were all other cells (between *** percent and *** percent). In 2020, the majority of CSPV cells produced were bifacial cells (*** percent). In interim 2021 the majority of CSPV cells produced were bifacial cells (*** percent), meanwhile in interim 2020 the majority of CSPV cells produced were other cells (*** percent).

Table VI-48
CSPV cells: Production in Singapore, by product type and by period

Quantity in kilowatts; shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Bifacial cells	Quantity	***	***	***	***	***
All other cells	Quantity	***	***	***	***	***
All cells	Quantity	***	***	***	***	***
Bifacial cells	Share	***	***	***	***	***
All other cells	Share	***	***	***	***	***
All cells	Share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-49 presents Singaporean producers' reported projections for CSPV cells operations during 2021-23. During 2020-23, Singaporean producers' capacity and production of CSPV cells are projected to increase by *** percent and by *** percent, respectively.

Table VI-49
CSPV cells: Projected experience of industry in Singapore

Quantity in kilowatts

Item	Projection 2021	Projection 2022	Projection 2023
Capacity	***	***	***
Production	***	***	***
End-of-period inventories	***	***	***
Internal consumption	***	***	***
Commercial home market shipments	***	***	***
Home market shipments	***	***	***
Exports to the United States	***	***	***
Exports to Canada	***	***	***
Exports to Mexico	***	***	***
Exports to the European Union	***	***	***
Exports to all other markets	***	***	***
Export shipments	***	***	***
Total shipments	***	***	***

Table continued.

Table VI-49 Continued
CSPV cells: Projected experience of industry in Singapore

Shares and ratios in percent

Item	Projection 2021	Projection 2022	Projection 2023
Capacity utilization ratio	***	***	***
Inventory ratio to production	***	***	***
Inventory ratio to total shipments	***	***	***
Internal consumption share	***	***	***
Commercial home market shipments share	***	***	***
Home market shipments share	***	***	***
Exports to the United States share	***	***	***
Exports to Canada share	***	***	***
Exports to Mexico share	***	***	***
Exports to the European Union share	***	***	***
Exports to all other markets share	***	***	***
Export shipments share	***	***	***
Total shipments share	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---".

Operations on CSPV modules

Table VI-50 presents information on the CSPV module operations of the responding producers in Singapore. During 2018-20, the responding Singaporean producer's production capacity fluctuated but overall increased by *** percent. The Singaporean producer's reported capacity was *** percent lower in interim 2021 interim compared to interim 2020.

During 2018-19, the Singaporean producer's CSPV module production increased by *** percent then decreased by *** percent from 2019 to 2020. Overall, Singaporean producer's CSPV modules production decreased by *** percent. Meanwhile CSPV module production was *** percent higher in interim 2021 compared to interim 2020. During 2018-20, export shipments to the United States increased by *** percent and accounted for the largest share of shipments during the period for which data were collected.

Table VI-50
CSPV modules: Data on industry in Singapore, by period

Quantity in kilowatts

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity	***	***	***	***	***
Production	***	***	***	***	***
End-of-period inventories	***	***	***	***	***
Internal consumption	***	***	***	***	***
Commercial home market shipments	***	***	***	***	***
Home market shipments	***	***	***	***	***
Exports to the United States	***	***	***	***	***
Exports to Canada	***	***	***	***	***
Exports to Mexico	***	***	***	***	***
Exports to the European Union	***	***	***	***	***
Exports to all other markets	***	***	***	***	***
Export shipments	***	***	***	***	***
Total shipments	***	***	***	***	***

Table continued.

Table VI-50 Continued
CSPV modules: Data on industry in Singapore, by period

Shares and ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity utilization ratio	***	***	***	***	***
Inventory ratio to production	***	***	***	***	***
Inventory ratio to total shipments	***	***	***	***	***
Internal consumption share	***	***	***	***	***
Commercial home market shipments share	***	***	***	***	***
Home market shipments share	***	***	***	***	***
Exports to the United States share	***	***	***	***	***
Exports to Canada share	***	***	***	***	***
Exports to Mexico share	***	***	***	***	***
Exports to the European Union share	***	***	***	***	***
Exports to all other markets share	***	***	***	***	***
Export shipments share	***	***	***	***	***
Total shipments share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-51 presents the Singaporean producer's reported production of CSPV modules using bifacial cells and all other cells. During 2018-20, and interim 2020, the *** of CSPV modules produced in Singapore were using other cells. During interim 2020 about *** of CSPV modules produced in Singapore were using bifacial cells compared to interim 2021 were about - two-thirds of CSPV modules were produced using bifacial cells.

Table VI-51
CSPV modules: Production in Singapore, by product type and by period

Quantity in kilowatts; shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Modules using bifacial cells	Quantity	***	***	***	***	***
Modules using all other cells	Quantity	***	***	***	***	***
Modules using all cells	Quantity	***	***	***	***	***
Modules using bifacial cells	Share	***	***	***	***	***
Modules using all other cells	Share	***	***	***	***	***
Modules using all cells	Share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-52 presents the Singaporean producer's reported projections for CSPV module operations during 2021-23. During 2020-23, the Singaporean producer's projected capacity of CSPV modules to decrease by *** percent; meanwhile, the Singaporean producer's production is projected to increase by *** percent.

Table VI-52
CSPV modules: Projected experience of industry in Singapore

Quantity in kilowatts

Item	Projection 2021	Projection 2022	Projection 2023
Capacity	***	***	***
Production	***	***	***
End-of-period inventories	***	***	***
Internal consumption	***	***	***
Commercial home market shipments	***	***	***
Home market shipments	***	***	***
Exports to the United States	***	***	***
Exports to Canada	***	***	***
Exports to Mexico	***	***	***
Exports to the European Union	***	***	***
Exports to all other markets	***	***	***
Export shipments	***	***	***
Total shipments	***	***	***

Table continued.

Table VI-52 Continued
CSPV modules: Projected experience of industry in Singapore

Shares and ratios in percent

Item	Projection 2021	Projection 2022	Projection 2023
Capacity utilization ratio	***	***	***
Inventory ratio to production	***	***	***
Inventory ratio to total shipments	***	***	***
Internal consumption share	***	***	***
Commercial home market shipments share	***	***	***
Home market shipments share	***	***	***
Exports to the United States share	***	***	***
Exports to Canada share	***	***	***
Exports to Mexico share	***	***	***
Exports to the European Union share	***	***	***
Exports to all other markets share	***	***	***
Export shipments share	***	***	***
Total shipments share	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---".

Alternative products

Responding producers from Singapore *** report the production of other products on the same machinery used to produce CSPV products.

Exports

According to GTA, the leading export markets for CSPV products from Singapore are the United States, the Netherlands, and Australia (table VI-53). During 2020, the United States was the top export market for CSPV products from Singapore, accounting for 58.9 percent, followed by the Netherlands, accounting for 16.1 percent.

Table VI-53
CSPV Products: Exports from Singapore, by period

Value in 1,000 dollars; shares in percent

Destination market	Measure	2018	2019	2020
United States	Value	140,708	168,508	174,698
Netherlands	Value	156,655	76,917	47,685
Australia	Value	20,344	25,616	22,964
Japan	Value	20,618	15,176	18,069
India	Value	34,432	12,497	5,618
Thailand	Value	4,888	6,255	4,223
British Indian Ocean Terr.	Value	---	---	3,040
Malaysia	Value	6,435	9,274	2,780
New Zealand	Value	1,218	1,820	2,533
All other destination markets	Value	39,738	25,127	14,787
All destination markets	Value	425,037	341,190	296,398
United States	Share of value	33.1	49.4	58.9
Netherlands	Share of value	36.9	22.5	16.1
Australia	Share of value	4.8	7.5	7.7
Japan	Share of value	4.9	4.4	6.1
India	Share of value	8.1	3.7	1.9
Thailand	Share of value	1.2	1.8	1.4
British Indian Ocean Terr.	Share of value	---	---	1.0
Malaysia	Share of value	1.5	2.7	0.9
New Zealand	Share of value	0.3	0.5	0.9
All other destination markets	Share of value	9.3	7.4	5.0
All destination markets	Share of value	100.0	100.0	100.0

Source: Official exports statistics under HS subheading 8541.40.21 and 8541.40.22 as reported by International Enterprise Singapore in the Global Trade Atlas database, accessed September 16, 2021.

Note: Share of value is the share of total exports by value. United States is shown at the top. All remaining top export destinations are shown in descending order of 2020 data.

The industry in Thailand

The Commission issued foreign producers' or exporters' questionnaires to 17 firms believed to produce and/or export CSPV products from Thailand.[41] Usable responses to the Commission's questionnaire were received from three firms: Canadian Solar Manufacturing (Thailand) Co., Ltd. ("Canadian Solar Thailand"), Sharp Solar Solution Asia Co., Ltd. ("Sharp Thailand"), and Trina Solar Science & Technology (Thailand) Ltd. ("Trina Solar Thailand"). These firms accounted for approximately *** percent of CSPV cell capacity and *** percent of CSPV module capacity in Thailand in 2020.[42] Table VI-54 and VI-55 present information on the CSPV cell and CSPV modules operations of the responding producers and exporters in Thailand, respectively.

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[41] These firms were identified through a review of information submitted in the petitions and presented in third-party sources.

[42] Talesun, Brochure, April 15, 2021, https://www.talesun.com/en/wp-content/uploads/2020/04/Talesun-Company-Brochure_EN_20210415.pdf; Bellini, Emiliano, "URE Announces Taiwan Factory Disposal," *PV Magazine*, July 17, 2020, https://www.pv-magazine.com/2020/07/17/ure-announces-taiwan-factory-disposal/, retrieved October 4, 2021; Renewables Now, "Neo Solar to Build Up to 600-MW Vietnam PV Factory," May 25, 2016, https://renewablesnow.com/news/neo-solar-to-build-up-to-600-mw-vietnam-pv-factory-526191/, retrieved October 4, 2021; Martin, Jose Rojo, "Jetion's Thailand PV Factory 'Not Affected' So Far by COVID-19," *PV Tech*, March 19, 2020, https://www.pv-tech.org/jetions-thailand-pv-factory-not-affected-so-far-by-covid-19/, retrieved October 4, 2021; IEA PVPS, "National Survey Report of PV Power Applications in Thailand 2018," n.d., p. 16, https://iea-pvps.org/wp-content/uploads/2020/01/NSR_2019_Thailand_draft_Complete.pdf, retrieved October 4, 2021; Solartron Website, https://www.solartron.co.th/english/about, retrieved October 4, 2021; Siam Solar Cell Co., Ltd. Website, http://www.schutten-solar.co.th/index.php?route=content/category&path=5, retrieved October 4, 2021; Astronergy, "The Power of Astrongery," n.d., p. 12, https://powerarksolar.com.au/wp-content/uploads/2018/01/Astronergy-Corporate-Introduction-201706.pdf, retrieved October 4, 2021; Astrongery Website, https://energy.chint.com/en/index.php/about/index.html, retrieved October 4, 2021; Trina Solar, "Trina Solar Chairman Jifan Gao Elaborates on the PV Maker's Continued Steady Growth in 2018," News release, August 27, 2018, https://www.trinasolar.com/en-glb/resources/newsroom/matrina-solar-chairman-jifan-gao-elaborates-pv-makers-continued-steady-growth, retrieved October 4, 2021; Canadian Solar, Form 20-F, Annual Filing to the Securities and Exchange Commission for the Fiscal Year Ended December 31, 2020, p. 34–35, https://investors.canadiansolar.com/static-files/7d8bde9d-6e91-46e0-8f52-ed3f423388cf, retrieved October 4, 2020; Canadian Solar, "Investor Presentation," June 2020, p. 29, https://investors.canadiansolar.com/static-files/ffcd1e9c-d2fe-40d7-b17d-06c288b8cc94, retrieved October 4, 2021.

Table VI-54
CSPV cells: Summary data for producers in Thailand, 2020

Firm	Production (kilowatts)	Share of reported production (percent)	Exports to the United States (kilowatts)	Share of reported exports to the United States (percent)	Total shipments (kilowatts)	Share of firm's total shipments exported to the United States (percent)
Canadian Solar Thailand	***	***	***	***	***	***
Sharp Thailand	***	***	***	***	***	***
Trina Solar Thailand	***	***	***	***	***	***
All firms	***	100.0	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: ***.

Table VI-55
CSPV modules: Summary data for producers in Thailand, 2020

Firm	Production (kilowatts)	Share of reported production (percent)	Exports to the United States (kilowatts)	Share of reported exports to the United States (percent)	Total shipments (kilowatts)	Share of firm's total shipments exported to the United States (percent)
Canadian Solar Thailand	***	***	***	***	***	***
Sharp Thailand	***	***	***	***	***	***
Trina Solar Thailand	***	***	***	***	***	***
All firms	***	100.0	***	100.0	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: ***.

Changes in operations

As presented in table VI-56, producers in Thailand reported several operational and organizational changes since January 1, 2018.

Table VI-56
CSPV products: Reported changes in operations by producers in Thailand, since January 1, 2018

Item	Firm name and accompanying narrative response
Expansions	***
Technology	***

Source: Compiled from data submitted in response to Commission questionnaires.

Operations on CSPV cells

CSPV cell manufacturing capacity in Thailand, according to publicly available data, totaled about 7 GW in 2020. There are at least 7 CSPV cell manufacturers, with the three largest firms (Canadian Solar, Talesun, and Trina Solar) accounting for almost 80 percent of production capacity.[43]

Table VI-57 presents information on the CSPV cell operations of the responding producers in Thailand. During 2018-20 Thai producers' capacity to produce CSPV cells increased by *** percent and was *** percent higher in interim 2021 compared to interim 2020. During 2018-20, Thai producers' production of CSPV cells increased by *** percent and was *** percent higher in interim 2021 compared to interim 2020. During 2018-20, interim 2020, and interim 2021, internal consumption accounted for the largest share of total shipments of CSPV cells (between *** and *** percent).

[43] Source: Talesun, Brochure, April 15, 2021, https://www.talesun.com/en/wp-content/uploads/2020/04/Talesun-Company-Brochure_EN_20210415.pdf, retrieved October 4, 2021; Bellini, Emiliano, "URE Announces Taiwan Factory Disposal," *PV Magazine*, July 17, 2020, https://www.pv-magazine.com/2020/07/17/ure-announces-taiwan-factory-disposal/, retrieved October 4, 2021; *Renewables Now*, "Neo Solar to Build Up to 600-MW Vietnam PV Factory," May 25, 2016, https://renewablesnow.com/news/neo-solar-to-build-up-to-600-mw-vietnam-pv-factory-526191/, retrieved October 4, 2021; Martin, Jose Rojo, "Jetion's Thailand PV Factory 'Not Affected' So Far by COVID-19," *PV Tech*, March 19, 2020, https://www.pv-tech.org/jetions-thailand-pv-factory-not-affected-so-far-by-covid-19/, retrieved October 4, 2021; IEA PVPS, "National Survey Report of PV Power Applications in Thailand 2018," n.d., p. 16, https://iea-pvps.org/wp-content/uploads/2020/01/NSR_2019_Thailand_draft_Complete.pdf, retrieved October 4, 2021; Solartron Website, https://www.solartron.co.th/english/about, retrieved October 4, 2021; Siam Solar Cell Co., Ltd. Website, http://www.schutten-solar.co.th/index.php?route=content/category&path=5, retrieved October 4, 2021; Astronergy, "The Power of Astrongery," n.d., p. 12, https://powerarksolar.com.au/wp-content/uploads/2018/01/Astronergy-Corporate-Introduction-201706.pdf, retrieved October 4, 2021; Astrongery Website, https://energy.chint.com/en/index.php/about/index.html, retrieved October 4, 2021; Trina Solar, " Trina Solar Chairman Jifan GAO Elaborates on the PV Maker's Continued Steady Growth in 2018," News release, August 27, 2018, https://www.trinasolar.com/en-glb/resources/newsroom/matrina-solar-chairman-jifan-gao-elaborates-pv-makers-continued-steady-growth, retrieved October 4, 2021; Canadian Solar, Form 20-F, Annual Filing to the Securities and Exchange Commission for the Fiscal Year Ended December 31, 2020, pp. 34–35, https://investors.canadiansolar.com/static-files/7d8bde9d-6e91-46e0-8f52-ed3f423388cf, retrieved October 4, 2020; Canadian Solar, "Investor Presentation," June 2020, p. 29, https://investors.canadiansolar.com/static-files/ffcd1e9c-d2fe-40d7-b17d-06c288b8cc94, retrieved October 4, 2021.

Table VI-57
CSPV cells: Data on industry in Thailand, by period

Quantity in kilowatts

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity	***	***	***	***	***
Production	***	***	***	***	***
End-of-period inventories	***	***	***	***	***
Internal consumption	***	***	***	***	***
Commercial home market shipments	***	***	***	***	***
Home market shipments	***	***	***	***	***
Exports to the United States	***	***	***	***	***
Exports to Canada	***	***	***	***	***
Exports to Mexico	***	***	***	***	***
Exports to the European Union	***	***	***	***	***
Exports to all other markets	***	***	***	***	***
Export shipments	***	***	***	***	***
Total shipments	***	***	***	***	***

Table continued.

Table VI-57 Continued
CSPV cells: Data on industry in Thailand, by period

Shares and ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity utilization ratio	***	***	***	***	***
Inventory ratio to production	***	***	***	***	***
Inventory ratio to total shipments	***	***	***	***	***
Internal consumption share	***	***	***	***	***
Commercial home market shipments share	***	***	***	***	***
Home market shipments share	***	***	***	***	***
Exports to the United States share	***	***	***	***	***
Exports to Canada share	***	***	***	***	***
Exports to Mexico share	***	***	***	***	***
Exports to the European Union share	***	***	***	***	***
Exports to all other markets share	***	***	***	***	***
Export shipments share	***	***	***	***	***
Total shipments share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Table VI-58 presents data on Thai producers' reported production of CSPV cells by product type: bifacial cells and all other cells. During 2018-19, the majority of CSPV cells produced were all other cells *** percent and *** percent, respectively. In 2020, interim 2020, and interim 2021, over *** percent of CSPV cells produced were bifacial cells.

Table VI-58
CSPV cells: Production in Thailand, by product type and by period

Quantity in kilowatts; shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Bifacial cells	Quantity	***	***	***	***	***
All other cells	Quantity	***	***	***	***	***
All cells	Quantity	***	***	***	***	***
Bifacial cells	Share	***	***	***	***	***
All other cells	Share	***	***	***	***	***
All cells	Share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-59 presents Thai producers reported projections for CSPV cell operations during 2021-23. During 2020-23, Thai producers' capacity and production of CSPV cells are projected to increase by *** percent and by *** percent, respectively.

Table VI-59
CSPV cells: Projected experience of industry in Thailand

Quantity in kilowatts

Item	Projection 2021	Projection 2022	Projection 2023
Capacity	***	***	***
Production	***	***	***
End-of-period inventories	***	***	***
Internal consumption	***	***	***
Commercial home market shipments	***	***	***
Home market shipments	***	***	***
Exports to the United States	***	***	***
Exports to Canada	***	***	***
Exports to Mexico	***	***	***
Exports to the European Union	***	***	***
Exports to all other markets	***	***	***
Export shipments	***	***	***
Total shipments	***	***	***

Table continued.

Table VI-59 Continued
CSPV cells: Projected experience of industry in Thailand

Shares and ratios in percent

Item	Projection 2021	Projection 2022	Projection 2023
Capacity utilization ratio	***	***	***
Inventory ratio to production	***	***	***
Inventory ratio to total shipments	***	***	***
Internal consumption share	***	***	***
Commercial home market shipments share	***	***	***
Home market shipments share	***	***	***
Exports to the United States share	***	***	***
Exports to Canada share	***	***	***
Exports to Mexico share	***	***	***
Exports to the European Union share	***	***	***
Exports to all other markets share	***	***	***
Export shipments share	***	***	***
Total shipments share	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---".

Operations on CSPV modules

CSPV module manufacturing capacity in Thailand (at firms for which production capacity was publicly available) totaled almost 7 GW in 2020. The three largest firms, in terms of annual production capacity, were Canadian Solar, Talesun, and Trina Solar.[44]

Table VI-60 presents information on the CSPV module operations of the responding producers in Thailand. During 2018-20, responding Thai producers' production capacity increased by *** percent. Thai producers' reported capacity was *** percent higher in interim 2021 interim compared to interim 2020.

During 2018-20, Thai producers' CSPV module production increased by *** percent and CSPV module production was *** percent higher in interim 2021 compared to interim 2020. During 2018-20, export shipments to the United States increased by *** percent. In 2018, export shipments to the European Union accounted for the largest share of total shipments (*** percent). During 2019-20, exports to the United States accounted for the largest share of total shipments, *** percent and *** percent, respectively.

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[44] Talesun, Brochure, April 15, 2021, https://www.talesun.com/en/wp-content/uploads/2020/04/Talesun-Company-Brochure_EN_20210415.pdf, retrieved October 4, 2021; Bellini, Emiliano, "URE Announces Taiwan Factory Disposal," *PV Magazine*, July 17, 2020, https://www.pv-magazine.com/2020/07/17/ure-announces-taiwan-factory-disposal/, retrieved October 4, 2021; *Renewables Now*, "Neo Solar to Build Up to 600-MW Vietnam PV Factory," May 25, 2016, https://renewablesnow.com/news/neo-solar-to-build-up-to-600-mw-vietnam-pv-factory-526191/, retrieved October 4, 2021; Martin, Jose Rojo, "Jetion's Thailand PV Factory 'Not Affected' So Far by COVID-19," *PV Tech*, March 19, 2020, https://www.pv-tech.org/jetions-thailand-pv-factory-not-affected-so-far-by-covid-19/, retrieved October 4, 2021; IEA PVPS, *National Survey Report of PV Power Applications in Thailand 2018*, n.d., p. 16, https://iea-pvps.org/wp-content/uploads/2020/01/NSR_2019_Thailand_draft_Complete.pdf, retrieved October 4, 2021; Solartron Website, https://www.solartron.co.th/english/about, retrieved October 4, 2021; Siam Solar Cell Co., Ltd. Website, http://www.schutten-solar.co.th/index.php?route=content/category&path=5, retrieved October 4, 2021; Astronergy, "The Power of Astrongery," n.d., p. 12, https://powerarksolar.com.au/wp-content/uploads/2018/01/Astronergy-Corporate-Introduction-201706.pdf, retrieved October 4, 2021; Astrongery Website, https://energy.chint.com/en/index.php/about/index.html, retrieved October 4, 2021; Trina Solar, " Trina Solar Chairman Jifan GAO Elaborates on the PV Maker's Continued Steady Growth in 2018," News release, August 27, 2018, https://www.trinasolar.com/en-glb/resources/newsroom/matrina-solar-chairman-jifan-gao-elaborates-pv-makers-continued-steady-growth, retrieved October 4, 2021; Canadian Solar, Form 20-F, Annual Filing to the Securities and Exchange Commission for the Fiscal Year Ended December 31, 2020, pp. 34–35, https://investors.canadiansolar.com/static-files/7d8bde9d-6e91-46e0-8f52-ed3f423388cf, retrieved October 4, 2020; Canadian Solar, "Investor Presentation," June 2020, p. 29, https://investors.canadiansolar.com/static-files/ffcd1e9c-d2fe-40d7-b17d-06c288b8cc94, retrieved October 4, 2021.

Table VI-60
CSPV modules: Data on industry in Thailand, by period

Quantity in kilowatts

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity	***	***	***	***	***
Production	***	***	***	***	***
End-of-period inventories	***	***	***	***	***
Internal consumption	***	***	***	***	***
Commercial home market shipments	***	***	***	***	***
Home market shipments	***	***	***	***	***
Exports to the United States	***	***	***	***	***
Exports to Canada	***	***	***	***	***
Exports to Mexico	***	***	***	***	***
Exports to the European Union	***	***	***	***	***
Exports to all other markets	***	***	***	***	***
Export shipments	***	***	***	***	***
Total shipments	***	***	***	***	***

Table continued.

Table VI-60 Continued
CSPV modules: Data on industry in Thailand, by period

Shares and ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity utilization ratio	***	***	***	***	***
Inventory ratio to production	***	***	***	***	***
Inventory ratio to total shipments	***	***	***	***	***
Internal consumption share	***	***	***	***	***
Commercial home market shipments share	***	***	***	***	***
Home market shipments share	***	***	***	***	***
Exports to the United States share	***	***	***	***	***
Exports to Canada share	***	***	***	***	***
Exports to Mexico share	***	***	***	***	***
Exports to the European Union share	***	***	***	***	***
Exports to all other markets share	***	***	***	***	***
Export shipments share	***	***	***	***	***
Total shipments share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-61 presents Thai producers' reported production of CSPV modules using bifacial cells and all other cells. In 2018 the majority of modules were produced using all other cells (*** percent). During 2019-20, interim 2020, and interim 2021, the majority of Thai CSPV modules were produced using bifacial cells.

Table VI-61
CSPV modules: Production in Thailand, by product type and by period

Quantity in kilowatts; shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Modules using bifacial cells	Quantity	***	***	***	***	***
Modules using all other cells	Quantity	***	***	***	***	***
Modules using all cells	Quantity	***	***	***	***	***
Modules using bifacial cells	Share	***	***	***	***	***
Modules using all other cells	Share	***	***	***	***	***
Modules using all cells	Share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-62 presents Thai producers' reported projections for CSPV module operations during 2021-23. During 2020-23, Thai producers' capacity and production of CSPV modules are projected to increase by *** percent and by *** percent, respectively.

Table VI-62
CSPV modules: Projected experience of industry in Thailand

Quantity in kilowatts

Item	Projection 2021	Projection 2022	Projection 2023
Capacity	***	***	***
Production	***	***	***
End-of-period inventories	***	***	***
Internal consumption	***	***	***
Commercial home market shipments	***	***	***
Home market shipments	***	***	***
Exports to the United States	***	***	***
Exports to Canada	***	***	***
Exports to Mexico	***	***	***
Exports to the European Union	***	***	***
Exports to all other markets	***	***	***
Export shipments	***	***	***
Total shipments	***	***	***

Table continued.

Table VI-62 Continued
CSPV modules: Projected experience of industry in Thailand

Shares and ratios in percent

Item	Projection 2021	Projection 2022	Projection 2023
Capacity utilization ratio	***	***	***
Inventory ratio to production	***	***	***
Inventory ratio to total shipments	***	***	***
Internal consumption share	***	***	***
Commercial home market shipments share	***	***	***
Home market shipments share	***	***	***
Exports to the United States share	***	***	***
Exports to Canada share	***	***	***
Exports to Mexico share	***	***	***
Exports to the European Union share	***	***	***
Exports to all other markets share	***	***	***
Export shipments share	***	***	***
Total shipments share	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Alternative products

Responding Thai producers *** report the production of other products on the same machinery used to produce CSPV products.

Exports

According to GTA, the leading export markets for CSPV products from Thailand are the United States, Vietnam, and China (table VI-63). During 2020, the United States was the top export market for CSPV products from Thailand, accounting for 74.6 percent, followed by Vietnam, accounting for 12.7 percent.

Table VI-63
CSPV products: Exports from Thailand, by period

Value in 1,000 dollars; shares in percent

Destination market	Measure	2018	2019	2020
United States	Value	103,195	437,368	933,992
Vietnam	Value	73,722	103,104	158,872
China	Value	109,347	54,602	40,006
Netherlands	Value	142,780	30,568	32,181
Brazil	Value	14,127	---	27,623
India	Value	48,925	122,032	20,637
France	Value	8,237	479	10,783
Turkey	Value	4,026	---	9,730
Canada	Value	28,250	37,442	7,140
All other destination markets	Value	212,795	44,322	10,564
All destination markets	Value	745,404	829,917	1,251,529
United States	Share of value	13.8	52.7	74.6
Vietnam	Share of value	9.9	12.4	12.7
China	Share of value	14.7	6.6	3.2
Netherlands	Share of value	19.2	3.7	2.6
Brazil	Share of value	1.9	---	2.2
India	Share of value	6.6	14.7	1.6
France	Share of value	1.1	0.1	0.9
Turkey	Share of value	0.5	---	0.8
Canada	Share of value	3.8	4.5	0.6
All other destination markets	Share of value	28.5	5.3	0.8
All destination markets	Share of value	100.0	100.0	100.0

Source: Official exports statistics under HS subheading 8541.09.0001 and 8541.02.2000 as reported by Thai Customs Department in the Global Trade Atlas database, accessed September 13, 2021.

Note: Share of value is the share of total exports by value. United States is shown at the top. All remaining top export destinations are shown in descending order of 2020 data.

The industry in Vietnam

The Commission issued foreign producers' or exporters' questionnaires to 29 firms believed to produce and/or export CSPV products from Vietnam.[45] Usable responses to the Commission's questionnaire were received from six firms: Canadian Solar Manufacturing Vietnam Co., Ltd. ("Canadian Solar Vietnam"), Irex Energy Joint Stock Company ("Irex"), Red Sun Energy Long An Company Limited ("Red Sun"), Trina Solar (Vietnam) Science & Technology Co., Ltd ("Trina Solar Vietnam"), Vietnergy Co., Ltd. ("Vietnergy"), and Vina Solar Technology CO., LTD. ("Vina Solar"). These firms accounted for approximately *** percent of CSPV cell capacity and *** percent of CSPV module capacity in Vietnam in 2020.[46] Table VI-64 and VI-65 present information on the CSPV cell and CSPV modules operations of the responding producers and exporters in Vietnam, respectively.

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[45] These firms were identified through a review of information submitted in the petitions and presented in third-party sources.

[46] Renewables Now, "Neo Solar to Build Up to 600-MW Vietnam PV Factory," May 25, 2016, https://renewablesnow.com/news/neo-solar-to-build-up-to-600-mw-vietnam-pv-factory-526191/, retrieved October 4, 2021; Trina Solar, "Trina Solar Chairman Jifan Gao Elaborates on the PV Maker's Continued Steady Growth in 2018," News release, August 27, 2018, https://www.trinasolar.com/en-glb/resources/newsroom/matrina-solar-chairman-jifan-gao-elaborates-pv-makers-continued-steady-growth, retrieved October 4, 2021; Boviet Solar Website, https://www.boviet.com/, retrieved October 4, 2021; IREX Website, https://irex.vn/en/, retrieved October 4, 2021; Dehui Website, https://www.dehui-technology.com, retrieved October 4, 2021; Vietnam Green Energy Solar Website, https://greenenergysolar.vn/about-us/, retrieved October 4, 2021; CSPV first review publication, p. IV-33; Canadian Solar, "Investor Presentation," June 2020, p. 29, https://investors.canadiansolar.com/static-files/ffcd1e9c-d2fe-40d7-b17d-06c288b8cc94, retrieved October 4, 2021; Osborne, Mark, "Canadian Solar to partner on 60MW module plant in Indonesia," PV Tech, September 2, 2013, https://www.pv-tech.org/canadian_solar_to_partner_on_60mw_module_plant_in_indonesia/, retrieved October 4, 2021; Canadian Solar, Sustainability Report 2018, p. 14, https://www.canadiansolar.com/solar-sustainability/, retrieved October 4, 2021; Osborne, Mark, "Longi Details Plans for Vina Solar after Recent Acquisition Deal," *PV Tech*, https://www.pv-tech.org/longi-details-plans-for-after-vina-solar-acquisition/, retrieved October 4, 2021; VSUN brochure, 2020, https://www.vsun-solar.com/uploadfiles/2020/10/20201010153704478.pdf, retrieved October 4, 2021; Viet Nam Green Energy Technology Facebook, https://www.facebook.com/VGE.technology/, retrieved October 5, 2021; Venergy Solar Facebook, https://www.facebook.com/VenergySolar/, retrieved October 5, 2021; Shengtian New Energy Vina Website, https://snevn.com/, retrieved October 5, 2021; *PV Magazine*, "ET Solar: Switching Directions with New Manufacturing Strategy," July 30, 2019, https://www.pv-magazine.com/2019/07/30/et-solar-switching-directions-with-new-manufacturing-strategy/, retrieved October 5, 2021; Gouras, Eckhart, "Phono Solar: Module Factories in the US and South America on the Horizon," *PV Magazine*, March 28, 2019, https://www.pv-magazine.com/2019/03/28/phono-solar-module-factories-in-the-us-and-south-america-on-the-horizon/, retrieved October 5, 2021; Allesun Website, https://www.allesun.com/index.php?s=/About/about.html, retrieved October 5, 2021.

Table VI-64
CSPV cells: Summary data for producers in Vietnam, 2020

Firm	Production (kilowatts)	Share of reported production (percent)	Exports to the United States (kilowatts)	Share of reported exports to the United States (percent)	Total shipments (kilowatts)	Share of firm's total shipments exported to the United States (percent)
Canadian Solar Vietnam	***	***	***	***	***	***
Irex	***	***	***	***	***	***
Red Sun	***	***	***	***	***	***
Trina Solar Vietnam	***	***	***	***	***	***
Vietnergy	***	***	***	***	***	***
Vina Solar	***	***	***	***	***	***
All firms	5,403,834	100.0	***	100.0	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-65
CSPV modules: Summary data for producers in Vietnam, 2020

Firm	Production (kilowatts)	Share of reported production (percent)	Exports to the United States (kilowatts)	Share of reported exports to the United States (percent)	Total shipments (kilowatts)	Share of firm's total shipments exported to the United States (percent)
Canadian Solar Vietnam	***	***	***	***	***	***
Irex	***	***	***	***	***	***
Red Sun	***	***	***	***	***	***
Trina Solar Vietnam	***	***	***	***	***	***
Vietnergy	***	***	***	***	***	***
Vina Solar	***	***	***	***	***	***
All firms	***	100.0	***	100.0	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Changes in operations

As presented in table VI-66, producers in Vietnam reported several operational and organizational changes since January 1, 2018.

Table VI-66
CSPV products: Reported changes in operations by producers in Vietnam, since January 1, 2018

Item	Firm name and accompanying narrative response
Plant openings	***
Relocations	***
Expansions	***
Expansions	***
Expansions	***
Expansions	***
Prolonged shutdowns or curtailments	***
Revised labor agreements	***
Technology	***
Technology	***

Source: Compiled from data submitted in response to Commission questionnaires.

Operations on CSPV cells

CSPV cell production capacity in Vietnam totaled more than 12 GW in 2020, according to publicly available data. There were three firms with at least 1 GW in annual cell production capacity, Vina Solar, Boviet Solar, and Trina Solar.[47] There are several additional investments in cell production that have come online or been announced. In May 2021, Canadian Solar opened a new plant in Vietnam with 3 GW of annual cell production capacity.[48] In September 2020, JA

[47] *Renewables Now*, "Neo Solar to Build Up to 600-MW Vietnam PV Factory," May 25, 2016, https://renewablesnow.com/news/neo-solar-to-build-up-to-600-mw-vietnam-pv-factory-526191/, retrieved October 4, 2021; Trina Solar, "Trina Solar Chairman Jifan GAO Elaborates on the PV Maker's Continued Steady Growth in 2018," News release, August 27, 2018, https://www.trinasolar.com/en-glb/resources/newsroom/matrina-solar-chairman-jifan-gao-elaborates-pv-makers-continued-steady-growth, retrieved October 4, 2021; Boviet Solar Website, https://www.boviet.com/, retrieved October 4, 2021; IREX Website, https://irex.vn/en /, retrieved October 4, 2021; Dehui Website, https://www.dehui-technology.com, retrieved October 4, 2021; Vietnam Green Energy Solar Website, https://greenenergysolar.vn/about-us/, retrieved October 4, 2021; CSPV first review publication, p. IV-33; Canadian Solar, "Investor Presentation," June 2020, p. 29, https://investors.canadiansolar.com/static-files/ffcd1e9c-d2fe-40d7-b17d-06c288b8cc94, retrieved October 4, 2021; Osborne, Mark, " Canadian Solar to Partner on 60MW Module Plant in Indonesia," *PV Tech*, September 2, 2013, https://www.pv-tech.org/canadian_solar_to_partner_on_60mw_module_plant_in_indonesia/, retrieved October 4, 2021; Canadian Solar, *Sustainability Report 2018*, p. 14, https://www.canadiansolar.com/solar-sustainability/, retrieved October 4, 2021; Osborne, Mark, "Longi Details Plans for Vina Solar after Recent Acquisition Deal," *PV Tech*, https://www.pv-tech.org/longi-details-plans-for-after-vina-solar-acquisition/, retrieved October 4, 2021; VSUN brochure, 2020, https://www.vsun-solar.com/uploadfiles/2020/10/20201010153704478.pdf, retrieved October 4, 2021; Viet Nam Green Energy Technology, https://www.facebook.com/VGE.technology/, retrieved October 5, 2021; Venergy Solar, https://www.facebook.com/VenergySolar/, retrieved October 5, 2021; Shengtian New Energy Vina Website, https://snevn.com/, retrieved October 5, 2021; *PV Magazine*, "ET Solar: Switching Directions with New Manufacturing Strategy," July 30, 2019, https://www.pv-magazine.com/2019/07/30/et-solar-switching-directions-with-new-manufacturing-strategy/, retrieved October 5, 2021; Gouras, Eckhart, "Phono Solar: Module Factories in the US and South America on the Horizon," *PV Magazine*, March 28, 2019, https://www.pv-magazine.com/2019/03/28/phono-solar-module-factories-in-the-us-and-south-america-on-the-horizon/, retrieved October 5, 2021; Allesun Website, https://www.allesun.com/index.php?s=/About/about.html, retrieved October 5, 2021.

[48] Pickerel, Kelly, "Trina Solar's Vertex Modules Are First Using 210-MM Wafer to Enter North American Market," *Solar Power World*, May 21, 2021, https://www.solarpowerworldonline.com/2021/05/trina-solars-vertex-modules-are-first-using-210-mm-wafer-to-enter-north-american-market/, retrieved October 4, 2021.

Solar announced that it would add 3.5 GW in cell production capacity in Vietnam.[49] In January 2021, VSUN announced plans to open a new 2 GW cell module plant in 2022.[50]

Table VI-67 presents information on the CSPV cell operations of the responding producers in Vietnam. During 2018-20 Vietnamese producers' capacity to produce CSPV cells increased by 80.2 percent and was 36.0 percent higher in interim 2021 compared to interim 2020. During 2018-20, Vietnamese producers' production of CSPV cells increased by 115.3 percent and production was 11.5 percent higher in interim 2021 compared to interim 2020. During 2018-20, interim 2020, and interim 2021 home market shipments accounted for the largest share of total shipments of CSPV cells. During 2018-20, exports of CSPV cells from Vietnam to the United States increased by *** percent. During 2018-20 exports of CSPV cells to the United States accounted for less than *** percent of total shipments.

[49] Bhambhani, Anu, "JA Solar To Expand Vertical Integrated Production Capacity Of Ingot, Wafer, Solar Cell & Modules For RMB 10.39 Billion Investment," *Taiyang News*, September 17, 2020, http://taiyangnews.info/business/ja-solar-to-expand-capacity-for-rmb-10-39-billion/, retrieved October 5, 2021.

[50] Bellini, Emiliano, "VSUN to Build 4 GW Panel Factory in Vietnam," *PV Magazine*, January 4, 2021, https://www.pv-magazine.com/2021/01/04/vsun-to-build-4-gw-panel-factory-in-vietnam/, retrieved October 4, 2021.

Table VI-67
CSPV cells: Data on industry in Vietnam, by period

Quantity in kilowatts

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity	3,063,042	3,667,990	5,520,446	2,470,743	3,360,156
Production	2,510,091	3,452,819	5,403,834	2,376,258	2,649,150
End-of-period inventories	***	***	***	***	***
Internal consumption	***	***	***	***	***
Commercial home market shipments	***	***	***	***	***
Home market shipments	***	***	***	***	***
Exports to the United States	***	***	***	***	***
Exports to Canada	***	***	***	***	***
Exports to Mexico	***	***	***	***	***
Exports to the European Union	***	***	***	***	***
Exports to all other markets	***	***	***	***	***
Export shipments	***	***	***	***	***
Total shipments	2,533,632	3,396,751	5,368,971	2,352,453	2,598,983

Table continued.

Table VI-67 Continued
CSPV cells: Data on industry in Vietnam, by period

Shares and ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity utilization ratio	81.9	94.1	97.9	96.2	78.8
Inventory ratio to production	***	***	***	***	***
Inventory ratio to total shipments	***	***	***	***	***
Internal consumption share	***	***	***	***	***
Commercial home market shipments share	***	***	***	***	***
Home market shipments share	***	***	***	***	***
Exports to the United States share	***	***	***	***	***
Exports to Canada share	***	***	***	***	***
Exports to Mexico share	***	***	***	***	***
Exports to the European Union share	***	***	***	***	***
Exports to all other markets share	***	***	***	***	***
Export shipments share	***	***	***	***	***
Total shipments share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Table VI-68 presents data on Vietnamese producers' reported production of CSPV cells by product type: bifacial cells and all other cells. During 2018-19, the majority of CSPV cells produced were all other cells (*** percent and *** percent, respectively). In 2020, the majority of CSPV cells produced were bifacial cells (*** percent). In interim 2021 the majority of CSPV cells produced were bifacial cells (*** percent), meanwhile in interim 2020 the majority of CSPV cells produced were all other (*** percent).

Table VI-68
CSPV cells: Production in Vietnam, by product type and by period

Quantity in kilowatts; shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Bifacial cells	Quantity	***	***	***	***	***
All other cells	Quantity	***	***	***	***	***
All cells	Quantity	***	***	***	***	***
Bifacial cells	Share	***	***	***	***	***
All other cells	Share	***	***	***	***	***
All cells	Share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-69 presents Vietnamese producers reported projections for CSPV cell operations during 2021-23. During 2020-23, Vietnamese producers' capacity and production of CSPV cells are projected to increase by 60.6 percent and by 62.0 percent, respectively.

Table VI-69
CSPV cells: Projected experience of industry in Vietnam

Quantity in kilowatts

Item	Projection 2021	Projection 2022	Projection 2023
Capacity	8,541,418	8,864,571	8,864,571
Production	7,384,970	8,721,872	8,751,872
End-of-period inventories	***	***	***
Internal consumption	***	***	***
Commercial home market shipments	***	***	***
Home market shipments	***	***	***
Exports to the United States	***	***	***
Exports to Canada	***	***	***
Exports to Mexico	***	***	***
Exports to the European Union	***	***	***
Exports to all other markets	***	***	***
Export shipments	***	***	***
Total shipments	7,426,678	8,721,872	8,751,872

Table continued.

Table VI-69 Continued
CSPV cells: Projected experience of industry in Vietnam

Shares and ratios in percent

Item	Projection 2021	Projection 2022	Projection 2023
Capacity utilization ratio	86.5	98.4	98.7
Inventory ratio to production	***	***	***
Inventory ratio to total shipments	***	***	***
Internal consumption share	***	***	***
Commercial home market shipments share	***	***	***
Home market shipments share	***	***	***
Exports to the United States share	***	***	***
Exports to Canada share	***	***	***
Exports to Mexico share	***	***	***
Exports to the European Union share	***	***	***
Exports to all other markets share	***	***	***
Export shipments share	***	***	***
Total shipments share	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---".

Operations on CSPV modules

There was more than 20 GW in module production capacity in Vietnam in 2020, according to publicly available data, with at least seven firms with 1 GW or more in annual production capacity (Vina Solar, Dehui Solar, VSUN, Boviet Solar, Green Wing Solar, HT Solar, and Beyondsun).[51] Several firms have announced investments in new production capacity. In May 2021, Canadian Solar opened a new plant in Vietnam with 4.5 GW of annual module production capacity.[52] In December 2020, Seraphim announced plans to open a new 750 MW module plant in Vietnam.[53] In January 2021, VSUN announced plans to open a new 4 GW

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[51] *Renewables Now*, "Neo Solar to Build Up to 600-MW Vietnam PV Factory," May 25, 2016, https://renewablesnow.com/news/neo-solar-to-build-up-to-600-mw-vietnam-pv-factory-526191/, retrieved October 4, 2021; Trina Solar, " Trina Solar Chairman Jifan GAO Elaborates on the PV Maker's Continued Steady Growth in 2018," News release, August 27, 2018, https://www.trinasolar.com/en-glb/resources/newsroom/matrina-solar-chairman-jifan-gao-elaborates-pv-makers-continued-steady-growth, retrieved October 4, 2021; Boviet Solar Website, https://www.boviet.com/, retrieved October 4, 2021; IREX Website, https://irex.vn/en /, retrieved October 4, 2021; Dehui Website, https://www.dehui-technology.com, retrieved October 4, 2021; Vietnam Green Energy Solar Website, https://greenenergysolar.vn/about-us/, retrieved October 4, 2021; CSPV first review publication, p. IV-33; Canadian Solar, "Investor Presentation," June 2020, p. 29, https://investors.canadiansolar.com/static-files/ffcd1e9c-d2fe-40d7-b17d-06c288b8cc94, retrieved October 4, 2021; Osborne, Mark, " Canadian Solar to Partner on 60MW Module Plant in Indonesia," *PV Tech*, September 2, 2013, https://www.pv-tech.org/canadian_solar_to_partner_on_60mw_module_plant_in_indonesia/, retrieved October 4, 2021; Canadian Solar, *Sustainability Report 2018*, p. 14, https://www.canadiansolar.com/solar-sustainability/, retrieved October 4, 2021; Osborne, Mark, "Longi Details Plans for Vina Solar after Recent Acquisition Deal," *PV Tech*, https://www.pv-tech.org/longi-details-plans-for-after-vina-solar-acquisition/, retrieved October 4, 2021; VSUN brochure, 2020, https://www.vsun-solar.com/uploadfiles/2020/10/20201010153704478.pdf, retrieved October 4, 2021; Viet Nam Green Energy Technology Facebook, https://www.facebook.com/VGE.technology/, retrieved October 5, 2021; Venergy Solar Facebook, https://www.facebook.com/VenergySolar/, retrieved October 5, 2021; Shengtian New Energy Vina Website, https://snevn.com/, retrieved October 5, 2021; PV Magazine, "ET Solar: Switching Directions with New Manufacturing Strategy," July 30, 2019, https://www.pv-magazine.com/2019/07/30/et-solar-switching-directions-with-new-manufacturing-strategy/, retrieved October 5, 2021; Gouras, Eckhart, "Phono Solar: Module Factories in the US and South America on the Horizon," *PV Magazine*, March 28, 2019, https://www.pv-magazine.com/2019/03/28/phono-solar-module-factories-in-the-us-and-south-america-on-the-horizon/, retrieved October 5, 2021; Allesun Website, https://www.allesun.com/index.php?s=/About/about.html, retrieved October 5, 2021.

[52] Pickerel, Kelly, "Trina Solar's Vertex Modules Are First Using 210-MM Wafer to Enter North American Market," Solar Power World, May 21, 2021, https://www.solarpowerworldonline.com/2021/05/trina-solars-vertex-modules-are-first-using-210-mm-wafer-to-enter-north-american-market/, retrieved October 4, 2021.

[53] Gupta, Anand, "Seraphim to Open 750-MW Solar Module Factory in Vietnam," *EQ International*, December 11, 2020, https://www.eqmagpro.com/seraphim-to-open-750-mw-solar-module-factory-in-vietnam/, retrieved October 4, 2020.

module plant in 2022.[54] In November 2020, JA Solar broke ground on a new 3.5 GW module plant in Vietnam.[55] Shengtian New Energy Vina Co. is adding 800 MW of module production capacity.[56]

Table VI-70 presents information on the CSPV module operations of the responding producers in Vietnam. During 2018-20, responding Vietnamese producers' production capacity increased by *** percent. Vietnamese producers' reported capacity was *** percent higher in interim 2021 interim compared to interim 2020.

During 2018-20, Vietnamese producers' CSPV module production increased by *** percent and was *** percent higher in interim 2021 compared to interim 2020. During 2018-20, export shipments to the United States increased by *** percent. Exports to the United States accounted for the largest share of total shipments in every period except for 2018. In 2018, export shipments to Mexico accounted for the largest share of total shipments (*** percent).

[54] Bellini, Emiliano, "VSUN to Build 4 GW Panel Factory in Vietnam," PV Magazine, January 4, 2021, https://www.pv-magazine.com/2021/01/04/vsun-to-build-4-gw-panel-factory-in-vietnam/, retrieved October 4, 2021.

[55] JA Solar, "JA Solar Holds Groundbreaking Ceremony for Its 3.5GW High-Power Module Project in Vietnam," November 13, 2020, https://www.jasolar.com/index.php?m=content&c=index&a=show&catid=399&id=88, retrieved October 4, 2021.

[56] Shengtian New Energy Vina Co. Ltd. Website, https://snevn.com/, retrieved October 5, 2021.

Table VI-70
CSPV modules: Data on industry in Vietnam, by period

Quantity in kilowatts

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity	***	***	***	***	***
Production	***	***	***	***	***
End-of-period inventories	***	***	***	***	***
Internal consumption	***	***	***	***	***
Commercial home market shipments	***	***	***	***	***
Home market shipments	***	***	***	***	***
Exports to the United States	***	***	***	***	***
Exports to Canada	***	***	***	***	***
Exports to Mexico	***	***	***	***	***
Exports to the European Union	***	***	***	***	***
Exports to all other markets	***	***	***	***	***
Export shipments	***	***	***	***	***
Total shipments	***	***	***	***	***

Table continued.

Table VI-70 Continued
CSPV modules: Data on industry in Vietnam, by period

Shares and ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity utilization ratio	***	***	***	***	***
Inventory ratio to production	***	***	***	***	***
Inventory ratio to total shipments	***	***	***	***	***
Internal consumption share	***	***	***	***	***
Commercial home market shipments share	***	***	***	***	***
Home market shipments share	***	***	***	***	***
Exports to the United States share	***	***	***	***	***
Exports to Canada share	***	***	***	***	***
Exports to Mexico share	***	***	***	***	***
Exports to the European Union share	***	***	***	***	***
Exports to all other markets share	***	***	***	***	***
Export shipments share	***	***	***	***	***
Total shipments share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-71 presents Vietnamese producers' reported production of CSPV modules using bifacial cells and all other cells. During 2018-19, the majority of CSPV modules were produced using other cells (*** percent and *** percent, respectively). In 2020, the majority of CSPV modules were produced using bifacial cells (*** percent).

Table VI-71
CSPV modules: Production in Vietnam, by product type and by period

Quantity in kilowatts; shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Modules using bifacial cells	Quantity	***	***	***	***	***
Modules using all other cells	Quantity	***	***	***	***	***
Modules using all cells	Quantity	***	***	***	***	***
Modules using bifacial cells	Share	***	***	***	***	***
Modules using all other cells	Share	***	***	***	***	***
Modules using all cells	Share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-72 presents Vietnamese producers' reported projections for CSPV module operations during 2021-23. During 2020-23, Vietnamese producers' capacity and production of CSPV modules are projected to increase by *** percent and by *** percent, respectively.

Table VI-72
CSPV modules: Projected experience of industry in Vietnam

Quantity in kilowatts

Item	Projection 2021	Projection 2022	Projection 2023
Capacity	***	***	***
Production	***	***	***
End-of-period inventories	***	***	***
Internal consumption	***	***	***
Commercial home market shipments	***	***	***
Home market shipments	***	***	***
Exports to the United States	***	***	***
Exports to Canada	***	***	***
Exports to Mexico	***	***	***
Exports to the European Union	***	***	***
Exports to all other markets	***	***	***
Export shipments	***	***	***
Total shipments	***	***	***

Table continued.

Table VI-72 Continued
CSPV modules: Projected experience of industry in Vietnam

Shares and ratios in percent

Item	Projection 2021	Projection 2022	Projection 2023
Capacity utilization ratio	***	***	***
Inventory ratio to production	***	***	***
Inventory ratio to total shipments	***	***	***
Internal consumption share	***	***	***
Commercial home market shipments share	***	***	***
Home market shipments share	***	***	***
Exports to the United States share	***	***	***
Exports to Canada share	***	***	***
Exports to Mexico share	***	***	***
Exports to the European Union share	***	***	***
Exports to all other markets share	***	***	***
Export shipments share	***	***	***
Total shipments share	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---".

Alternative products

Responding Vietnamese producers *** report the production of other products on the same machinery used to produce CSPV products.

Exports

According to GTA, the leading export markets for CSPV products from Vietnam are the United States, China, and Korea (table VI-73). During 2020, the United States was the top export market for CSPV products from Vietnam, accounting for 77.2 percent, followed by China, accounting for 4.9 percent.

Table VI-73
CSPV products: Exports from Vietnam, by period

Value in 1,000 dollars; shares in percent

Source	Measure	2018	2019	2020
United States	Value	372,188	1,642,546	2,386,628
China	Value	169,567	99,293	150,402
South Korea	Value	112,566	103,536	131,830
Canada	Value	20,403	39,078	122,401
Japan	Value	42,127	82,876	84,778
Thailand	Value	34,103	15,707	51,923
Netherlands	Value	349,678	69,377	30,323
India	Value	54,948	171,910	25,615
Israel	Value	1	7,923	25,029
All other destination markets	Value	307,141	161,031	84,418
All destination markets	Value	1,462,723	2,393,278	3,093,347
United States	Share of value	25.4	68.6	77.2
China	Share of value	11.6	4.1	4.9
South Korea	Share of value	7.7	4.3	4.3
Canada	Share of value	1.4	1.6	4.0
Japan	Share of value	2.9	3.5	2.7
Thailand	Share of value	2.3	0.7	1.7
Netherlands	Share of value	23.9	2.9	1.0
India	Share of value	3.8	7.2	0.8
Israel	Share of value	0.0	0.3	0.8
All other destination markets	Share of value	21.0	6.7	2.7
All destination markets	Share of value	100.0	100.0	100.0

Source: Official imports statistics of imports from Vietnam (constructed export statistics for Vietnam) under HS subheading 8541.40 as reported by various statistical reporting authorities in the Global Trade Atlas database, accessed September 13, 2021.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Share of value is the share of total exports by value. United States is shown at the top, all remaining top export destinations shown in descending order of 2020 data. These data may be overstated as HS statistical reporting number 8541.40 may contain products outside the scope of this investigation including photosensitive semiconductor devices and light-emitting diodes.

The industry in other countries

The Commission issued foreign producers' or exporters' questionnaires to 214 firms believed to produce and/or export CSPV products from all other countries.[57] Usable responses to the Commission's questionnaire were received from thirteen firms: EEPV Corp. ("EEPV"), EMMVEE Photovoltaic Power Private Limited ("EMMVEE"), Jinkosolar Investment Limited ("Jinko Hong Kong"), New East, PT Len Industri (Persero) ("PT Len Indonesia"), PT Wijaya Karya Industri Energi ("PT Wijaya Indonesia"), Sharp Electronics GmbH ("Sharp Germany"), Sino-American Silicon Products Inc. ("Sino-American Silicon"), Sun Power Manufacturing de Vernejoul SAS, Sun Power Philippines Manufacturing Limited ("Sun Power Philippines"), Udhaya Energy Photovoltaics Private Limited ("Udhaya"), United Renewable Energy Co., Ltd. ("United"), and Win Win Precision Technology Co., Ltd. ("Win Win").[58] These firms accounted for approximately *** percent of CSPV cell capacity and *** percent of CSPV module capacity in other countries in 2020.[59] Table VI-74 and VI-75 present information on the CSPV cell and CSPV modules operations of the responding producers and exporters in all other countries, respectively.

[57] These firms were identified through a review of information submitted in the petitions and presented in third-party sources.

[58] *** submitted a questionnaire response ***. This questionnaire was not included in the dataset due to underlying data issues.

[59] Compiled from publicly available data and industry data from ***.

Table VI-74
CSPV cells: Summary data for producers in all other countries, 2020

Firm	Country	Production (kilowatts)	Share of reported production (percent)	Exports to the United States (kilowatts)	Share of reported exports to the United States (percent)	Total shipments (kilowatts)	Share of firm's total shipments exported to the United States (percent)
EEPV	Taiwan	***	***	***	***	***	***
EMMVEE	India	***	***	***	***	***	***
Jinkosolar Hong Kong	Hong Kong	***	***	***	***	***	***
New East	Cambodia	***	***	***	***	***	***
PT Len Indonesia	Indonesia	***	***	***	***	***	***
PT Wijaya Indonesia	Indonesia	***	***	***	***	***	***
Sharp Germany	Germany	***	***	***	***	***	***
Sino-American	Taiwan	***	***	***	***	***	***
Sun Power France	France	***	***	***	***	***	***
Sun Power Philippines	Philippines	***	***	***	***	***	***
Udhaya	India	***	***	***	***	***	***
United	Taiwan	***	***	***	***	***	***
Win Win	Taiwan	***	***	***	***	***	***
All firms	Various	1,744,924	100.0	***	100.0	1,764,079	***

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-75
CSPV modules: Summary data for producers in all other countries, 2020

Firm	Country	Production (kilowatts)	Share of reported production (percent)	Exports to the United States (kilowatts)	Share of reported exports to the United States (percent)	Total shipments (kilowatts)	Share of firm's total shipments exported to the United States (percent)
EEPV	Taiwan	***	***	***	***	***	***
EMMVEE	India	***	***	***	***	***	***
Jinkosolar Hong Kong	Hong Kong	***	***	***	***	***	***
New East	Cambodia	***	***	***	***	***	***
PT Len Indonesia	Indonesia	***	***	***	***	***	***
PT Wijaya Indonesia	Indonesia	***	***	***	***	***	***
Sharp Germany	Germany	***	***	***	***	***	***
Sino-American	Taiwan	***	***	***	***	***	***
Sun Power France	France	***	***	***	***	***	***
Sun Power Philippines	Philippines	***	***	***	***	***	***
Udhaya	India	***	***	***	***	***	***
United	Taiwan	***	***	***	***	***	***
Win Win	Taiwan	***	***	***	***	***	***
All firms	Various	1,126,838	100.0	***	100.0	1,090,402	***

Source: Compiled from data submitted in response to Commission questionnaires.

Changes in operations

As presented in table VI-76 producers in other countries reported several operational and organizational changes since January 1, 2018.

Table VI-76
CSPV products: Reported changes in operations by producers in all other countries, since January 1, 2018

Item	Firm name and reported change in operations
Plant openings	***
Plant closings	***
Plant closings	***
Plant closings	***
Expansions	***
Acquisitions	***
Prolonged shutdowns or curtailments	***
Technology	***
Technology	***
Technology	***
Technology	***
Other	***
Other	***

Source: Compiled from data submitted in response to Commission questionnaires.

Operations on CSPV cells

CSPV cell production capacity in all other countries totaled *** in 2020, with Taiwan accounting for *** percent, Cambodia for *** percent, and India for *** percent.[60] Taiwan's PV production capacity, including out of scope thin film products, *** from *** in 2018 to *** in 2020.[61] ***, a number of countries are experiencing significant growth in production capacity.[62] For the four firms in Cambodia for which information was available, production capacity reached 2.8 GW in 2020, with New East Solar in the process of further expanding capacity.[63] In Indonesia, CSPV cell production capacity totaled 100 MW prior to 2020. However, Suntech opened a 1 GW CSPV cell plant in 2020, Sky Energy Indonesia planned to bring a new 100 MW CSPV cell plant online in 2021, and Jolywood announced, in April 2021, plans to open a 1 GW CSPV cell plant in Indonesia.[64] In India, a number of firms were planning significant expansions in their cell manufacturing plants as of June 2021.[65] In France, REC is considering investing in a 2 GW CSPV cell plant in France and in

[60] Compiled from publicly available data and industry data from ***.

[61] ***.

[62] This section will provide examples of countries where CSPV cell production capacity is significantly expanding, but will not comprehensively cover all such countries.

[63] Ningbo HERTZ Optoelectronic Tech. Co., Ltd. Website, http://www.hertzpv.com/en/about.php, retrieved September 7, 2021; *PV Magazine*, "Statement from ET Solar Hong Kong--Taitong Has Nothing to Do with Solar Module Business," February 7, 2020, https://www.pv-magazine.com/2019/07/30/et-solar-switching-directions-with-new-manufacturing-strategy/, October 8, 2021; New East Solar, "Company Profile," October 20, 2020, https://www.youtube.com/watch?v=Kob_Ee7ohiI, retrieved October 8, 2021; New East Solar, "Third Phase of the Phnom Penh Plant in Cambodia," May 28, 2021, http://www.nesolar.com.kh/?content/142, retrieved October 8, 2021; Imperial Star Website, www.imperialstar.biz/about.html, retrieved October 27, 2021.

[64] Suntech, "Suntech Announced 500 MW PV Cell and Module Capacity in Indonesia, to Enhance US Market Coverage," September 18, 2020, https://www.suntech-power.com/suntech-announced-500-mw-pv-cell-and-module-capacity-in-indonesia-to-enhance-us-market-coverage/, retrieved October 8, 2020; PT Sky Energy Indonesia, *Annual Report 2019*, n.d., p. 37, https://www.sky-energy.co.id/wp-content/uploads/2020/08/JSKY_Annual_Report_2019.pdf, retrieved October 8, 2020; PT Sky Energy Indonesia, *Annual Report 2020*, n.d., p. 83, https://www.sky-energy.co.id/wp-content/uploads/2021/06/JSKY_Annual_Report_2020.pdf, retrieved October 8, 2020; Shaw, Vincent, "Jolywood Plans New Indonesian Fab," PV Magazine, April 12, 2021, https://www.pv-magazine.com/2021/04/12/jolywood-plans-new-indonesian-fab/, retrieved October 8, 2021.

[65] Rajshekar, M., "The Fall and Rise of Solar Costs in India," *The Wire*, June 24, 2021, https://thewire.in/energy/the-fall-and-rise-of-solar-costs-in-india, retrieved October 7, 2021.

Germany Meyer Burger opened a 400 MW CSPV cell plant in May 2021 and Oxford PV had finished installing most tools in its 100 MW CSPV cell plant as of July 2021.[66]

Table VI-77 presents information on the CSPV cell operations of the responding producers in all other countries. During 2018-20, all other producers' capacity to produce CSPV cells decreased by 22.9 percent and was 8.4 percent lower in interim 2021 compared to interim 2020. During 2018-20, all other producers' production of CSPV cells decreased by 15.5 percent and production was 17.4 percent lower in interim 2021 compared to interim 2020. During 2018-20, interim 2020, and interim 2021 home market shipments accounted for the largest share of total shipments of CSPV cells. During 2018-20, exports of CSPV cells from all other countries to the United States fluctuated but overall increased by *** percent.

[66] Diermann, Ralph, "Meyer Burger Begins Manufacturing Activities at 400 MW Module Factory in Germany," *PV Magazine*, May 26, 2021, https://www.pv-magazine.com/2021/05/26/meyer-burger-begins-manufacturing-activities-at-400-mw-module-factory-in-germany/, retrieved October 8, 2021; Gifford, Jonathan, "Oxford PV Completes 100 MW Factory Build Out," *PV Magazine*, July 2021, https://www.pv-magazine.com/2021/07/23/oxford-pv-completes-100-mw-factory-build-out/, retrieved May 8, 2021; Hutchins, Mark, "Reliance Industries Acquires 100% Stake in Rec Group, Plans New Manufacturing Bases," PV Magazine, October 11, 2021, https://www.pv-magazine.com/2021/10/11/reliance-industries-acquires-100-stake-in-rec-group/, retrieved October 13, 2021; Spaes, Joel, "Rec Postpones Investment Decision for 4 GW French Solar Factory to Second Quarter," *PV Magazine*, April 2, 2021, https://www.pv-magazine.com/2021/04/02/rec-postpones-investment-decision-for-4-gw-french-solar-factory-to-second-quarter/, retrieved October 8, 2021; Houot, Geraldine, "(Re)birth of the French PV Industry," *Observer Perspectives*, September 2021, p. 7, https://tecsol.blogs.com/files/journal-pv-perspectives-eu-pv-sec-20210906.pdf, retrieved October 8, 2021.

Table VI-77
CSPV cells: Data on industry in all other countries, by period

Quantity in kilowatts

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity	2,960,801	2,721,626	2,282,297	1,203,241	1,102,030
Production	2,065,056	2,066,784	1,744,924	832,393	977,534
End-of-period inventories	219,531	82,660	63,257	89,138	66,805
Internal consumption	471,431	713,318	703,726	331,855	383,413
Commercial home market shipments	194,576	204,205	258,000	132,567	116,810
Home market shipments	666,007	917,523	961,726	464,422	500,223
Exports to the United States	***	***	***	***	***
Exports to Canada	***	***	***	***	***
Exports to Mexico	***	***	***	***	***
Exports to the European Union	***	***	***	***	***
Exports to all other markets	***	***	***	***	***
Export shipments	1,365,091	1,289,502	802,353	361,563	473,007
Total shipments	2,031,098	2,207,025	1,764,079	825,985	973,230

Table continued.

Table VI-77 Continued
CSPV cells: Data on industry in all other countries, by period

Shares and ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity utilization ratio	69.7	75.9	76.5	69.2	88.7
Inventory ratio to production	10.6	4.0	3.6	5.4	3.4
Inventory ratio to total shipments	10.8	3.7	3.6	5.4	3.4
Internal consumption share	23.2	32.3	39.9	40.2	39.4
Commercial home market shipments share	9.6	9.3	14.6	16.0	12.0
Home market shipments share	32.8	41.6	54.5	56.2	51.4
Exports to the United States share	***	***	***	***	***
Exports to Canada share	***	***	***	***	***
Exports to Mexico share	***	***	***	***	***
Exports to the European Union share	***	***	***	***	***
Exports to all other markets share	***	***	***	***	***
Export shipments share	67.2	58.4	45.5	43.8	48.6
Total shipments share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Table VI-78 presents data on all other producers' reported production of CSPV cells by product type: bifacial cells and all other cells. During all periods the *** of cells produced were all other cells.

Table VI-78
CSPV cells: Production in all other countries, by product type and by period

Quantity in kilowatts; shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Bifacial cells	Quantity	***	***	***	***	***
All other cells	Quantity	***	***	***	***	***
All cells	Quantity	***	***	***	***	***
Bifacial cells	Share	***	***	***	***	***
All other cells	Share	***	***	***	***	***
All cells	Share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-79 presents all other producers' reported projections for CSPV cells operations during 2021-23. During 2020-23, all other producers' capacity and production of CSPV cells are projected to increase by 10.6 percent and by 40.7 percent, respectively.

Table VI-79
CSPV cells: Projected experience of industry in all other countries

Quantity in kilowatts

Item	Projection 2021	Projection 2022	Projection 2023
Capacity	2,250,035	2,404,607	2,524,370
Production	2,058,871	2,347,617	2,454,903
End-of-period inventories	47,824	45,533	44,163
Internal consumption	864,064	1,094,500	1,301,500
Commercial home market shipments	311,687	353,738	370,042
Home market shipments	1,175,751	1,448,238	1,671,542
Exports to the United States	***	***	***
Exports to Canada	***	***	***
Exports to Mexico	***	***	***
Exports to the European Union	***	***	***
Exports to all other markets	***	***	***
Export shipments	898,553	901,669	784,731
Total shipments	2,074,304	2,349,907	2,456,273

Table continued.

Table VI-79 Continued
CSPV cells: Projected experience of industry in all other countries

Shares and ratios in percent

Item	Projection 2021	Projection 2022	Projection 2023
Capacity utilization ratio	91.5	97.6	97.2
Inventory ratio to production	2.3	1.9	1.8
Inventory ratio to total shipments	2.3	1.9	1.8
Internal consumption share	41.7	46.6	53.0
Commercial home market shipments share	15.0	15.1	15.1
Home market shipments share	56.7	61.6	68.1
Exports to the United States share	***	***	***
Exports to Canada share	***	***	***
Exports to Mexico share	***	***	***
Exports to the European Union share	***	***	***
Exports to all other markets share	***	***	***
Export shipments share	43.3	38.4	31.9
Total shipments share	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as "---".

Operations on CSPV modules

CSPV module production capacity in other countries totaled *** in 2020, of which India accounted for *** percent, Turkey for *** percent, and Taiwan for *** percent.[67] As with cells, significant capacity expansions are taking place in a number of countries.[68] In Cambodia, for the four firms for which production data were available, an additional 700 MW of capacity is under construction that will increase CSPV module capacity to 3.0 GW by the fall of 2021.[69] In India, as of June 2021, a number of CSPV module plant expansions were planned or under construction. For example, Waaree Solar is adding 2.5 GW in production capacity, Premier Energies added 750 MW in 2021, Adani Solar is adding 500 MW, and Tata Power is adding over 500 MW.[70] In Indonesia, Suntech brought a 1 GW CSPV module plant online in the second half of 2020 and, in April 2021, Jolywood announced plans to open a 1 GW CSPV module plant in Indonesia.[71] In France, a number of additional plants and expansions are planned or under consideration, with Systovi/Voltec Solar planning to add 700 MW of capacity, Recom considering investing in a new plant, and REC planning a 2 GW CSPV module plant.[72]

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[67] Compiled from publicly available data and industry data from ***.

[68] This section will provide examples of countries where CSPV module production capacity is significantly expanding, but will not comprehensively cover all such countries.

[69] HERTZ Optoelectronic Tech. Co., Ltd. Website, http://www.hertzpv.com/en/about.php, retrieved September 7, 2021; *PV Magazine*, "Statement from ET Solar Hong Kong--Taitong Has Nothing to Do with Solar Module Business," February 7, 2020, https://www.pv-magazine.com/2019/07/30/et-solar-switching-directions-with-new-manufacturing-strategy/, October 8, 2021; New East Solar Website, http://www.nesolar.com.kh/?about/29, retrieved October 8, 2021; New East Solar, "Company Profile," October 20, 2020, https://www.youtube.com/watch?v=Kob_Ee7ohiI, retrieved October 8, 2021; New East Solar, "Third Phase of the Phnom Penh Plant in Cambodia," May 28, 2021, http://www.nesolar.com.kh/?content/142, retrieved October 8, 2021; Imperial Star Website, www.imperialstar.biz/about.html, retrieved October 27, 2021.

[70] Rajshekar, M., "The Fall and Rise of Solar Costs in India," *The Wire*, June 24, 2021, https://thewire.in/energy/the-fall-and-rise-of-solar-costs-in-india, retrieved October 7, 2021.

[71] Shaw, Vincent, "Jolywood Plans New Indonesian Fab," *PV Magazine*, April 12, 2021, https://www.pv-magazine.com/2021/04/12/jolywood-plans-new-indonesian-fab/, retrieved October 8, 2021; Suntech, "Suntech Announced 500 MW PV Cell and Module Capacity in Indonesia, to Enhance US Market Coverage," September 18, 2020, https://www.suntech-power.com/suntech-announced-500-mw-pv-cell-and-module-capacity-in-indonesia-to-enhance-us-market-coverage/, retrieved October 8, 2020.

[72] Spaes, Joel, "Rec Postpones Investment Decision for 4 GW French Solar Factory to Second Quarter," *PV Magazine*, April 2, 2021, https://www.pv-magazine.com/2021/04/02/rec-postpones-investment-decision-for-4-gw-french-solar-factory-to-second-quarter/, retrieved October 8, 2021; Houot, Geraldine, "(Re)birth of the French PV Industry," *Observer Perspectives*, September 2021, p. 7, https://tecsol.blogs.com/files/journal-pv-perspectives-eu-pv-sec-20210906.pdf, retrieved October 8,

(*continued*...)

Table VI-80 presents information on the CSPV module operations of the responding producers in all other countries. During 2018-20, responding all other producers' production capacity increased by 44.3 percent. All other producers' reported capacity was 14.7 percent higher in interim 2021 interim compared to interim 2020.

During 2018-20, all other producers' CSPV modules production increased by 45.2 percent and was 10.8 percent lower in interim 2021 compared to interim 2020. During 2018-20, export shipments to the United States increased by *** percent. Meanwhile, home market shipments accounted for the largest share of shipments during all periods.

(…*continued*)
2021; Spaes, Joel, "Systovi, Voltec Solar Move Forward with Plans to Expand Panel Capacity," PV Magazine, May 4, 2021, https://www.pv-magazine.com/2021/05/04/systovi-voltec-solar-move-forward-with-plans-to-expand-panel-capacity/, retrieved October 8, 2021; Hutchins, Mark, "Reliance Industries Acquires 100% Stake in Rec Group, Plans New Manufacturing Bases," PV Magazine, October 11, 2021, https://www.pv-magazine.com/2021/10/11/reliance-industries-acquires-100-stake-in-rec-group/, retrieved October 13, 2021.

Table VI-80
CSPV modules: Data on industry in all other countries, by period

Quantity in kilowatts

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity	1,193,700	1,461,700	1,722,500	812,250	931,475
Production	776,025	863,283	1,126,838	549,042	489,519
End-of-period inventories	74,371	79,351	115,787	134,042	100,658
Internal consumption	46,274	22,631	14,368	9,044	2,902
Commercial home market shipments	505,296	639,463	777,826	355,493	348,686
Home market shipments	551,570	662,094	792,194	364,537	351,588
Exports to the United States	***	***	***	***	***
Exports to Canada	***	***	***	***	***
Exports to Mexico	***	***	***	***	***
Exports to the European Union	***	***	***	***	***
Exports to all other markets	***	***	***	***	***
Export shipments	193,350	196,209	298,208	153,869	181,440
Total shipments	744,920	858,303	1,090,402	518,406	533,028

Table continued.

Table VI-80 Continued
CSPV modules: Data on industry in all other countries, by period

Shares and ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity utilization ratio	65.0	59.1	65.4	67.6	52.6
Inventory ratio to production	9.6	9.2	10.3	12.2	10.3
Inventory ratio to total shipments	10.0	9.2	10.6	12.9	9.4
Internal consumption share	6.2	2.6	1.3	1.7	0.5
Commercial home market shipments share	67.8	74.5	71.3	68.6	65.4
Home market shipments share	74.0	77.1	72.7	70.3	66.0
Exports to the United States share	***	***	***	***	***
Exports to Canada share	***	***	***	***	***
Exports to Mexico share	***	***	***	***	***
Exports to the European Union share	***	***	***	***	***
Exports to all other markets share	***	***	***	***	***
Export shipments share	26.0	22.9	27.3	29.7	34.0
Total shipments share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-81 presents all other producers' reported production of CSPV modules using bifacial cells and all other cells. During all periods the *** of CSPV modules produced used all other cells.

Table VI-81
CSPV modules: Production in all other countries, by product type and by period

Quantity in kilowatts; shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Modules using bifacial cells	Quantity	***	***	***	***	***
Modules using all other cells	Quantity	***	***	***	***	***
Modules using all cells	Quantity	***	***	***	***	***
Modules using bifacial cells	Share	***	***	***	***	***
Modules using all other cells	Share	***	***	***	***	***
Modules using all cells	Share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-82 presents all other producers' reported projections for CSPV module operations during 2021-23. During 2020-23, all other producers' capacity and production of CSPV modules are projected to increase by 108.5 percent and by 167.6 percent, respectively.

Table VI-82
CSPV modules: Projected experience of industry in all other countries

Quantity in kilowatts

Item	Projection 2021	Projection 2022	Projection 2023
Capacity	1,436,350	2,486,750	3,591,750
Production	1,056,006	2,114,425	3,015,000
End-of-period inventories	62,461	50,879	50,034
Internal consumption	45,380	112,750	162,750
Commercial home market shipments	760,056	1,757,300	2,517,595
Home market shipments	805,436	1,870,050	2,680,345
Exports to the United States	***	***	***
Exports to Canada	***	***	***
Exports to Mexico	***	***	***
Exports to the European Union	***	***	***
Exports to all other markets	***	***	***
Export shipments	322,054	255,957	335,500
Total shipments	1,127,490	2,126,007	3,015,845

Table continued.

Table VI-82 Continued
CSPV modules: Projected experience of industry in all other countries

Shares and ratios in percent

Item	Projection 2021	Projection 2022	Projection 2023
Capacity utilization ratio	73.5	85.0	83.9
Inventory ratio to production	5.9	2.4	1.7
Inventory ratio to total shipments	5.5	2.4	1.7
Internal consumption share	4.0	5.3	5.4
Commercial home market shipments share	67.4	82.7	83.5
Home market shipments share	71.4	88.0	88.9
Exports to the United States share	***	***	***
Exports to Canada share	***	***	***
Exports to Mexico share	***	***	***
Exports to the European Union share	***	***	***
Exports to all other markets share	***	***	***
Export shipments share	28.6	12.0	11.1
Total shipments share	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Alternative products

Responding producers in all other countries *** report the production of other products on the same machinery used produce to CSPV products.

Exports

Table VI-83, table VI-84, table VI-85, and table VI-86 presents exports of CSPV products by India, Indonesia, the Philippines, and Taiwan, respectively.[73] The United States was the leading (India and Indonesia) or second leading (Philippines) export market in 2020.

Table VI-83
CSPV products: Exports from India, by period

Value in 1,000 dollars; shares in percent

Source	Measure	2018	2019	2020
United States	Value	50,450	149,977	65,845
Turkey	Value	275	6,124	3,800
South Africa	Value	4,952	5,941	2,335
United Arab Emirates	Value	3,688	2,778	1,142
Oman	Value	1,066	1,463	834
Belgium	Value	4,350	7,065	827
Zambia	Value	59	155	726
Nepal	Value	1,317	3,941	694
Canada	Value	827	342	610
All other destination markets	Value	39,855	33,211	6,482
All destination markets	Value	106,840	210,997	83,294
United States	Share of value	47.2	71.1	79.1
Turkey	Share of value	0.3	2.9	4.6
South Africa	Share of value	4.6	2.8	2.8
United Arab Emirates	Share of value	3.5	1.3	1.4
Oman	Share of value	1.0	0.7	1.0
Belgium	Share of value	4.1	3.3	1.0
Zambia	Share of value	0.1	0.1	0.9
Nepal	Share of value	1.2	1.9	0.8
Canada	Share of value	0.8	0.2	0.7
All other destination markets	Share of value	37.3	15.7	7.8
All destination markets	Share of value	100.0	100.0	100.0

Source: Official exports statistics under HS subheading 8541.40.11 as reported by Ministry of Commerce in the Global Trade Atlas database, accessed October 13, 2021.

Note: Share of value is the share of total exports by value. United States is shown at the top. All remaining top export destinations are shown in descending order of 2020 data.

[73] Export data are presented for India, Indonesia, the Philippines, and Taiwan are based on specific tariff lines consistent with known and reported production. Export data for Cambodia, France, Germany, Hong Kong, and all other countries are not presented because these countries do not have specific enough tariff lines, the values appear to be inconsistent potential CSPV products exports, and may contain out-of-scope products.

Table VI-84
CSPV products: Exports from Indonesia, by period

Value in 1,000 dollars; shares in percent

Source	Measure	2018	2019	2020
United States	Value	6,581	5,897	5,996
Japan	Value	264	181	287
Ireland	Value	428	130	147
Turkey	Value	---	---	79
Canada	Value	78	---	75
Israel	Value	---	---	56
China	Value	9	9	12
Uganda	Value	---	---	8
Singapore	Value	28	---	8
All other destination markets	Value	20,998	410	8
All destination markets	Value	28,386	6,628	6,676
United States	Share of value	23.2	89.0	89.8
Japan	Share of value	0.9	2.7	4.3
Ireland	Share of value	1.5	2.0	2.2
Turkey	Share of value	---	---	1.2
Canada	Share of value	0.3	---	1.1
Israel	Share of value	---	---	0.8
China	Share of value	0.0	0.1	0.2
Uganda	Share of value	---	---	0.1
Singapore	Share of value	0.1	---	0.1
All other destination markets	Share of value	74.0	6.2	0.1
All destination markets	Share of value	100.0	100.0	100.0

Source: Official exports statistics under HS subheading 8541.40.21 and 8541.40.22 as reported by Statistics Indonesia in the Global Trade Atlas database, accessed October 13, 2021.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Share of value is the share of total exports by value. United States is shown at the top, all remaining top export destinations shown in descending order of 2020 data.

Table VI-85
CSPV products: Exports from the Philippines, by period

Value in 1,000 dollars; shares in percent

Source	Measure	2018	2019	2020
United States	Value	112,803	135,667	82,470
Japan	Value	54,662	159,445	281,242
China	Value	7,068	6,039	23,821
Mexico	Value	---	6,530	17,439
France	Value	2,997	4,397	1,326
Malaysia	Value	15	502	188
Poland	Value	---	57	149
Israel	Value	4	---	140
Singapore	Value	12	2	125
All other destination markets	Value	2,129	1,989	486
All destination markets	Value	179,689	314,625	407,385
United States	Share of value	62.8	43.1	20.2
Japan	Share of value	30.4	50.7	69.0
China	Share of value	3.9	1.9	5.8
Mexico	Share of value	---	2.1	4.3
France	Share of value	1.7	1.4	0.3
Malaysia	Share of value	0.0	0.2	0.0
Poland	Share of value	---	0.0	0.0
Israel	Share of value	0.0	---	0.0
Singapore	Share of value	0.0	0.0	0.0
All other destination markets	Share of value	1.2	0.6	0.1
All destination markets	Share of value	100.0	100.0	100.0

Source: Official exports statistics under HS subheading 8541.40.2100 and 8541.40.2200 as reported by Philippine Statistics Authority in the Global Trade Atlas database, accessed October 13, 2021.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Share of value is the share of total exports by value. United States is shown at the top, all remaining top export destinations shown in descending order of 2020 data.

Table VI-86
CSPV products: Exports from Taiwan, by period

Value in 1,000 dollars; shares in percent

Source	Measure	2018	2019	2020
United States	Value	25,267	46,201	28,410
Japan	Value	72,790	45,942	16,983
Vietnam	Value	170,808	86,699	11,394
China	Value	260,057	52,976	10,023
Italy	Value	20,284	7,159	6,669
Canada	Value	3,692	11,383	4,454
India	Value	106,426	19,910	3,961
Switzerland	Value	3,190	2,813	3,591
Hong Kong	Value	10,966	5,229	3,534
All other destination markets	Value	482,315	130,639	11,653
All destination markets	Value	1,155,796	408,949	100,673
United States	Share of value	2.2	11.3	28.2
Japan	Share of value	6.3	11.2	16.9
Vietnam	Share of value	14.8	21.2	11.3
China	Share of value	22.5	13.0	10.0
Italy	Share of value	1.8	1.8	6.6
Canada	Share of value	0.3	2.8	4.4
India	Share of value	9.2	4.9	3.9
Switzerland	Share of value	0.3	0.7	3.6
Hong Kong	Share of value	0.9	1.3	3.5
All other destination markets	Share of value	41.7	31.9	11.6
All destination markets	Share of value	100.0	100.0	100.0

Source: Official exports statistics under HS subheading 8541.40.3000 and 8541.40.4000 as reported by Ministry of Commerce in the Global Trade Atlas database, accessed October 13, 2021.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Share of value is the share of total exports by value. United States is shown at the top, all remaining top export destinations shown in descending order of 2020 data.

Information on all countries combined

CSPV cells production

Table VI-87, table VI-88, and table VI-89 present information on the CSPV cell operations for all countries.

Table VI-87
CSPV cells: Data on industry in all countries, by period

Quantity in kilowatts

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity	50,636,526	65,488,676	91,646,178	35,495,983	52,633,742
Production	42,174,867	52,271,812	69,901,473	29,909,415	45,252,446
End-of-period inventories	1,774,476	2,179,248	2,468,227	2,265,116	4,872,271
Internal consumption	33,028,831	40,704,798	57,782,635	24,246,635	36,498,610
Commercial home market shipments	2,350,038	2,633,256	3,392,747	1,843,079	1,145,005
Home market shipments	35,378,869	43,338,054	61,175,382	26,089,714	37,643,615
Exports to the United States	624,233	1,954,995	1,773,530	804,826	1,284,986
Exports to Canada	77,223	31,360	63,709	11,900	24,212
Exports to Mexico	986,570	1,215,018	1,017,379	431,689	440,759
Exports to the European Union	316,306	165,052	97,404	47,097	12,136
Exports to all other markets	4,318,714	5,229,626	5,515,783	2,529,789	3,543,008
Export shipments	6,323,046	8,596,051	8,467,805	3,825,301	5,305,101
Total shipments	41,701,915	51,934,105	69,643,187	29,915,015	42,948,716

Table continued.

Table VI-87 Continued
CSPV cells: Data on industry in all countries, by period

Shares and ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity utilization ratio	83.3	79.8	76.3	84.3	86.0
Inventory ratio to production	4.2	4.2	3.5	3.8	5.4
Inventory ratio to total shipments	4.3	4.2	3.5	3.8	5.7
Internal consumption share	79.2	78.4	83.0	81.1	85.0
Commercial home market shipments share	5.6	5.1	4.9	6.2	2.7
Home market shipments share	84.8	83.4	87.8	87.2	87.6
Exports to the United States share	1.5	3.8	2.5	2.7	3.0
Exports to Canada share	0.2	0.1	0.1	0.0	0.1
Exports to Mexico share	2.4	2.3	1.5	1.4	1.0
Exports to the European Union share	0.8	0.3	0.1	0.2	0.0
Exports to all other markets share	10.4	10.1	7.9	8.5	8.2
Export shipments share	15.2	16.6	12.2	12.8	12.4
Total shipments share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“.

Table VI-88
CSPV cells: Production in all countries, by product type and by period

Quantity in kilowatts; shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Bifacial cells	Quantity	4,317,200	12,298,424	45,112,002	15,755,319	39,433,876
All other cells	Quantity	37,857,667	39,973,388	24,789,471	14,154,096	5,818,570
All cells	Quantity	42,174,867	52,271,812	69,901,473	29,909,415	45,252,446
Bifacial cells	Share	10.2	23.5	64.5	52.7	87.1
All other cells	Share	89.8	76.5	35.5	47.3	12.9
All cells	Share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-89
CSPV cells: Projected experience of industry in all countries

Quantity in kilowatts

Item	Projection 2021	Projection 2022	Projection 2023
Capacity	121,144,969	151,373,185	165,427,540
Production	104,544,495	133,322,876	149,796,994
End-of-period inventories	4,406,401	4,010,267	4,032,944
Internal consumption	89,938,396	112,682,245	124,427,508
Commercial home market shipments	2,353,386	3,238,694	3,759,382
Home market shipments	92,291,782	115,920,939	128,186,890
Exports to the United States	2,559,552	2,620,105	3,271,821
Exports to Canada	55,642	143,820	143,820
Exports to Mexico	805,131	2,206,370	2,805,568
Exports to the European Union	15,382	15,400	1,041
Exports to all other markets	6,876,906	12,812,365	15,375,177
Export shipments	10,312,613	17,798,060	21,597,427
Total shipments	102,604,395	133,718,999	149,784,317

Table continued.

Table VI-89 Continued
CSPV cells: Projected experience of industry in all countries

Shares and ratios in percent

Item	Projection 2021	Projection 2022	Projection 2023
Capacity utilization ratio	86.3	88.1	90.6
Inventory ratio to production	4.2	3.0	2.7
Inventory ratio to total shipments	4.3	3.0	2.7
Internal consumption share	87.7	84.3	83.1
Commercial home market shipments share	2.3	2.4	2.5
Home market shipments share	89.9	86.7	85.6
Exports to the United States share	2.5	2.0	2.2
Exports to Canada share	0.1	0.1	0.1
Exports to Mexico share	0.8	1.7	1.9
Exports to the European Union share	0.0	0.0	0.0
Exports to all other markets share	6.7	9.6	10.3
Export shipments share	10.1	13.3	14.4
Total shipments share	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Shares and ratios shown as "0.0" represent values greater than zero, but less than "0.05" percent. Zeroes, null values, and undefined calculations are suppressed and shown as “---“. ***. *** foreign producer questionnaire response, section II-14.

Operations on CSPV modules

Table VI-90, table VI-91, and table VI-92 present information on the operations of CSPV modules for all countries.

Table VI-90
CSPV modules: Data on industry in all countries, by period

Quantity in kilowatts

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity	54,018,797	72,567,604	100,899,586	45,348,092	68,881,670
Production	44,357,383	61,406,634	83,635,793	35,203,349	48,684,715
End-of-period inventories	2,931,704	3,702,278	4,562,524	4,086,617	4,905,693
Internal consumption	3,019,157	5,970,138	8,453,510	2,873,717	5,157,904
Commercial home market shipments	9,602,963	8,604,478	20,970,737	7,292,945	10,000,337
Home market shipments	12,622,120	14,574,616	29,424,247	10,166,662	15,158,241
Exports to the United States	4,770,832	12,486,870	17,992,872	9,397,202	9,563,302
Exports to Canada	361,904	181,474	355,641	172,085	130,424
Exports to Mexico	2,572,388	1,176,330	901,571	309,236	161,862
Exports to the European Union	6,196,067	9,247,562	10,669,806	5,171,910	7,481,639
Exports to all other markets	17,183,189	22,964,865	23,429,289	9,625,569	15,873,965
Export shipments	31,084,380	46,057,101	53,349,179	24,676,002	33,211,192
Total shipments	43,706,500	60,631,717	82,773,426	34,842,664	48,369,433

Table continued.

Table VI-90 Continued
CSPV modules: Data on industry in all countries, by period

Shares and ratios in percent

Item	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Capacity utilization ratio	82.1	84.6	82.9	77.6	70.7
Inventory ratio to production	6.6	6.0	5.5	5.8	5.0
Inventory ratio to total shipments	6.7	6.1	5.5	5.9	5.1
Internal consumption share	6.9	9.8	10.2	8.2	10.7
Commercial home market shipments share	22.0	14.2	25.3	20.9	20.7
Home market shipments share	28.9	24.0	35.5	29.2	31.3
Exports to the United States share	10.9	20.6	21.7	27.0	19.8
Exports to Canada share	0.8	0.3	0.4	0.5	0.3
Exports to Mexico share	5.9	1.9	1.1	0.9	0.3
Exports to the European Union share	14.2	15.3	12.9	14.8	15.5
Exports to all other markets share	39.3	37.9	28.3	27.6	32.8
Export shipments share	71.1	76.0	64.5	70.8	68.7
Total shipments share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-91
CSPV modules: Production in all countries, by product type and by period

Quantity in kilowatts; shares in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Modules using bifacial cells	Quantity	1,746,300	6,360,303	42,701,468	14,650,356	30,118,666
Modules using all other cells	Quantity	42,611,083	55,046,331	40,934,325	20,552,993	18,566,049
Modules using all cells	Quantity	44,357,383	61,406,634	83,635,793	35,203,349	48,684,715
Modules using bifacial cells	Share	3.9	10.4	51.1	41.6	61.9
Modules using all other cells	Share	96.1	89.6	48.9	58.4	38.1
Modules using all cells	Share	100.0	100.0	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-92
CSPV modules: Projected experience of industry in all countries

Quantity in kilowatts

Item	Projection 2021	Projection 2022	Projection 2023
Capacity	157,407,001	189,212,777	213,720,853
Production	108,612,703	134,085,474	153,825,098
End-of-period inventories	4,294,118	4,280,406	4,123,080
Internal consumption	9,777,692	12,984,429	15,483,845
Commercial home market shipments	29,915,223	37,709,487	44,004,341
Home market shipments	39,692,915	50,693,916	59,488,186
Exports to the United States	22,267,449	28,093,557	30,136,285
Exports to Canada	239,433	304,370	289,314
Exports to Mexico	831,231	904,709	934,487
Exports to the European Union	12,956,796	17,374,735	21,484,012
Exports to all other markets	32,912,302	36,727,900	41,650,141
Export shipments	69,207,211	83,405,271	94,494,239
Total shipments	108,900,126	134,099,187	153,982,425

Table continued.

Table VI-92 Continued
CSPV modules: Projected experience of industry in all countries

Shares and ratios in percent

Item	Projection 2021	Projection 2022	Projection 2023
Capacity utilization ratio	69.0	70.9	72.0
Inventory ratio to production	4.0	3.2	2.7
Inventory ratio to total shipments	3.9	3.2	2.7
Internal consumption share	9.0	9.7	10.1
Commercial home market shipments share	27.5	28.1	28.6
Home market shipments share	36.4	37.8	38.6
Exports to the United States share	20.4	20.9	19.6
Exports to Canada share	0.2	0.2	0.2
Exports to Mexico share	0.8	0.7	0.6
Exports to the European Union share	11.9	13.0	14.0
Exports to all other markets share	30.2	27.4	27.0
Export shipments share	63.6	62.2	61.4
Total shipments share	100.0	100.0	100.0

Source: Compiled from data submitted in response to Commission questionnaires.

Note: ***. *** foreign producer questionnaire response, section II-15.

Table VI-93 presents information on cell type by actual and future planned production of CSPV products by type of cell. Table VI-94 presents information on cell form factor by actual and future planned production.

Table VI-93
CSPV products: Count of foreign producers' responses regarding production, by cell type

Count in number of firms reporting

Cell type	Actual production	Planned production
Mono	***	***
Multi	***	***
PERC	***	***
Heterojunction	***	***
Bifacial	***	***
P-type	***	***
N-type	***	***
Greater than 162 by 162 millimeter cells	***	***
All other cell types	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Responses for actual production are since January 1, 2018 and planned production is for 2022 to 2024.

Table VI-94
CSPV products: Count of foreign producers' responses regarding production, by cell form factor

Count in number of firms reporting

Cell form factor	Actual production	Planned production
M0	***	***
G1	***	***
M2	***	***
M4	***	***
M6	***	***
Larger than M6	***	***
All other cell form factors	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Responses for actual production are since January 1, 2018 and planned production is for 2022 to 2024.

Part VII: Pricing data

Factors affecting prices

Raw material costs

The primary underlying raw material input for CSPV cells is polysilicon, which is made into ingots and wafers. In turn, one of the primary raw cost components of CSPV modules is the CSPV cells. Other inputs in the production of CSPV modules include solar glass, aluminum frames, junction boxes, and backsheet.[1] [2] As shown in figure VII-1, the price of polysilicon ingots and multi and mono wafers declined between the first quarter of 2018 and the second/third quarter of 2020 before increasing slightly in the third/fourth quarter of 2020. As shown in figure VII-2, the prices of all types of cells and modules decreased between the first quarter of 2018 and the fourth quarter of 2020.

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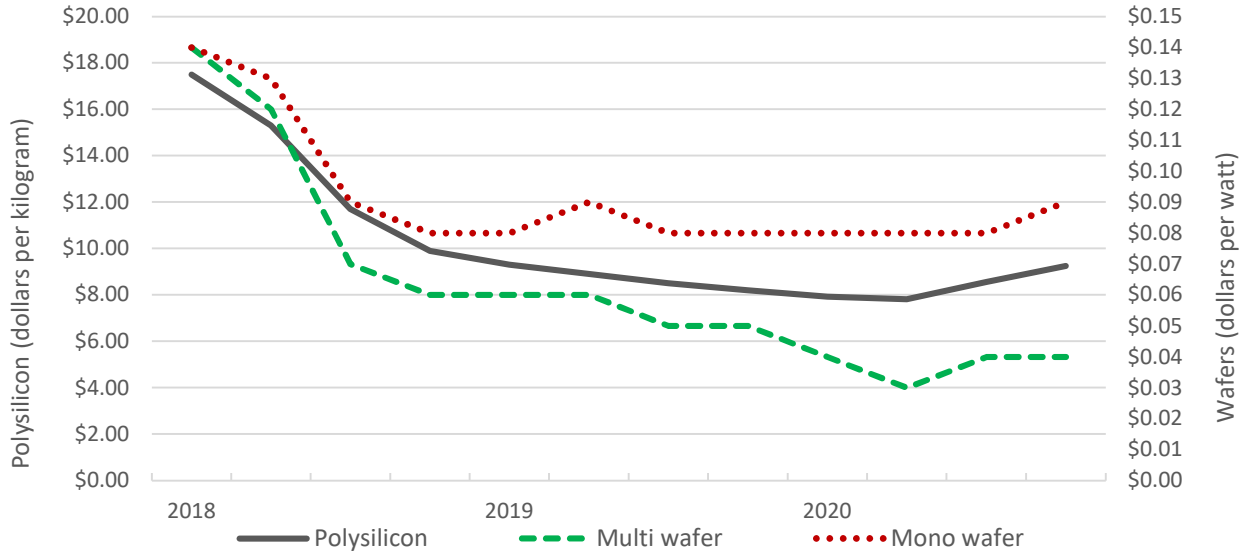
[1] As discussed in parts I and II, several of these inputs are subject to overlapping tariffs, including Section 301 duties on ethylene vinyl acetate (EVA) encapsulants, tempered glass, and backsheets. Petitioners Hanwha and Mission also argue that recent constraints on electricity production in China have been the primary driver of raw material cost increases in polysilicon, wafers, glass, EVA, and junction boxes beginning in September and October of 2021, and that these raw material price increases are projected to continue into 2022. See Petitioners Hanwha and Mission's prehearing brief, pp. 58-63; Petitioners Hanwha and Mission's posthearing brief, Responses to Commission Questions, pp. 59-60; and Hearing transcript, p. 150-51 (Szamosszegi). See also Petitioner LG's posthearing brief, Responses to Commission Questions, p. 29.

When asked whether they could pass on increases in input costs to customers, Hanwha estimated that it could do so in approximately *** percent of its transactions, whereas in *** percent of cases it could not. LG indicated that its input prices rose *** percent in the first half of 2021, and that while pricing for new projects could be proposed more in line with actual costs, it has to comply with longer-term supply agreements that did not have price adjustment clauses, and that even if it did projects "would fall apart economically if forced to absorb a *** percent price." See Petitioners Hanwha and Mission's posthearing brief, Responses to Commission Questions, p. 33; and Petitioner LG's posthearing brief, Responses to Commission Questions, p. 13.

[2] There are also two sets of AD/CVD duties on CSPV products from China and Taiwan. See part I, "Previous and related investigations." See also Respondent CCCME's prehearing brief, pp. 11-13.

Figure VII-1

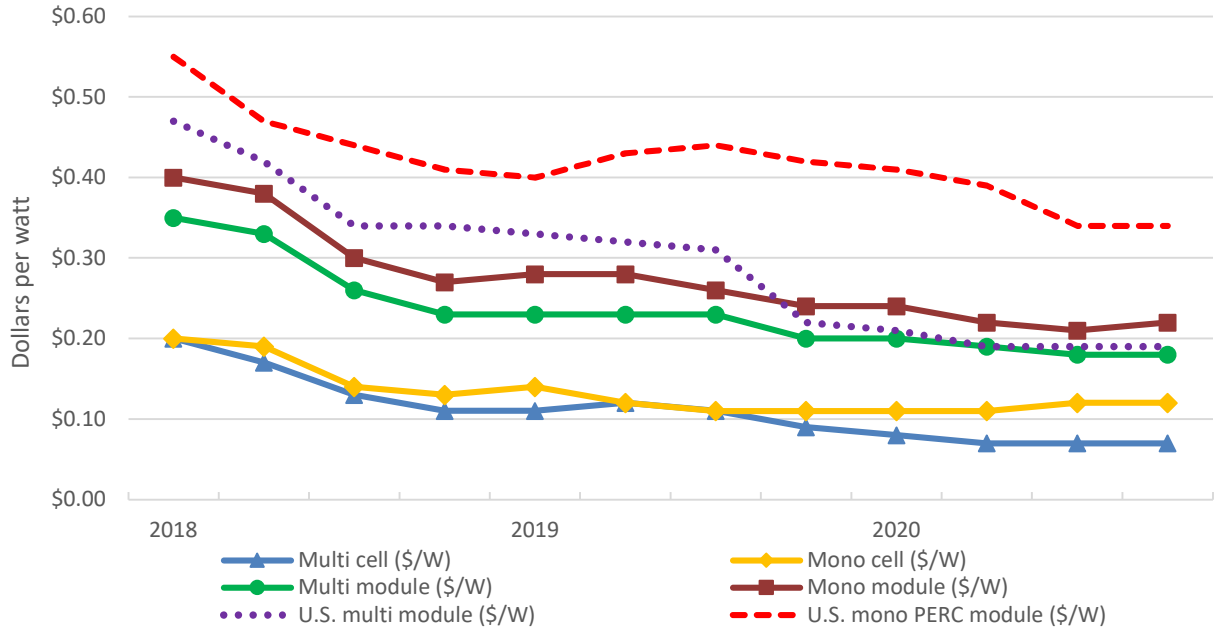
Polysilicon ingots and wafers: Global spot prices for polysilicon ingots and wafers, quarterly, first quarter of 2018 through the fourth quarter of 2020



Source: Wood Mackenzie Power Renewables and the Solar Energy Industries Association ("SEIA"), U.S. Solar Market Insight: 2016-2018 Year in Review, Q3 2019, 2020 Year in Review, Executive Summaries.

Figure VII-2

CSPV cell and module prices: Global spot prices for multi cells, mono cells, multi modules, and mono modules, and U.S. prices for multi modules and mono-PERC modules, quarterly, first quarter of 2018 through the fourth quarter of 2020



Source: Wood Mackenzie Power Renewables and the Solar Energy Industries Association ("SEIA"), U.S. Solar Market Insight: 2016-2018 Year in Review, Q3 2019, 2020 Year in Review, Executive Summaries.

Transportation costs

Transportation costs for CSPV products shipped from other countries to the United States averaged 3.3 percent for all import sources during 2020. These estimates were derived from official import data and represent the transportation and other charges on imports.[3]

Other sources of electricity

In the original safeguard investigation, the Commission found that electricity providers using renewable energy sources seek to achieve "grid parity" (the point at which the levelized cost of electricity ("LCOE") generated from renewable sources equals the cost from the grid of electricity generated by conventional sources).[4]

As shown in figure VII-3, the prices of coal and natural gas both decreased overall during January 2018-June 2021. The price of coal decreased by 3.8 percent and the price of natural gas decreased by 31.7 percent during this time, with a sharp uptick in February 2021.[5]

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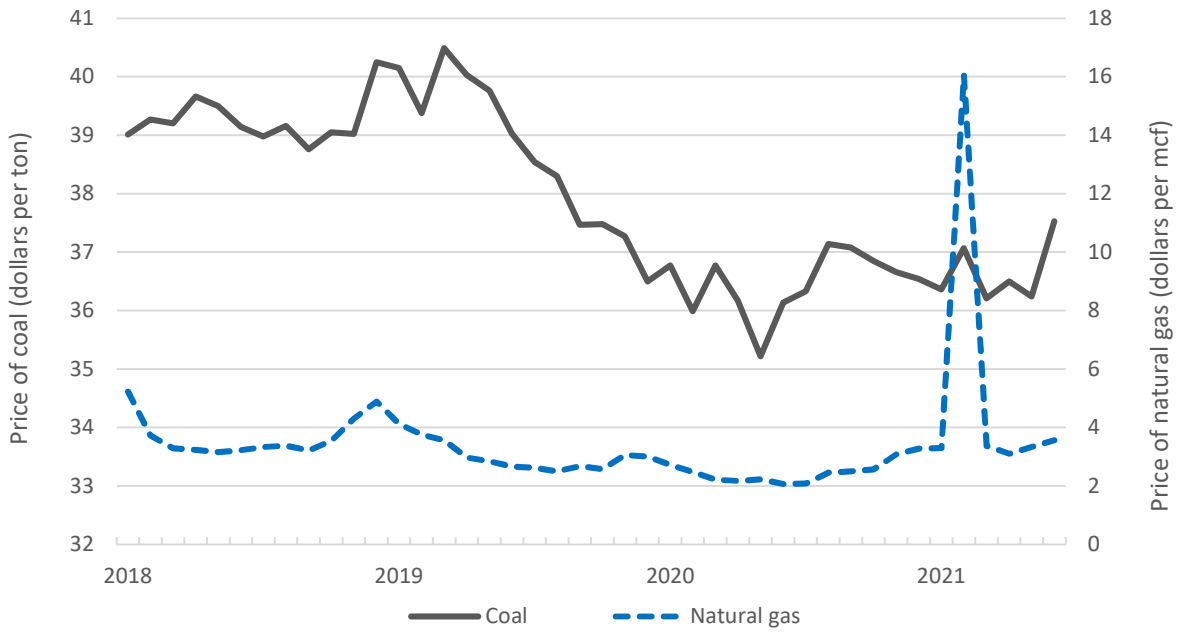
[3] The estimated transportation costs were obtained by subtracting the customs value from the c.i.f. value of the imports for 2020 and then dividing by the customs value based on the HTS statistical reporting numbers 8541.40.6015, 8541.40.6020, 8541.40.6025, 8541.40.6030, 8541.40.6035, and 8541.40.6045.

[4] Safeguard publication, vol. I, pp. 25-26.

[5] According to the U.S. Department of Energy, the natural gas price spike in February 2021 was due to a record-breaking cold snap, which caused production freeze-offs and natural gas processing plant outages in the U.S. South Central Region, especially in Texas. See EIA website, https://www.eia.gov/todayinenergy/detail.php?id=47896, accessed October 19, 2021; S&P Global website, https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/february-spot-gas-values-in-parts-of-us-grew-by-900-month-over-month-62948924, accessed October 19, 2021.

Figure VII-3

Coal and natural gas: Average cost of coal and natural gas for electricity generation for all sectors, monthly, January 2018-June 2021



Source: U.S. Energy Information Administration, http://www.eia.gov/electricity/data/browser/, retrieved October 14, 2021.

In the current proceeding, firms were asked how changes in the price of electricity generated from U.S. conventional energy sources affected the price of solar generated electricity since February 7, 2018. As shown in table VII-1, responses were mixed, but most firms reported that changes in the price of conventional sources either led to no changes in the price of solar electricity or that it fluctuated. However, relatively more firms reported decreases in the price of solar electricity resulting from changes in the price of conventional sources than reported increases in the price of solar electricity.

Table VII-1

CSPV products: Count of firm responses regarding the effect of changes in conventional energy prices on the prices of CSPV products since February 7, 2018

Firm type	Increase	No change	Decrease	Fluctuate
U.S. producers	0	3	1	6
Importers	2	11	7	15
Purchasers	4	17	17	9

Source: Compiled from data submitted in response to Commission questionnaires.

Several firms reported that solar generated power has decreased in price, which has made it more competitive with conventional energy sources, particularly for the utility sector. Several firms also reported that solar electricity is most competitive with natural gas, with some

firms indicating that as either of these sources go down in prices, the other often follows in order to remain competitive. One firm noted that, according industry data, solar installation costs have decreased by more than 70 percent since 2010.[6] Other firms reported that greater pricing competition between solar and conventional sources has spurred improvements in efficiency, and vice versa.

Price data

The Commission requested U.S. producers and importers to provide quarterly data for the total quantity and f.o.b. value of the following CSPV products shipped to unrelated U.S. customers during January 2018-June 2021.[7]

Product 1.-- Monocrystalline silicon module with front-side area of less than 1.9 square meters and a peak power wattage between 275w to 325w, inclusive, P-max or Wp as measured under Standard Test Conditions ("STC"), excluding bifacial modules.

Product 2.-- Monocrystalline silicon module with front-side area of less than 1.9 square meters and a peak power wattage between 330w to 415w, inclusive, P-max or Wp as measured under Standard Test Conditions ("STC"), excluding bifacial modules.

Product 3.-- Monocrystalline silicon module with front-side area of greater than or equal to 1.9 square meters and a peak power wattage between 325w to 375w, inclusive, P-max or Wp as measured under Standard Test Conditions ("STC"), excluding bifacial modules.

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[6] See *SEIA website*, Solar Industry Research Data, https://www.seia.org/solar-industry-research-data, accessed November 11, 2021; *NREL website*, Documenting a Decade of Cost Declines for PV Systems, https://www.nrel.gov/news/program/2021/documenting-a-decade-of-cost-declines-for-pv-systems.html, accessed November 11, 2021.

[7] These pricing products differ from those of the original safeguard investigation and the monitoring phase investigation. In the original investigation, there were four pricing products. For the monitoring phase, staff removed descriptions on the number of cells (60 and 72) and added descriptions on surface area (modules less than 1.9 meters and greater than or equal to 1.9 meters) as well as the universal testing standard "STC" for power wattage. Additionally, pricing product 4 from the safeguard investigation was broken into two categories – monocrystalline and multicrystalline – making a total of six pricing products. For the current proceeding, data were only collected for monocrystalline products, and on higher-wattage modules than the previous investigations. One bifacial product was also added.

Product 4.-- Monocrystalline silicon module with front-side area of greater than or equal to 1.9 square meters and a peak power wattage between 380w to 430w, inclusive, P-max or Wp as measured under Standard Test Conditions ("STC"), excluding bifacial modules.

Product 5.-- Monocrystalline silicon module with front-side area of greater than or equal to 1.9 square meters and a peak power wattage between 440w to 640w, inclusive, P-max or Wp as measured under Standard Test Conditions ("STC"), excluding bifacial modules.

Product 6.-- Monocrystalline silicon bifacial module that generates power on both sides of the panel with front-side area of greater than or equal to 1.9 square meters and a peak power wattage greater than or equal to 325w, inclusive, P-max or Wp as measured under Standard Test Conditions ("STC").

Nine U.S. producers and 21 importers provided usable pricing data for sales of the requested products, although not all firms reported pricing for all products for all quarters.[8] Pricing data reported by these firms accounted for *** percent of U.S. producers' shipments of CSPV products and *** percent of U.S. shipments of imported CSPV products in 2020.[9]

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[8] Per-unit pricing data are calculated from total quantity and total value data provided by U.S. producers and importers. The precision and variation of these figures may be affected by rounding, limited quantities, and producer or importer estimates.

[9] ***. Similarly, ***. Several other firms also reported quantities in their pricing data that exceeded the quantity of modules they reported commercially shipping. In some cases, this was due to transfers to related entities made at commercial value. Some instances therefore exist where the pricing data for individual firms or country sources slightly exceed the responding firms' reported commercial shipment quantities.

Additionally, *** indicated that some of its reported data for product 6 was ***. *** also initially provided data for pricing product 1 ***. These data have therefore not been included in this pricing analysis.

Price data for products 1-6 are presented in tables VII-2 to VII-7 and figures VII-4 to VII-9. Prices from U.S. producers by cell origin and importer prices by country source are presented in appendix J.[10]

Table VII-2
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 1, by quarter

Price in dollars per kilowatt, quantity in kilowatts

Period	US price	US quantity	Imported price	Imported quantity
2018 Q1	***	***	***	***
2018 Q2	***	***	***	***
2018 Q3	***	***	***	***
2018 Q4	***	***	***	***
2019 Q1	***	***	***	***
2019 Q2	***	***	***	***
2019 Q3	***	***	***	***
2019 Q4	***	***	***	***
2020 Q1	***	***	***	***
2020 Q2	***	***	***	***
2020 Q3	***	***	***	***
2020 Q4	***	***	***	***
2021 Q1	***	***	***	***
2021 Q2	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 1: Monocrystalline silicon module with front-side area of less than 1.9 square meters and a peak power wattage between 275w to 325w, inclusive, P-max or Wp as measured under Standard Test Conditions ("STC"), excluding bifacial modules.

[10] Data were collected separately for U.S. producers' sales of modules using U.S. cells and U.S. producers' sales of modules using foreign-origin cells. One U.S. producer (***) provided pricing data for modules using U.S. cells ***, and eight firms provided pricing data for modules using foreign-origin cells. These data were combined in the pricing analysis in the section and separately in appendix J.

Table VII-3
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 2, by quarter

Price in dollars per kilowatt; quantity in kilowatts

Period	US price	US quantity	Imported price	Imported quantity
2018 Q1	***	***	***	***
2018 Q2	***	***	***	***
2018 Q3	***	***	***	***
2018 Q4	***	***	***	***
2019 Q1	***	***	***	***
2019 Q2	***	***	***	***
2019 Q3	***	***	***	***
2019 Q4	***	***	***	***
2020 Q1	***	***	***	***
2020 Q2	***	***	***	***
2020 Q3	***	***	***	***
2020 Q4	***	***	***	***
2021 Q1	***	***	***	***
2021 Q2	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 2: Monocrystalline silicon module with front-side area of less than 1.9 square meters and a peak power wattage between 330w to 415w, inclusive, P-max or Wp as measured under Standard Test Conditions (“STC”), excluding bifacial modules.

Table VII-4
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 3, by quarter

Price in dollars per kilowatt; quantity in kilowatts

Period	US price	US quantity	Imported price	Imported quantity
2018 Q1	***	***	***	***
2018 Q2	***	***	***	***
2018 Q3	***	***	***	***
2018 Q4	***	***	***	***
2019 Q1	***	***	***	***
2019 Q2	***	***	***	***
2019 Q3	***	***	***	***
2019 Q4	***	***	***	***
2020 Q1	***	***	***	***
2020 Q2	***	***	***	***
2020 Q3	***	***	***	***
2020 Q4	***	***	***	***
2021 Q1	***	***	***	***
2021 Q2	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 3: Monocrystalline silicon module with front-side area of greater than or equal to 1.9 square meters and a peak power wattage between 325w to 375w, inclusive, P-max or Wp as measured under Standard Test Conditions (“STC”), excluding bifacial modules.

Table VII-5
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 4, by quarter

Price in dollars per kilowatt; quantity in kilowatts

Period	US price	US quantity	Imported price	Imported quantity
2018 Q1	***	***	***	***
2018 Q2	***	***	***	***
2018 Q3	***	***	***	***
2018 Q4	***	***	***	***
2019 Q1	***	***	***	***
2019 Q2	***	***	***	***
2019 Q3	***	***	***	***
2019 Q4	***	***	***	***
2020 Q1	***	***	***	***
2020 Q2	***	***	***	***
2020 Q3	***	***	***	***
2020 Q4	***	***	***	***
2021 Q1	***	***	***	***
2021 Q2	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 4: Monocrystalline silicon module with front-side area of greater than or equal to 1.9 square meters and a peak power wattage between 380w to 430w, inclusive, P-max or Wp as measured under Standard Test Conditions (“STC”), excluding bifacial modules.

Table VII-6
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 5, by quarter

Price in dollars per kilowatt; quantity in kilowatts

Period	US price	US quantity	Imported price	Imported quantity
2018 Q1	***	***	***	***
2018 Q2	***	***	***	***
2018 Q3	***	***	***	***
2018 Q4	***	***	***	***
2019 Q1	***	***	***	***
2019 Q2	***	***	***	***
2019 Q3	***	***	***	***
2019 Q4	***	***	***	***
2020 Q1	***	***	***	***
2020 Q2	***	***	***	***
2020 Q3	***	***	***	***
2020 Q4	***	***	***	***
2021 Q1	***	***	***	***
2021 Q2	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 5: Monocrystalline silicon module with front-side area of greater than or equal to 1.9 square meters and a peak power wattage between 440w to 640w, inclusive, P-max or Wp as measured under Standard Test Conditions (“STC”), excluding bifacial modules.

Table VII-7
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 6, by quarter

Price in dollars per kilowatt; quantity in kilowatts

Period	US price	US quantity	Imported price	Imported quantity
2018 Q1	***	***	***	***
2018 Q2	***	***	***	***
2018 Q3	***	***	***	***
2018 Q4	***	***	***	***
2019 Q1	***	***	***	***
2019 Q2	***	***	***	***
2019 Q3	***	***	***	***
2019 Q4	***	***	***	***
2020 Q1	***	***	***	***
2020 Q2	***	***	***	***
2020 Q3	***	***	***	***
2020 Q4	***	***	***	***
2021 Q1	***	***	***	***
2021 Q2	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 6: Monocrystalline silicon bifacial module that generates power on both sides of the panel with front-side area of greater than or equal to 1.9 square meters and a peak power wattage greater than or equal to 325w, inclusive, P-max or Wp as measured under Standard Test Conditions (“STC”).

Figure VII-4
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 1, by quarter, January 2018-June 2021

* * * * * * *

* * * * * * *

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 1: Monocrystalline silicon module with front-side area of less than 1.9 square meters and a peak power wattage between 275w to 325w, inclusive, P-max or Wp as measured under Standard Test Conditions (“STC”), excluding bifacial modules.

Figure VII-5
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 2, by quarter, January 2018-June 2021

* * * * * * *

* * * * * * *

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 2: Monocrystalline silicon module with front-side area of less than 1.9 square meters and a peak power wattage between 330w to 415w, inclusive, P-max or Wp as measured under Standard Test Conditions (“STC”), excluding bifacial modules.

Figure VII-6
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 3, by quarter, January 2018-June 2021

* * * * * * *

* * * * * * *

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 3: Monocrystalline silicon module with front-side area of greater than or equal to 1.9 square meters and a peak power wattage between 325w to 375w, inclusive, P-max or Wp as measured under Standard Test Conditions (“STC”), excluding bifacial modules.

Figure VII-7
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 4, by quarter, January 2018-June 2021

* * * * * * *

* * * * * * *

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 4: Monocrystalline silicon module with front-side area of greater than or equal to 1.9 square meters and a peak power wattage between 380w to 430w, inclusive, P-max or Wp as measured under Standard Test Conditions (“STC”), excluding bifacial modules.

Figure VII-8
CSPV products: Weighted-average f.o.b. prices and quantities of imported product 5, by quarter, January 2018-June 2021

* * * * * * *

* * * * * * *

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 5: Monocrystalline silicon module with front-side area of greater than or equal to 1.9 square meters and a peak power wattage between 440w to 640w, inclusive, P-max or Wp as measured under Standard Test Conditions ("STC"), excluding bifacial modules.

Figure VII-9
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 6, by quarter, January 2018-June 2021

* * * * * * *

* * * * * * *

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 6: Monocrystalline silicon bifacial module that generates power on both sides of the panel with front-side area of greater than or equal to 1.9 square meters and a peak power wattage greater than or equal to 325w, inclusive, P-max or Wp as measured under Standard Test Conditions ("STC").

Price trends

Table VII-8 summarizes the price trends, by country and by product. In general, prices decreased during January 2018-June 2021. Domestic and import prices decreased for all of the pricing products for which there were data. As shown in the table, domestic price decreases ranged from *** percent (for product ***) to *** percent (for product ***) between the first quarter of 2018 and the second quarter of 2021, while import price decreases ranged from *** percent (for product ***) to *** percent (for product ***).

Table VII-8
CSPV products: Number of quarters containing observations low price, high price, and change in price over period, by product and source

Quantity in kilowatts; price in dollars per kilowatt; change in percent

Product	Source	Number of quarters	Quantity	Low price	High price	First quarter price	Last quarter price	Change over period
Product 1	United States	***	***	***	***	***	***	***
Product 1	Imports	***	***	***	***	***	***	***
Product 2	United States	***	***	***	***	***	***	***
Product 2	Imports	***	***	***	***	***	***	***
Product 3	United States	***	***	***	***	***	***	***
Product 3	Imports	***	***	***	***	***	***	***
Product 4	United States	***	***	***	***	***	***	***
Product 4	Imports	***	***	***	***	***	***	***
Product 5	United States	***	***	***	***	***	***	***
Product 5	Imports	***	***	***	***	***	***	***
Product 6	United States	***	***	***	***	***	***	***
Product 6	Imports	***	***	***	***	***	***	***

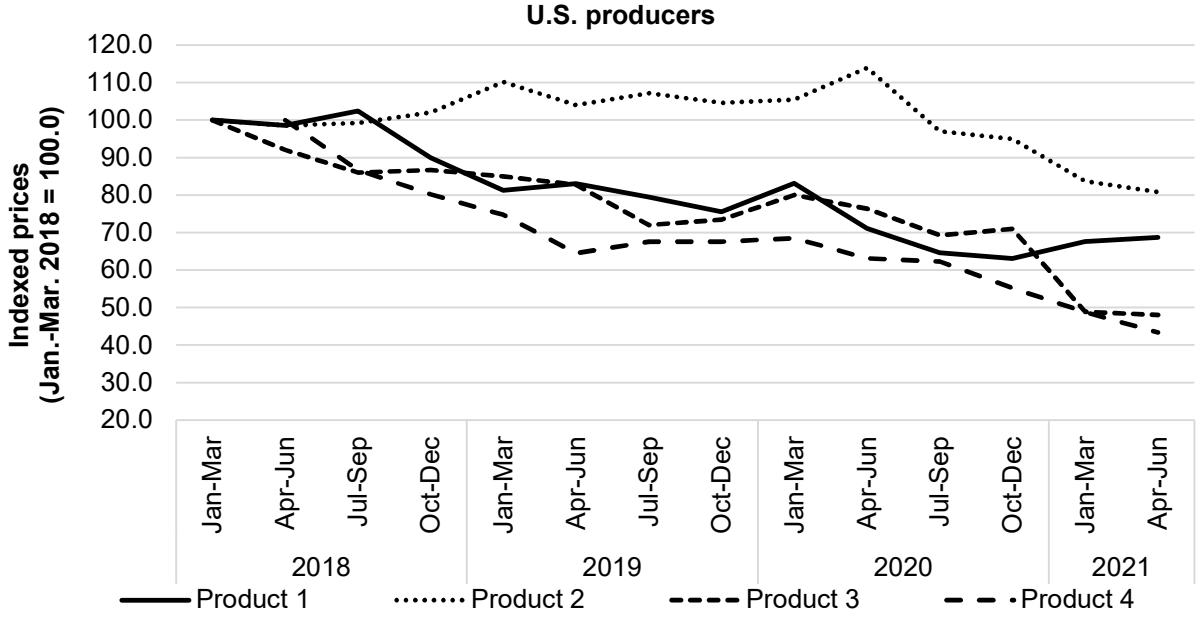
Source: Compiled from data submitted in response to Commission questionnaires.

Note: Percentage change from the first quarter in which data were available to the last quarter in which price data were available.

Indexed U.S. producer prices during January 2018 through June 2021 are shown in figure VII-10 and indexed import prices are shown in figure VII-11. In general, U.S. and import prices followed similar trends during January 2018-June 2021.

Figure VII-10

CSPV products: Indexed U.S. producer prices for products 1-4, by quarter, January 2018–June 2021

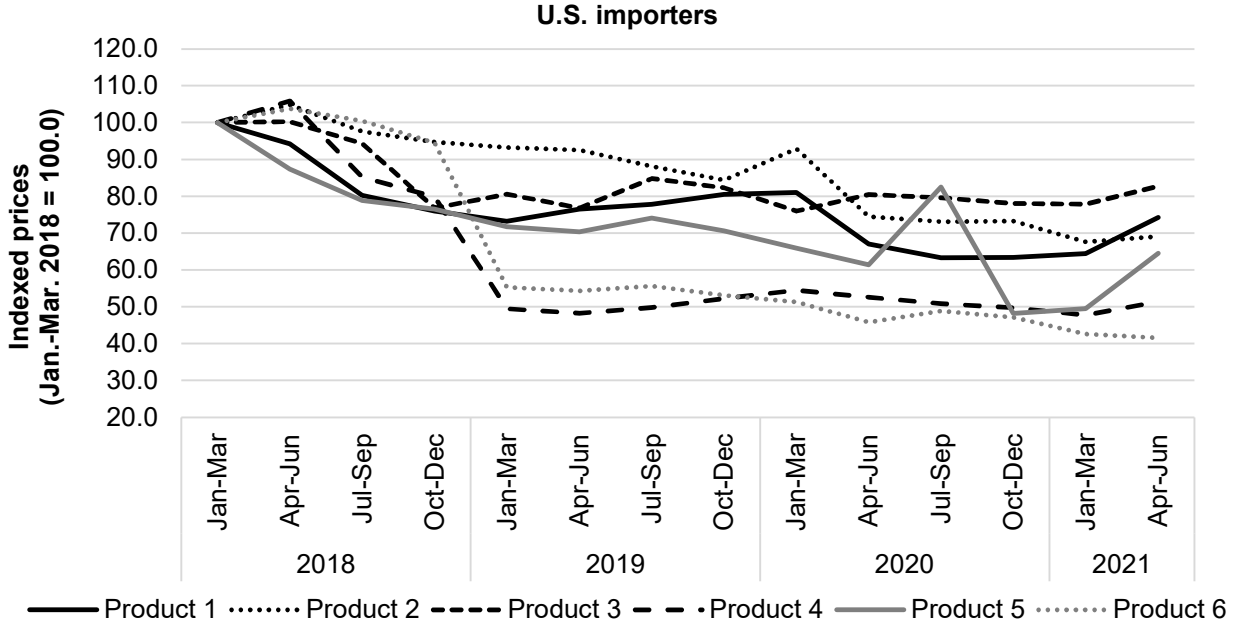


Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 4 is indexed to the second quarter (April-June) of 2018. No pricing data were reported by U.S. producers for product 5.

Figure VII-11

CSPV products: Indexed importer prices for products 1-6, by quarter, January 2018–June 2021



Source: Compiled from data submitted in response to Commission questionnaires.

Price comparisons

In the original safeguard investigation, prices for foreign-origin CSPV products were lower than U.S.-origin CSPV products in 33 of 52 instances and higher in the other 19 instances.[11] In the monitoring phase investigation, prices for imported CSPV modules were below those for U.S.-produced modules in 32 of 43 instances (9.0 GW) and higher in the remaining 11 instances (1.2 GW).[12]

In the current proceeding, as shown in table VII-9, prices for imported CSPV products were below those for U.S.-produced product in 59 of 64 comparisons (28.9 GW of imports) and above those for U.S.-produced product in 5 instances (1.1 GW of imports).

Table VII-9
CSPV products: Summary of instances of import prices (lower)/higher than U.S. prices, by product, January 2018-June 2021

Quantity in kilowatts

Product	Number of quarters lower than U.S.	Quantity lower than U.S.	Number of quarters higher than U.S.	Quantity higher than U.S.
Product 1	14	4,124,172	---	---
Product 2	12	4,071,291	2	332,895
Product 3	12	2,984,045	2	200,905
Product 4	12	9,453,032	1	532,065
Product 5	---	---	---	---
Product 6	9	8,221,591	---	---
All products	59	28,854,131	5	1,065,865

Source: Compiled from data submitted in response to Commission questionnaires.

Note: These data include only quarters in which there is a comparison between the U.S. and imported product.

[11] Safeguard publication, vol. II, p. V-26.
[12] Monitoring publication, p. VI-28.

Part VIII: Adjustment efforts and comments on the safeguard measure

Adjustment plans

Following the vote on injury in the Commission's safeguard investigation, one U.S. producer (SolarWorld, i.e., prior to acquisition by SunPower) included in its prehearing remedy brief a proposed adjustment plan for implementation in the event of appropriate import relief.[1] The applicable excerpt from that brief is reproduced below {footnotes omitted}.

> ***VII. THE DOMESTIC SOLAR INDUSTRY'S ADJUSTMENT TO IMPORTS***
>
> *The relief recommended by the Commission should be aimed {sic} giving the U.S. solar products industry the "breathing space" to adjust positively to competition with imports. Elsewhere in this brief, SolarWorld has recommended a variety of options aimed at providing such relief, as well as forestalling and combatting circumvention. Here, SolarWorld lays out its vision for what the solar industry in the United States should look like after safeguard relief is phased out. SolarWorld also recounts the specific actions that the current members of the industry have committed to undertake during the relief period. These efforts, which involve expenditures of approximately $***, will increase U.S. product range, capacity, and employment, while enabling cost savings that will permit the U.S. industry to compete more effectively against imports. Coupled with effective relief, SolarWorld believes that these efforts are realistically targeted at achieving healthy competitive conditions for the U.S. industry, and enabling the industry to compete effectively against imports on a going-forward basis.*

[1] Other than SolarWorld's inclusion of its plans in its prehearing remedy brief and individual U.S. producer responses to questions in the Commission's Safeguard questionnaire concerning efforts to compete and anticipated adjustments in the event relief were provided, no separate proposed adjustment plans were submitted by U.S. producers. U.S. producers' responses on adjustment plans submitted in the Safeguard questionnaire were presented at tables D-1 and D-2 in the Commission's report in the Safeguard proceeding and are reproduced in appendix D of this report.

*In assessing the domestic solar industry's plan for adjusting to imports, and its commitments to undertake significant investment to achieve such adjustment, the Commission should pay no heed to entities such as the Solar Energy Industry Association, which have complained that U.S. solar manufacturers did not file an adjustment plan within 120 days of the petition. As even SEIA admits, the Trade Act of 1974 does not require the filing of an adjustment plan at all. Moreover, a robust, realistic plan {sic} adjustment plan depends on the scope of the injury determination, as well as on a determination of what relief efforts may be most effective given that scope. A{s} such, it would have made little sense for the domestic industry to prematurely present a plan that would be overtaken by events, and which would have to be substantially revised. In this regard, SolarWorld would also like to point out that, ***, incorporating the proposed adjustment plan into the remedy proposal permits greater accuracy as to the proposed adjustments.*

With the benefit of the agency's injury finding, and in light of the domestic industry's evaluation of potential remedies and its own current position as of the date of this filing, SolarWorld is able to present an adjustment plan that it believes is both realistic and achievable. SolarWorld stresses, however, that achievement of this adjustment plan requires effective import relief that enables U.S. producers to achieve profitability during the relief period. Further, in light of the technologically complex and competitive nature of this industry, it is not possible to forecast every investment that will be made by every U.S. producer during the relief period.

Below, SolarWorld first describes the conditions that it believes will characterize a healthy U.S. solar industry, and which form goals for the domestic industry's position as it emerges from the relief period. SolarWorld then recounts the commitments that both SolarWorld and other companies made in their questionnaire responses. Finally, SolarWorld briefly addresses the fact that both its overall vision for the industry, and the ability of individual firms to enact the commitments described in their questionnaire responses, necessarily depend on effective relief.

A. The Conditions That Will Characterize a Healthy Industry

As the Commission has found, the U.S. solar industry has suffered serious injury by reason of global imports of solar products. Many producers have exited the market entirely; factories have closed, jobs have been lost, and profits have sunk, even as demand continues to rise. In order to adapt successfully to imports, the solar industry will need to become profitable once again, increase production, increase the diversity of its product offerings, and revive upstream production that has relocated overseas. Below, SolarWorld describes some of the conditions that will characterize a healthy, post-relief industry that can compete effectively with imports. SolarWorld believes that these conditions form a reasonable goal for the industry, and can be achieved given the commitments described in subsection VII.B below, and given relief that provides an effective breathing space for the industry to recover from the serious injury that it has suffered.

More producers. *SolarWorld envisions that a healthy industry would be comprised of at least 5-6 competing U.S.-based cell/module producers. Each of these producers will have 1 GW or more of capacity, in order to achieve scale and raw material purchasing power. SolarWorld believes that, with a minimum of 5-6 such producers, the U.S. solar products industry will be well placed to provide competitively priced product to consumers across the country, and across distribution channels.*

Lowered production costs. *U.S. production costs have risen as producers exited the market in the face of import competition, and the remaining producers were unable to finance improvements to their facilities that would permit cost savings. A healthy industry, however, will have lowered production costs that not only enable U.S. producers to compete with imports in the U.S. market, but abroad. Given growing global solar demand, SolarWorld expects that a fully adjusted U.S. solar industry will be fully competitive in the U.S. market and able to export a substantial portion of its yearly production by the end of a safeguards remedy period.*

Competitive for government contracts. *A healthy U.S. industry should be fully competitive to supply all U.S. military and federally funded projects. This means an industry that has multiple producers with sufficient production capacity and product diversity to supply such projects, and whose cost structure enables it to compete effectively for such business.*

A revived upstream production chain. *It is not only U.S. production of solar cells and modules that has suffered during the past five years. U.S. production operations for upstream inputs into solar production, such as polysilicon, wafers, ribbon, solar glass, and aluminum frames have also suffered, and are currently very limited. SolarWorld envisions a U.S. solar products industry that can access U.S.-based supply for a growing portion of its needs, and becomes progressively less dependent on import supply.*

New R&D partnerships. *SolarWorld envisions that each U.S. producer in a revived and healthy solar industry will be engaged in research & development partnerships with one or more major U.S. research universities. Such public/private research, including partnerships supported by the U.S. Department of Energy, will lead to new solar patents, new and more efficient solar products, and increased cost savings in production operations. SolarWorld notes that independent commentators have pointed to vigorous R&D as a potent means for restoring U.S. solar competitiveness.*

Increased cell and module efficiency. *SolarWorld believes that, given effective relief, the U.S. industry can continue to improve cell and module efficiency every year. The continuing development of more efficient products will contribute to the overall competitiveness of U.S. solar products, both in the U.S. market and abroad, and will increase solar product demand.*

Long term supply contracts. *The enhanced production capacity, product diversity, and cost savings achieved during the relief period will permit U.S. solar companies to form long term, stable commercial supply relationships with major U.S. companies, commercial installers, and corporate leaders. U.S. producers have already developed top-notch customer service and relations programs in an attempt to compete with imports, but have lost ground to the low prices offered by such products, affecting sales, production, and product offerings. During the relief period, the U.S. industry will aim to regain this ground and to transform their superior service into relationships that will enable to industry to effectively compete with imports after the relief period ends.*

B. U.S. Solar Producers Have Committed to Significant Adjustment Measures During the Relief Period

*In their responses to the Commission's questionnaires, the remaining members of the domestic solar products industry described in detail specific investments that they would be able to undertake during a relief period. These efforts, which involve expenditures of approximately $***, will increase U.S. product range, capacity, and employment, while enabling cost savings that will permit the U.S. industry to compete more effectively against imports. Coupled with effective relief, SolarWorld believes that these efforts are realistically targeted at achieving healthy competitive conditions for the U.S. industry, and enabling the industry to compete effectively against imports on a going-forward basis.*

1. SolarWorld is Committed to Engaging in Significant Measures During a Period of Temporary Relief to Allow it to Adjust to Imports

*In its questionnaire response, SolarWorld described approximately $*** in investments it plans to undertake during the relief period in order to affirmatively adjust to import competition. The proposed investments will increase SolarWorld's ***. Indeed, in the few days since the Commission's injury vote, SolarWorld has already begun hiring back workers and ramping up its production efforts in anticipation of meaningful relief.*

*SolarWorld proposes to use the relief period to implement investments aimed at ***. In particular, SolarWorld proposes to spend more than $*** to ***. In conjunction with this increase in ***, the company also proposes to increase its ***.*

*In addition to increasing its overall ***, SolarWorld has also committed to *** through an approximately $*** investment to produce ***. A further $*** would go toward increasing ***.*

2. Other Producer Commitments

*SolarWorld is not the only U.S. manufacturer that has committed to taking concrete steps to adjust to import competition, and compete more effectively against imports, during the relief period. Producers other than SolarWorld have stated that they will invest a collective $*** in an effort to adjust to import competition.*

Such adjustments include:

- *$*** by *** to ***.*
- *$*** by *** to ***;*
- *$*** by *** to ***;*
- *$*** by *** to ***;*
- *$*** by *** to ***.*
- *$*** by *** to ***, and a further $*** aimed at ***; and*
- *$*** by *** to ***.*

C. The Measures Described Above are Based on Estimated Profitability During a Temporary Relief Period

The goals and commitments described above are specific and achievable, but only to the extent that the remedy ultimately recommended and adopted in this case is sufficient to allow the U.S. industry to generate profits during the relief period. The remedy being proposed by the industry is aimed at achieving this goal, thus allowing the relief period to be of maximal effectiveness. Further, in light of the technologically complex and competitive nature of this industry, it is not possible to forecast every investment that will be made by every new or existing producer during the relief period. Nonetheless, the commitments laid out above provide a realistic framework for the U.S. solar industry's actions during the relief period, based on the current status of their facilities and equipment. If the ultimate remedy is sufficient to allow sustained operating profitability during the relief period, these adjustments can be implemented and will equip the producers to compete effectively against imports once relief is phased out.[2]

[2] SolarWorld's prehearing remedy brief, September 27, 2017, pp. 49-57.

Commentary on adjustment plans

U.S. producers were asked in the Commission's questionnaire whether they had submitted adjustment plans to the Commission in connection with the original safeguard investigation on CSPV products, or indicated to USTR since the initiation of the original safeguard investigation that they would make adjustments in their operations that would permit them to compete more effectively with imports after relief expires if they were to receive import relief as a result of that investigation. Of the 14 responding firms, 12 reported that they had not done so (table VIII-1). The remaining two firms (Suniva, and SunPower, which reported identical narratives in its pre-acquisition and post-acquisition response) provided commentary in their responses to the Commission's questionnaire on the implementation of their adjustment plans (table VIII-2).

Table VIII-1
CSPV products: Count of U.S. producers' responses on adjustment plans

Item	Not known	No	Yes
Adjustment plans	---	12	2

Table continued.

Table VIII-2
CSPV products: U.S. producers' adjustment plans narratives

Firm	Position on safeguard measures
Sunpower (Pre- and post-acquisition)	***.
Suniva	***.

Source: Compiled from data submitted in response to Commission questionnaires.

Trade adjustment assistance for workers

On November 28, 2017, the U.S. Department of Labor ("DOL") submitted a report to the President, pursuant to section 224(b) of the Trade Act of 1974, on the extent to which U.S. workers in the CSPV products industry are likely to be certified as eligible for trade adjustment assistance ("TAA") and if such workers might be covered by existing U.S. government adjustment programs.[3] The DOL's study on CSPV products as required under Section 224 found the following:

1. The DOL received TAA petitions for 20 worker groups involved in the production of CSPV products since January 2012. Seventeen of those worker groups were certified as eligible to apply for TAA, resulting in an estimated 2,124 workers eligible to apply for individual benefits under the TAA Program.
2. The DOL estimated that 562 additional workers were likely to be covered by certified TAA petitions before the end of the year 2019, which included 230 CSPV cell producers and 332 module producers.
3. The DOL determined that sufficient funding was available to provide TAA benefits and services to these workers. In FY 2017, the DOL provided $391 million to states to provide training and other activities for TAA participants, as well as $294 million in funding for Trade Readjustment Allowances, and $31 million in Reemployment Trade Adjustment Assistance funds.
4. The DOL found that training and benefits under the Trade Act, other DOL programs, and programs at other federal agencies are sufficient to assist workers in the CSPV industry to adjust to the trade impact.

In order to receive TAA benefits and services, the affected group of workers must be certified by the DOL as eligible to apply for such benefits. To begin this process, a petition must be filed with the DOL, after which the DOL collects information to determine if the group of workers meets the eligibility criteria. Since the November 28, 2017 transmittal of the DOL's report to the President, one additional firm (SolarTech Universal, LLC) filed a petition in December 2017 with the DOL for TAA benefits and was certified as eligible, resulting in an

[3] 82 FR 57617, December 6, 2017.

estimated additional 19 workers eligible to apply for individual benefits under the TAA Program. The certification expired on November 21, 2018.[4]

Significance of relief

U.S. producers were asked to describe the significance of the safeguard measure in terms of the measure's effect on several aspects of their firm's operations.[5] As shown in table VIII-3, all U.S. producers except *** provided a response.

Table VIII-3
CSPV products: U.S. producers' reported significance of the safeguard measure

Item	Firm name and narrative
Trade data impact	***
Trade data impact	***
Trade data impact	***
Trade data impact	***
Trade data impact	***
Trade data impact	***
Trade data impact	***
Trade data impact	***
Trade data impact	***

[4] Data on TAA Petitions and Determinations, U.S. Department of Labor, https://www.doleta.gov/tradeact/taa-data/petitions-determinations-data/, retrieved on November 3, 2019.

[5] These aspects include: 1) Production capacity, production, shipments, inventories, and employment ("Trade data impact"); 2) Return on investment, ability to generate capital to finance the modernization of domestic plant(s) and equipment, or ability to maintain existing levels of expenditures for research and development ("Return on investment"); and 3) Changes in firm's collective bargaining agreements ("Labor negotiations").

Item	Firm name and narrative
Trade data impact	***
Trade data impact	***
Trade data impact	***
Return on investment	***

Item	Firm name and narrative
Return on investment	***
Return on investment	***
Return on investment	***
Return on investment	***
Return on investment	***
Return on investment	***
Return on investment	***
Return on investment	***
Return on investment	***
Return on investment	***
Return on investment	***
Labor negotiations	***
Labor negotiations	***
Labor negotiations	***
Labor negotiations	***

Item	Firm name and narrative
Labor negotiations	***
Labor negotiations	***
Labor negotiations	***
Labor negotiations	***

Source: Compiled from data submitted in response to Commission questionnaires.

U.S. producers were also asked to indicate their position on the safeguard measures (see "U.S. market participants" in part I) regarding CSPV cells and CSPV modules separately, and to provide an explanation of their position. Nine firms (counting SunPower's two responses as one) provided explanation regarding their position on the safeguard measures for CSPV cells. Their explanations are shown in table VIII-4.

Table VIII-4
CSPV cells: U.S. producers' narratives on their position on safeguard measures

Item	Firm name and narrative
CSPV cells	***
CSPV cells	***
CSPV cells	***
CSPV cells	***
CSPV cells	***
CSPV cells	***

Item	Firm name and narrative
CSPV cells	***
CSPV cells	***
CSPV cells	***
CSPV cells	***

Source: Compiled from data submitted in response to Commission questionnaires.

Seven firms (counting SunPower's two responses as one) provided explanation regarding their position on the safeguard measures for CSPV modules. Their explanations are shown in table VIII-5.

Table VIII-5
CSPV modules: U.S. producers' narratives on their position on safeguard measures

Item	Firm name and narrative
CSPV modules	***
CSPV modules	***
CSPV modules	***
CSPV modules	***
CSPV modules	***
CSPV modules	***
CSPV modules	***
CSPV modules	***

Source: Compiled from data submitted in response to Commission questionnaires.

U.S. importers were also asked to describe the significance of the safeguard measure in terms of its effect on their imports, U.S. shipments, exports, and inventories. Responses provided are shown in table VIII-6.

Table VIII-6
CSPV products: U.S. importers' narratives on the significance on safeguard measures

Item	Firm name and narrative
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***

Item	Firm name and narrative
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***

Item	Firm name and narrative
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***

Item	Firm name and narrative
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***

Item	Firm name and narrative
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***

Item	Firm name and narrative
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***
Effect of safeguard measure	***

Source: Compiled from data submitted in response to Commission questionnaires.

Post-relief efforts

The Commission's questionnaires asked U.S. producers whether they had undertaken any efforts to compete more effectively in the U.S. market for CSPV products since February 7, 2018. Eleven U.S. producers provided responses, which are presented in table VIII-7.

Table VIII-7
CSPV products: U.S. producers' narratives on their efforts to compete

Item	Firm name and narrative
Efforts since implementation of safeguard measures	***

Item	Firm name and narrative
Efforts since implementation of safeguard measures	***
Efforts since implementation of safeguard measures	***
Efforts since implementation of safeguard measures	***

Item	Firm name and narrative
Efforts since implementation of safeguard measures	***
Efforts since implementation of safeguard measures	***
Efforts since implementation of safeguard measures	***
Efforts since implementation of safeguard measures	***

Item	Firm name and narrative
Efforts since implementation of safeguard measures	***
Efforts since implementation of safeguard measures	***
Efforts since implementation of safeguard measures	***
Efforts since implementation of safeguard measures	***

Source: Compiled from data submitted in response to Commission questionnaires.

In addition, purchasers were asked whether, based on their experience, domestic producers have taken certain specified steps toward making positive adjustments to import competition since February 7, 2018, including introducing new or innovative products, improving product quality, expanding marketing efforts (including e-commerce), and/or improving customer service. As shown in table VIII-8, a majority of responding purchasers reported that U.S. producers have not taken all of the specified steps to adjust to import competition.

Table VIII-8
CSPV products: Count of purchasers' responses regarding producer actions taken to adjust to import competition since February 7, 2018

Count in number of firms reporting

Action	No	Yes
Introduction of new or innovative products	35	15
Improved product quality	37	10
Expansion of marketing efforts	37	11
Improvements in customer service	41	6
Other efforts	39	11

Source: Compiled from data submitted in response to Commission questionnaires.

APPENDIX A

FEDERAL REGISTER NOTICES

The Commission makes available notices relevant to its investigations and reviews on its website, www.usitc.gov. In addition, the following tabulation presents, in chronological order, *Federal Register* notices issued by the Commission during the current proceeding.

Citation	Title	Link
86 FR 44403, August 12, 2021	*Crystalline Silicon Photovoltaic Cells, Whether or Not Partially or Fully Assembled Into Other Products: Extension of Action*	https://www.govinfo.gov/content/pkg/FR-2021-08-12/pdf/2021-17190.pdf

APPENDIX B

LIST OF HEARING WITNESSES

CALENDAR OF PUBLIC HEARING

Those listed below appeared in the United States International Trade Commission's hearing via videoconference:

Subject:	Crystalline Silicon Photovoltaic Cells, Whether or Not Partially or Fully Assembled into Other Products: Extension of Action
Inv. No.:	TA-201-75 (Extension)
Date and Time:	November 3, 2021 - 9:30 a.m.

CONGRESSIONAL APPEARANCE:

The Honorable Raja Krishnamoorthi, U.S. Representative, 8th District, Illinois

COUNTY GOVERNMENT APPEARANCE:

Carl Campbell, Executive Director, Dalton-Whitfield County Joint Development Authority

EMBASSY WITNESSES:

Embassy of the Republic of Indonesia
Washington, DC

Mr. Wijayanto, Commercial Attaché

Embassy of Canada
Washington, DC

Nadia Bourély, Minister-Counsellor

Embassy of the Socialist Republic of Vietnam
Washington, DC

Bui Huy Son, Minister Counselor, Head of Trade Office

Luong Kim Thanh, First Secretary, Trade Office

EMBASSY WITNESSES (continued):

Government of Malaysia
Ministry of International Trade and Industry
Washington, DC

Aida Safinaz Allias, Minister (Economic Affairs)

Nur' Alia Ismail, First Secretary

OPENING REMARKS:

In Support of Extension (**Diana Dimitriuc Quaia**, Arent Fox LLP)
In Opposition to Extension
(**Matthew R. Nicely**, Akin Gump Strauss Hauer & Feld LLP)

IN SUPPORT OF EXTENSION:

Cassidy Levy Kent (USA) LLP
Schagrin Associates
Washington, DC
on behalf of

Auxin Solar Inc. ("Auxin")
Suniva, Inc. ("Suniva")

Mamun Rashid, Chief Executive Officer, Auxin

Matt Card, President, Suniva

Andrew Szamosszegi, Economist, Capital Trade, Inc.

Travis Pope, Economist, Capital Trade, Inc.

Thomas M. Beline)
Jack A. Levy)
Mary Jane Alves)
) – OF COUNSEL
Sarah E. Shulman)
Christopher T. Cloutier)
Elizabeth J. Drake)

IN SUPPORT OF EXTENSION (continued):

Arent Fox LLP
Washington, DC
on behalf of

Hanwha Q CELLS USA, Inc. ("Hanwha Q CELLS")
Mission Solar Energy ("Mission")

Scott Moskowitz, Director of Strategy and Market Intelligence,
Hanwha Q CELLS USA, Inc.

Lisa Nash, General Manager, Human Resources/Environmental Health & Safety,
Q CELLS North America

Paul Mutchler, Director of Commercial Operations, Mission Solar Energy LLC

Andrew Munro, General Counsel, Hanwha Q CELLS USA, Inc.

Michael T. Kerwin, Director, Georgetown Economic Services, LLC

W. Bradley Hudgens, Senior Economist, Georgetown Economic Services, LLC

John M. Gurley)
Diana Dimitriuc Quaia)
) – OF COUNSEL
Jessica R. DiPietro)
John A. Gurtunca)

Curtis, Mallet-Prevost, Colt & Mosle LLP
Washington, DC
on behalf of

LG Electronics USA, Inc. ("LGEUS")
LG Electronics, Inc.
(collectively "LGE")

Brian Lynch, Director of Solar and ESS Sales, LGEUS

Daniel L. Porter)
James P. Durling) – OF COUNSEL
Ana Amador)

IN OPPOSITION TO EXTENSION:

Morris, Manning & Martin, LLP
Washington, DC
on behalf of

China Chamber of Commerce for Import
and Export of Machinery and Electronic Products ("CCCME")
LONGi Green Energy Technology Co., Ltd. ("LONGi")
Risen Energy Co., Ltd. ("Risen")
GCL System Integration Technology Co. Ltd. ("GCL")
(collectively, "CCCME")

Emma K. Peterson, Director of Int'l Trade Analytics,
Morris, Manning & Martin, LLP

Donald B. Cameron) – OF COUNSEL

Mowry & Grimson, PLLC
Washington, DC
on behalf of

American Clean Power Association ("ACP")
Clearway Energy Group LLC ("Clearway")

Heather Zichal, Chief Executive Officer, ACP

Logan Granger, Vice President, Clearway

Art Fletcher, Executive Vice President,
Invenergy Renewables LLC, member of ACP

Tom Wynyard Bellhouse, Senior Trade Economist to ACP,
Mowry & Grimson PLLC

Kristin H. Mowry)
Jeffrey S. Grimson) – OF COUNSEL
Sarah M. Wyss)

IN OPPOSITION TO EXTENSION (continued):

Akin Gump Strauss Hauer & Feld LLP
Washington, DC
on behalf of

NextEra Energy Inc.

Ron Reagan, Executive Vice President, Engineering & Construction and Integrated Supply Chain, NextEra Energy Inc.

Bernd G. Janzen)
) – OF COUNSEL
Yujin K. McNamara)

Akin Gump Strauss Hauer & Feld LLP
Washington, DC
on behalf of

Solar Energy Industries Association ("SEIA")
REC Americas LLC

Abigail Ross Hopper, President and Chief Executive Officer, SEIA

George Hershman, President, SOLV Energy

James Resor, Chief Executive Officer, EDF Renewables Distributed Solutions Inc.

Aaron Hall, President, Borrego Solar Systems, Inc.

.

Thomas J. Prusa, PhD, Professor, Department of Economics, Rutgers University

James P. Dougan, Partner, ION Economics, LLC

Jerrie V. Mirga, Director, ION Economics, LLC

Matthew R. Nicely)
Julia K. Eppard)
) – OF COUNSEL
Daniel M. Witkowski)
Sydney L. Stringer)

IN OPPOSITION TO EXTENSION (continued):

Hogan Lovells US LLP
Washington, DC
on behalf of

Government of Canada
Canadian Solar Solutions Inc.
Silfab Solar WA Inc.
Silfab Solar USA Inc.
Silfab Solar Inc.
Heliene USA Inc.
Heliene Inc.

Martin Pochtaruk, President, Heliene Inc. and Heliene USA Inc.

Paolo Maccario, President and Chief Executive Officer,
Silfab Solar, Inc. and Silfab Solar WA, Inc.

Vincent Ambrose, General Manager for North America, Canadian Solar Inc.

Jonathan T. Stoel)
Michael G. Jacobson) – OF COUNSEL
Nicholas R. Sparks)

REBUTTAL/CLOSING REMARKS:

In Support of Extension
(**James P. Durling**, Curtis, Mallet-Prevost, Colt & Mosle LLP and
Thomas M. Beline, Cassidy Levy Kent (USA) LLP and)
In Opposition to Extension
(**Matthew R. Nicely**, Akin Gump Strauss Hauer & Feld LLP)

- END -

APPENDIX C

SUMMARY DATA

Table C-1: CSPV cells: Summary data concerning the U.S. market, by item and by period C-3

Table C-2: CSPV modules: Summary data concerning the U.S. market, by item and by period C-5

Table C-3: CSPV products: Summary data on U.S. imports and U.S. producers, by item and by period.....C-8

CSPV cells

Table C-1
CSPV cells: Summary data concerning the U.S. market, by item and by period
Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted

	Reported data					Period changes			
	Calendar year			Jan-Jun		Comparison years			Jan-Jun
	2018	2019	2020	2020	2021	2018-20	2018-19	2019-20	2020-21
U.S. consumption quantity:									
Amount	***	***	***	***	***	▲***	▲***	▼***	▼***
Producers' share (fn1)	***	***	***	***	***	▼***	▼***	▼***	***
Importers' share (fn1):									
China	***	***	***	***	***	▲***	▲***	▲***	▼***
Japan	***	***	***	***	***	▼***	▼***	▼***	▼***
Korea	***	***	***	***	***	▲***	▲***	▲***	▼***
Malaysia	***	***	***	***	***	▼***	▼***	▲***	▲***
Phillipines	***	***	***	***	***	▼***	▼***	▼***	▼***
Taiwan	***	***	***	***	***	▲***	▲***	▼***	▲***
Thailand	***	***	***	***	***	▼***	▼***	***	▲***
Vietnam	***	***	***	***	***	▼***	▼***	▼***	▲***
All other sources	***	***	***	***	***	▼***	▼***	▲***	▲***
All import sources	***	***	***	***	***	▲***	▲***	▲***	***
U.S. consumption value:									
Amount	***	***	***	***	***	▲***	▲***	▲***	▼***
Producers' share (fn1)	***	***	***	***	***	▼***	▼***	▼***	***
Importers' share (fn1):									
China	***	***	***	***	***	▲***	▲***	▲***	▼***
Japan	***	***	***	***	***	▼***	▼***	▼***	▼***
Korea	***	***	***	***	***	▲***	▲***	▲***	▼***
Malaysia	***	***	***	***	***	▼***	▼***	▲***	▲***
Phillipines	***	***	***	***	***	▼***	▼***	▼***	▲***
Taiwan	***	***	***	***	***	▲***	▲***	▼***	▲***
Thailand	***	***	***	***	***	▼***	▼***	***	▲***
Vietnam	***	***	***	***	***	▲***	▲***	▼***	▲***
All other sources	***	***	***	***	***	▼***	▼***	▲***	▲***
All import sources	***	***	***	***	***	▲***	▲***	▲***	***
U.S. imports from:									
China:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▼***
Value	***	***	***	***	***	▲***	▲***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▲***
Japan:									
Quantity	***	***	***	***	***	▼***	▲***	▼***	▼***
Value	***	***	***	***	***	▼***	▲***	▼***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Korea:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▼***
Value	***	***	***	***	***	▲***	▲***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
Malaysia:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▲***
Value	***	***	***	***	***	▼***	▼***	▲***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
Phillipines:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Value	***	***	***	***	***	▼***	▼***	▼***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▲***
Taiwan:									
Quantity	***	***	***	***	***	▲***	▲***	▼***	▲***
Value	***	***	***	***	***	▲***	▲***	▼***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▲***
Thailand:									
Quantity	***	***	***	***	***	▼***	▼***	***	▲***
Value	***	***	***	***	***	▼***	▼***	***	▲***
Unit value	***	***	***	***	***	▼***	▼***	***	▲***
Vietnam:									
Quantity	***	***	***	***	***	▲***	▲***	▼***	▲***
Value	***	***	***	***	***	▲***	▲***	▼***	▲***
Unit value	***	***	***	***	***	▲***	▲***	▼***	▼***

Table continued.

Table C-1 continued
CSPV cells: Summary data concerning the U.S. market, by item and by period
Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted

	Reported data					Period changes			
	Calendar year			Jan-Jun		Comparison years			Jan-Jun
	2018	2019	2020	2020	2021	2018-20	2018-19	2019-20	2020-21
U.S. imports from:--Continued									
All other sources:									
Quantity	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	▼***	▲***	▲***
Unit value	***	***	***	***	***	***	▼***	▲***	▲***
All import sources:									
Quantity	754,939	2,189,237	2,172,166	1,290,324	1,145,810	▲187.7	▲190.0	▼(0.8)	▼(11.2)
Value	231,554	430,197	467,648	273,794	218,858	▲102.0	▲85.8	▲8.7	▼(20.1)
Unit value	$307	$197	$215	$212	$191	▼(29.8)	▼(35.9)	▲9.6	▼(10.0)
U.S. producers':									
Average capacity quantity	***	***	***	***	***	▼***	▼***	▲***	▼***
Production quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Capacity utilization (fn1)	***	***	***	***	***	▼***	▲***	▼***	▼***
U.S. shipments:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	***
Value	***	***	***	***	***	▼***	▼***	▼***	***
Unit value	***	***	***	***	***	▼***	▲***	▼***	***
Export shipments:									
Quantity	***	***	***	***	***	▲***	▲***	▼***	▼***
Value	***	***	***	***	***	▲***	▲***	▼***	▼***
Unit value	***	***	***	***	***	▲***	▲***	▼***	▼***
Ending inventory quantity	***	***	***	***	***	▼***	▼***	▼***	***
Inventories/total shipments (fn1)	***	***	***	***	***	▼***	▲***	▼***	***
Production workers	***	***	***	***	***	▼***	▼***	***	▼***
Hours worked (1,000s)	***	***	***	***	***	▼***	▲***	▼***	▼***
Wages paid ($1,000)	***	***	***	***	***	▼***	▼***	▼***	▼***
Hourly wages (dollars per hour)	***	***	***	***	***	▼***	▼***	▲***	▼***
Productivity (watts per hour)	***	***	***	***	***	▼***	▼***	▲***	▼***
Unit labor costs	***	***	***	***	***	▲***	▲***	▼***	▼***
Open market net sales (fn3):									
Quantity	***	***	***	***	***	▲***	▲***	▼***	▼***
Value	***	***	***	***	***	▲***	▲***	▼***	▼***
Unit value	***	***	***	***	***	▲***	▲***	▼***	▼***
Cost of goods sold (COGS)	***	***	***	***	***	▼***	▲***	▼***	▼***
Gross profit or (loss) (fn2)	***	***	***	***	***	▲***	▲***	▲***	▲***
SG&A expenses	***	***	***	***	***	▼***	▲***	▼***	▼***
Operating income or (loss) (fn2)	***	***	***	***	***	▲***	▲***	▲***	▲***
Net income or (loss) (fn2)	***	***	***	***	***	▲***	▲***	▲***	▲***
Unit COGS	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit SG&A expenses	***	***	***	***	***	▼***	▲***	▼***	▼***
Unit operating income or (loss) (fn2)	***	***	***	***	***	▲***	▲***	▲***	▲***
Unit net income or (loss) (fn2)	***	***	***	***	***	▲***	▲***	▲***	▲***
COGS/sales (fn1)	***	***	***	***	***	▼***	▼***	▼***	▼***
Operating income or (loss)/sales (fn1)	***	***	***	***	***	▲***	▲***	▲***	▲***
Net income or (loss)/sales (fn1)	***	***	***	***	***	▲***	▲***	▲***	▲***
Capital expenditures	***	***	***	***	***	▼***	▼***	***	***
Research and development expenses	***	***	***	***	***	***	***	***	***
Net assets	***	***	***	***	***	▼***	▲***	▼***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note.--Shares and ratios shown as "0.0" percent represent non-zero values less than "0.05" percent (if positive) and greater than "(0.05)" percent (if negative). Zeroes, null values, and undefined calculations are suppressed and shown as "---". Period changes preceded by a "▲" represent an increase, while period changes preceded by a "▼" represent a decrease.

fn1.--Reported data are in percent and period changes are in percentage points.
fn2.--Percent changes only calculated when both comparison values represent profits; The directional change in profitability provided when one or both comparison values represent a loss.
fn3.--Financial results in Commission questionnaires were limited to open market sales.

Table C-2
CSPV modules: Summary data concerning the U.S. market, by item and by period
Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted

	Reported data					Period changes			
	Calendar year			Jan-Jun		Comparison years			Jan-Jun
	2018	2019	2020	2020	2021	2018-20	2018-19	2019-20	2020-21
U.S. consumption quantity:									
Amount	5,378,322	13,626,937	21,026,155	10,848,276	11,617,468	▲290.9	▲153.4	▲54.3	▲7.1
Producers' share (fn1)	8.5	14.2	10.2	10.3	9.6	▲1.7	▲5.7	▼(4.0)	▼(0.7)
Importers' share (fn1):									
Cambodia	***	***	***	***	***	▲***	▲***	▲***	▲***
China	***	***	***	***	***	▲***	▲***	▲***	▼***
India	***	***	***	***	***	▼***	▼***	▲***	▲***
Indonesia	***	***	***	***	***	▼***	▼***	▼***	***
Japan	***	***	***	***	***	▼***	▼***	***	***
Korea	***	***	***	***	***	▼***	▼***	▲***	▼***
Malaysia	***	***	***	***	***	▼***	▲***	▼***	▼***
Philippines	***	***	***	***	***	▼***	▼***	▼***	▼***
Singapore	***	***	***	***	***	▼***	▼***	▼***	▼***
Taiwan	***	***	***	***	***	▲***	▲***	▼***	▼***
Thailand	***	***	***	***	***	▲***	▲***	▲***	▲***
Turkey	***	***	***	***	***	▼***	▼***	▼***	***
Vietnam	***	***	***	***	***	▲***	▲***	▲***	▲***
All other sources	***	***	***	***	***	▼***	▼***	▼***	***
All import sources	91.5	85.8	89.8	89.7	90.4	▼(1.7)	▼(5.7)	▲4.0	▲0.7
U.S. consumption value:									
Amount	2,269,525	4,504,165	6,573,873	3,467,286	3,349,041	▲189.7	▲98.5	▲46.0	▼(3.4)
Producers' share (fn1)	11.1	19.3	13.6	13.8	13.6	▲2.6	▲8.2	▼(5.7)	▼(0.2)
Importers' share (fn1):									
Cambodia	***	***	***	***	***	▲***	▲***	▲***	▲***
China	***	***	***	***	***	▲***	▲***	▲***	▼***
India	***	***	***	***	***	▼***	▼***	▲***	▲***
Indonesia	***	***	***	***	***	▼***	▼***	▼***	***
Japan	***	***	***	***	***	▼***	▼***	***	***
Korea	***	***	***	***	***	▼***	▼***	▲***	▼***
Malaysia	***	***	***	***	***	▼***	▲***	▼***	▼***
Philippines	***	***	***	***	***	▼***	▼***	▼***	▲***
Singapore	***	***	***	***	***	▼***	▼***	▼***	▲***
Taiwan	***	***	***	***	***	▲***	▲***	▼***	▼***
Thailand	***	***	***	***	***	▲***	▲***	▲***	▲***
Turkey	***	***	***	***	***	▼***	▼***	▼***	***
Vietnam	***	***	***	***	***	▲***	▲***	▲***	▲***
All other sources	***	***	***	***	***	▼***	▲***	▼***	***
All import sources	88.9	80.7	86.4	86.2	86.4	▼(2.6)	▼(8.2)	▲5.7	▲0.2
U.S. imports from:									
Cambodia:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▲***
Value	***	***	***	***	***	▲***	▲***	▲***	▲***
Unit value	***	***	***	***	***	▲***	▲***	▼***	▲***
China:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▼***
Value	***	***	***	***	***	▲***	▲***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
India:									
Quantity	***	***	***	***	***	▼***	▼***	▲***	▲***
Value	***	***	***	***	***	▼***	▼***	▲***	▲***
Unit value	***	***	***	***	***	▲***	▲***	▲***	▲***
Indonesia:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	***
Value	***	***	***	***	***	▼***	▲***	▼***	***
Unit value	***	***	***	***	***	▼***	▲***	▼***	***
Japan:									
Quantity	***	***	***	***	***	▼***	▼***	***	***
Value	***	***	***	***	***	▼***	▼***	***	***
Unit value	***	***	***	***	***	▼***	▼***	***	***
Korea:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▼***
Value	***	***	***	***	***	▲***	▼***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***

Table continued.

Table C-2 continued
CSPV modules: Summary data concerning the U.S. market, by item and by period
Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted

	Reported data					Period changes			
	Calendar year			Jan-Jun		Comparison years			Jan-Jun
	2018	2019	2020	2020	2021	2018-20	2018-19	2019-20	2020-21
U.S. imports from:--Continued									
Malaysia:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▼***
Value	***	***	***	***	***	▲***	▲***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Philippines:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Value	***	***	***	***	***	▼***	▼***	▼***	▲***
Unit value	***	***	***	***	***	▼***	▲***	▼***	▲***
Singapore:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▼***
Value	***	***	***	***	***	▼***	▼***	▲***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▲***
Taiwan:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▼***
Value	***	***	***	***	***	▲***	▲***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Thailand:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▲***
Value	***	***	***	***	***	▲***	▲***	▲***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
Turkey:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	***
Value	***	***	***	***	***	▼***	▼***	▼***	***
Unit value	***	***	***	***	***	▼***	▼***	▼***	***
Vietnam:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▲***
Value	***	***	***	***	***	▲***	▲***	▲***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
All other sources:									
Quantity	***	***	***	***	***	▼***	▲***	▼***	***
Value	***	***	***	***	***	▼***	▲***	▼***	***
Unit value	***	***	***	***	***	▲***	▲***	▲***	***
All import sources:									
Quantity	4,921,483	11,696,707	18,882,847	9,731,910	10,500,717	▲283.7	▲137.7	▲61.4	▲7.9
Value	2,018,133	3,633,775	5,676,766	2,990,435	2,894,517	▲181.3	▲80.1	▲56.2	▼(3.2)
Unit value	$410	$311	$301	$307	$276	▼(26.7)	▼(24.2)	▼(3.2)	▼(10.3)
U.S. producers':									
Average capacity quantity	1,121,200	3,703,017	3,830,309	1,901,447	1,766,521	▲241.6	▲230.3	▲3.4	▼(7.1)
Production quantity	469,829	2,077,344	2,216,759	1,160,948	1,117,057	▲371.8	▲342.1	▲6.7	▼(3.8)
Capacity utilization (fn1)	41.9	56.1	57.9	61.1	63.2	▲16.0	▲14.2	▲1.8	▲2.2
U.S. shipments:									
Quantity	456,839	1,930,230	2,143,308	1,116,366	1,116,751	▲369.2	▲322.5	▲11.0	▲0.0
Value	251,392	870,390	897,107	476,851	454,524	▲256.9	▲246.2	▲3.1	▼(4.7)
Unit value	$550	$451	$419	$427	$407	▼(23.9)	▼(18.1)	▼(7.2)	▼(4.7)
Export shipments:									
Quantity	***	***	***	***	***	▲***	▲***	▼***	▲***
Value	***	***	***	***	***	▲***	▲***	▼***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Ending inventory quantity	12,500	118,041	168,692	151,993	155,734	▲1,249.5	▲844.3	▲42.9	▲2.5
Inventories/total shipments (fn1)	***	***	***	***	***	▲***	▲***	▲***	▲***
Production workers	1,097	2,644	2,583	2,489	2,305	▲135.5	▲141.0	▼(2.3)	▼(7.4)
Hours worked (1,000s)	1,584	4,367	4,239	2,250	1,941	▲167.6	▲175.7	▼(2.9)	▼(13.7)
Wages paid ($1,000)	50,085	106,071	91,357	46,596	47,951	▲82.4	▲111.8	▼(13.9)	▲2.9
Hourly wages (dollars per hour)	$31.62	$24.29	$21.55	$20.71	$24.70	▼(31.8)	▼(23.2)	▼(11.3)	▲19.3
Productivity (watts per hour)	296.6	475.7	522.9	516.0	575.5	▲76.3	▲60.4	▲9.9	▲11.5
Unit labor costs	$107	$51	$41	$40	$43	▼(61.3)	▼(52.1)	▼(19.3)	▲7.0

Table continued.

Table C-2 continued
CSPV modules: Summary data concerning the U.S. market, by item and by period
Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted

	Reported data					Period changes			
	Calendar year			Jan-Jun		Comparison years			Jan-Jun
	2018	2019	2020	2020	2021	2018-20	2018-19	2019-20	2020-21
U.S. producers':--Continued									
Net sales:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▼***
Value	***	***	***	***	***	▲***	▲***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Cost of goods sold (COGS)	***	***	***	***	***	▲***	▲***	▲***	▼***
Gross profit or (loss) (fn2)	***	***	***	***	***	▼***	▲***	▼***	▲***
SG&A expenses	***	***	***	***	***	▲***	▲***	▼***	▲***
Operating income or (loss) (fn2)	***	***	***	***	***	▼***	▲***	▼***	▲***
Net income or (loss) (fn2)	***	***	***	***	***	▲***	▲***	▼***	▲***
Unit COGS	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit SG&A expenses	***	***	***	***	***	▼***	▼***	▼***	▲***
Unit operating income or (loss) (fn2)	***	***	***	***	***	▲***	▲***	▼***	▲***
Unit net income or (loss) (fn2)	***	***	***	***	***	▲***	▲***	▼***	▲***
COGS/sales (fn1)	***	***	***	***	***	▼***	▼***	▲***	▼***
Operating income or (loss)/sales (fn1)	***	***	***	***	***	▲***	▲***	▼***	▲***
Net income or (loss)/sales (fn1)	***	***	***	***	***	▲***	▲***	▼***	▲***
Capital expenditures	***	***	***	***	***	▼***	▼***	▼***	▼***
Research and development expenses	***	***	***	***	***	▼***	▼***	▼***	▼***
Net assets (fn3)	***	***	***	***	***	▲***	▲***	▼***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note.--Shares and ratios shown as "0.0" percent represent non-zero values less than "0.05" percent (if positive) and greater than "(0.05)" percent (if negative). Zeroes, null values, undefined calculations, and unmeaningfully large percent changes are suppressed and shown as "---". Period changes preceded by a "▲" represent an increase, while period changes preceded by a "▼" represent a decrease.

fn1.--Reported data are in percent and period changes are in percentage points.
fn2.--Percent changes only calculated when both comparison values represent profits; The directional change in profitability provided when one or both comparison values represent a loss.
fn3.--Total module net asset also includes cell assets used to produce cells consumed in module production.

CSPV products (cells and modules)

Table C-3
CSPV products: Summary data on U.S. imports and U.S. producers, by item and by period
Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted

	Reported data					Period changes			
	Calendar year			Jan-Jun		Comparison years			Jan-Jun
	2018	2019	2020	2020	2021	2018-20	2018-19	2019-20	2020-21
U.S. imports from:									
Cambodia:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▲***
Value	***	***	***	***	***	▲***	▲***	▲***	▲***
Unit value	***	***	***	***	***	▲***	▲***	▼***	▲***
China:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▼***
Value	***	***	***	***	***	▲***	▲***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▲***
India:									
Quantity	***	***	***	***	***	▼***	▼***	▲***	▲***
Value	***	***	***	***	***	▼***	▼***	▲***	▲***
Unit value	***	***	***	***	***	▲***	▲***	▲***	▲***
Indonesia:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	***
Value	***	***	***	***	***	▼***	▲***	▼***	***
Unit value	***	***	***	***	***	▼***	▲***	▼***	***
Japan:									
Quantity	***	***	***	***	***	▼***	▲***	▼***	▼***
Value	***	***	***	***	***	▼***	▲***	▼***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Korea:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▼***
Value	***	***	***	***	***	▲***	▲***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
Malaysia:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▲***
Value	***	***	***	***	***	▲***	▲***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Philippines:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Value	***	***	***	***	***	▼***	▼***	▼***	▲***
Unit value	***	***	***	***	***	▼***	▲***	▼***	▲***
Singapore:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▼***
Value	***	***	***	***	***	▼***	▼***	▲***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▲***
Taiwan:									
Quantity	***	***	***	***	***	▲***	▲***	▼***	▼***
Value	***	***	***	***	***	▲***	▲***	▼***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
Thailand:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▲***
Value	***	***	***	***	***	▲***	▲***	▲***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
Turkey:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	***
Value	***	***	***	***	***	▼***	▼***	▼***	***
Unit value	***	***	***	***	***	▼***	▼***	▼***	***
Vietnam:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▲***
Value	***	***	***	***	***	▲***	▲***	▲***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
All other sources:									
Quantity	***	***	***	***	***	▼***	▲***	▼***	***
Value	***	***	***	***	***	▼***	▲***	▼***	▲***
Unit value	***	***	***	***	***	▲***	▲***	▲***	▲***
All import sources:									
Quantity	5,676,422	13,885,944	21,055,013	11,022,234	11,646,527	▲270.9	▲144.6	▲51.6	▲5.7
Value	2,249,687	4,063,972	6,144,414	3,264,229	3,113,375	▲173.1	▲80.6	▲51.2	▼(4.6)
Unit value	$396	$293	$292	$296	$267	▼(26.4)	▼(26.2)	▼(0.3)	▼(9.7)

Table continued.

Table C-3 continued
CSPV products: Summary data concerning the U.S. market, by item and by period
Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted

	Reported data					Period changes			
	Calendar year			Jan-Jun		Comparison years			Jan-Jun
	2018	2019	2020	2020	2021	2018-20	2018-19	2019-20	2020-21
U.S. producers':									
CSPV cells:									
Average capacity quantity	***	***	***	***	***	▼***	▼***	▲***	▼***
Production quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Capacity utilization (fn1)	***	***	***	***	***	▼***	▲***	▼***	▼***
CSPV modules:									
Average capacity quantity	1,121,200	3,703,017	3,830,309	1,901,447	1,766,521	▲241.6	▲230.3	▲3.4	▼(7.1)
Production quantity	469,829	2,077,344	2,216,759	1,160,948	1,117,057	▲371.8	▲342.1	▲6.7	▼(3.8)
Capacity utilization (fn1)	41.9	56.1	57.9	61.1	63.2	▲16.0	▲14.2	▲1.8	▲2.2
CSPV cells:									
U.S. shipments:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	***
Value	***	***	***	***	***	▼***	▼***	▼***	***
Unit value	***	***	***	***	***	▼***	▲***	▼***	***
CSPV modules:									
U.S. shipments:									
Quantity	456,839	1,930,230	2,143,308	1,116,366	1,116,751	▲369.2	▲322.5	▲11.0	▲0.0
Value	251,392	870,390	897,107	476,851	454,524	▲256.9	▲246.2	▲3.1	▼(4.7)
Unit value	$550	$451	$419	$427	$407	▼(23.9)	▼(18.1)	▼(7.2)	▼(4.7)
CSPV products:									
Export shipments:									
Quantity	***	***	***	***	***	▲***	▲***	▼***	▼***
Value	***	***	***	***	***	▲***	▲***	▼***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Ending inventory quantity	***	***	***	***	***	▲***	▲***	▲***	▲***
Production workers	***	***	***	***	***	▲***	▲***	▼***	▼***
Hours worked (1,000s)	***	***	***	***	***	▲***	▲***	▼***	▼***
Wages paid ($1,000)	***	***	***	***	***	▲***	▲***	▼***	▲***
Hourly wages (dollars per hour)	***	***	***	***	***	▼***	▼***	▼***	▲***
CSPV cells:									
Productivity (watts per hour)	***	***	***	***	***	▼***	▼***	▲***	▼***
Unit labor costs	***	***	***	***	***	▲***	▲***	▼***	▼***
CSPV modules:									
Productivity (watts per hour)	***	***	***	***	***	▲***	▲***	▲***	▲***
Unit labor costs	***	***	***	***	***	▼***	▼***	▼***	▲***
CSPV products:									
Productivity (watts per hour)	***	***	***	***	***	▲***	▲***	▲***	▲***
Unit labor costs	***	***	***	***	***	▼***	▼***	▼***	▲***
Net sales:									
Quantity	481,156	2,048,798	2,191,402	1,152,826	1,114,087	▲355.4	▲325.8	▲7.0	▼(3.4)
Value	261,380	900,356	904,397	484,262	451,082	▲246.0	▲244.5	▲0.4	▼(6.9)
Cost of goods sold (COGS)	300,098	896,089	933,735	513,472	459,893	▲211.1	▲198.6	▲4.2	▼(10.4)
SG&A expenses	37,912	62,376	56,941	26,932	28,109	▲50.2	▲64.5	▼(8.7)	▲4.4
Operating income or (loss) (fn2)	(76,630)	(58,109)	(86,279)	(56,142)	(36,920)	▼---	▲---	▼---	▲---
Net income or (loss) (fn2)	(163,503)	(65,280)	(89,209)	(59,038)	(35,920)	▲---	▲---	▼---	▲---
COGS/sales (fn1)	114.8	99.5	103.2	106.0	102.0	▼(11.6)	▼(15.3)	▲3.7	▼(4.1)
Operating income or (loss)/sales (fn1)	(29.3)	(6.5)	(9.5)	(11.6)	(8.2)	▲19.8	▲22.9	▼(3.1)	▲3.4
Net income or (loss)/sales (fn1)	(62.6)	(7.3)	(9.9)	(12.2)	(8.0)	▲52.7	▲55.3	▼(2.6)	▲4.2
Capital expenditures	***	***	***	***	***	▼***	▼***	▼***	▼***
Research and development expenses	***	***	***	***	***	▼***	▼***	▼***	▼***
Net assets	386,215	500,659	387,631	n.a.	n.a.	▲0.4	▲29.6	▼(22.6)	n.a.

Source: Compiled from data submitted in response to Commission questionnaires.

Note.--Shares and ratios shown as "0.0" percent represent non-zero values less than "0.05" percent (if positive) and greater than "(0.05)" percent (if negative). Zeroes, null values, undefined calculations, and unmeaningfully large percent changes are suppressed and shown as "---". Period changes preceded by a "▲" represent an increase, while period changes preceded by a "▼" represent a decrease.

fn1.--Reported data are in percent and period changes are in percentage points.
fn2.--Percent changes only calculated when both comparison values represent profits; The directional change in profitability provided when one or both comparison values represent a loss.

APPENDIX D

SELECT DATA FROM SAFEGUARD AND MONITORING INVESTIGATIONS

Safeguard investigation

Table C-1a: CSPV products: Total market: Summary data concerning the U.S. market with country-of-origin of imports based on cell manufacture location, 2012-16

Table C-1b: CSPV products: Summary data concerning the U.S. market with country-of-origin of imports based on cell manufacture location except modules assembled in NAFTA countries, 2012-16

Table C-2: CSPV products: Summary data concerning the merchant U.S. market for cells, 2012-16

Table C-3a: CSPV products: Summary data concerning the total U.S. market for modules with country-of-origin of imports based on cell manufacture location, 2012-16

Table C-3b: CSPV products: Summary data concerning the total U.S. market for modules with country-of-origin of imports based on cell manufacture location except modules assembled in NAFTA countries, 2012-16

Table C-4: CSPV products: Apparent consumption and market shares for by channel for modules (utilities vs. residential and commercial installation), 2012-16

Table C-5: CSPV products: Apparent consumption and market shares by 60-cell vs 72-cell modules, 2012-16

Table C-6: CSPV products: Apparent consumption and market shares by mono- vs multi-crystaline cell modules 2012-16

Table V-11: CSPV products: Sales of U.S. produced and imported cells and modules, by wattage ranges, 2012-16

Table V-12: CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 1, by quarters, 2012-16

Table V-13: CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 2, by quarters, 2012-16

Table V-14: CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 3, by quarters, 2012-16

Table V-15: CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 4, by quarters, 2012-16

Table V-16: CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 5, by quarters, 2012-16

Table G-1: CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 1, by quarters, 2012-16

Table G-2: CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 2, by quarters, 2012-16

Table G-3: CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 3, by quarters, 2012-16

Table G-4: CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 4, by quarters, 2012-16

Table G-5: CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 5, by quarters, 2012-16

Remedy Recommendations

Table D-1: CSPV products: U.S. producers' efforts to compete more effectively in the U.S. market, by reporting firm, January 2012 – June 2017

Table D-2: CSPV products: U.S. producers' anticipated adjustments under safeguard import relief

Monitoring investigation

Table C-1: CSPV products: Summary data concerning the U.S. total market, 2016-18, January to June 2018, and January to June 2019

Table C-2: CSPV modules: Summary data concerning the U.S. total market, 2016-18, January to June 2018, and January to June 2019

Table C-3: CSPV cells: Summary data concerning the U.S. merchant market, 2016-18, January to June 2018, and January to June 2019

Table C-4: CSPV products: Channels of distribution by type for U.S. producers and importers, 2016-18, January to June 2018, and January to June 2019

CSPV products: Total market: COO petition

Table C-1a
CSPV products: Summary data concerning the U.S. market with country-of-origin of imports based on cell manufacture location, 2012-16
(Quantity=kW; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes				
	Calendar year					Between calendar years				
	2012	2013	2014	2015	2016	2012-16	2012-13	2013-14	2014-15	2015-16
U.S. consumption quantity:										
Amount	***	***	***	***	***	***	***	***	***	***
Producers' share (fn1)	***	***	***	***	***	***	***	***	***	***
Importers' share (fn1):										
Canada	***	***	***	***	***	***	***	***	***	***
China	***	***	***	***	***	***	***	***	***	***
Germany	***	***	***	***	***	***	***	***	***	***
Indonesia	***	***	***	***	***	***	***	***	***	***
Japan	***	***	***	***	***	***	***	***	***	***
Korea	***	***	***	***	***	***	***	***	***	***
Malaysia	***	***	***	***	***	***	***	***	***	***
Mexico	***	***	***	***	***	***	***	***	***	***
Philippines	***	***	***	***	***	***	***	***	***	***
Singapore	***	***	***	***	***	***	***	***	***	***
Taiwan	***	***	***	***	***	***	***	***	***	***
Thailand	***	***	***	***	***	***	***	***	***	***
Vietnam	***	***	***	***	***	***	***	***	***	***
All other sources	***	***	***	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***	***	***	***
U.S. consumption value:										
Amount	***	***	***	***	***	***	***	***	***	***
Producers' share (fn1)	***	***	***	***	***	***	***	***	***	***
Importers' share (fn1):										
Canada	***	***	***	***	***	***	***	***	***	***
China	***	***	***	***	***	***	***	***	***	***
Germany	***	***	***	***	***	***	***	***	***	***
Indonesia	***	***	***	***	***	***	***	***	***	***
Japan	***	***	***	***	***	***	***	***	***	***
Korea	***	***	***	***	***	***	***	***	***	***
Malaysia	***	***	***	***	***	***	***	***	***	***
Mexico	***	***	***	***	***	***	***	***	***	***
Philippines	***	***	***	***	***	***	***	***	***	***
Singapore	***	***	***	***	***	***	***	***	***	***
Taiwan	***	***	***	***	***	***	***	***	***	***
Thailand	***	***	***	***	***	***	***	***	***	***
Vietnam	***	***	***	***	***	***	***	***	***	***
All other sources	***	***	***	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***	***	***	***
U.S. imports from:										
Canada:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
China:										
Quantity	326,846	82,264	1,263,270	3,311,513	2,720,193	732.3	(74.8)	1,435.6	162.1	(17.9)
Value	291,878	69,976	747,148	1,680,733	1,258,864	331.3	(76.0)	967.7	125.0	(25.1)
Unit value	$893	$851	$591	$508	$463	(48.2)	(4.7)	(30.5)	(14.2)	(8.8)
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Germany:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Indonesia:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Japan:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Korea:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Malaysia:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Mexico:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Philippines:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Signapore:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Taiwan:										
Quantity	1,065,160	2,113,220	2,090,974	852,758	1,118,967	5.1	98.4	(1.1)	(59.2)	31.2
Value	743,337	1,349,271	1,274,305	467,820	606,449	(18.4)	81.5	(5.6)	(63.3)	29.6
Unit value	$698	$638	$609	$549	$542	(22.3)	(8.5)	(4.6)	(10.0)	(1.2)
Ending inventory quantity	128,249	116,508	200,189	170,345	91,083	(29.0)	(9.2)	71.8	(14.9)	(46.5)
Thailand:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Vietnam:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
All other sources:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
All import sources:										
Quantity	2,162,388	3,101,412	4,582,898	8,430,393	12,813,568	492.6	43.4	47.8	84.0	52.0
Value	1,904,664	2,214,457	3,014,861	4,967,865	7,060,489	270.7	16.3	36.1	64.8	42.1
Unit value	$881	$714	$658	$589	$551	(37.4)	(18.9)	(7.9)	(10.4)	(6.5)
Ending inventory quantity	303,409	327,638	560,211	1,107,536	1,238,641	308.2	8.0	71.0	97.7	11.8

Table continued on next page.

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Table C-1a--Continued
CSPV products: Summary data concerning the U.S. market with country-of-origin of imports based on cell manufacture location, 2012-16
(Quantity=kW; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes				
	Calendar year					Between calendar years				
	2012	2013	2014	2015	2016	2012-16	2012-13	2013-14	2014-15	2015-16
U.S. producers': (fn3)										
Average capacity quantity	***	***	***	***	***	***	***	***	***	***
Production quantity	***	***	***	***	***	***	***	***	***	***
Capacity utilization (fn1)	***	***	***	***	***	***	***	***	***	***
U.S. shipments (fn4):										
Quantity	***	***	***	***	***	***	***	***	***	***
Value (fn5)	***	***	***	***	***	***	***	***	***	***
Unit value (fn6)	***	***	***	***	***	***	***	***	***	***
Export shipments:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Inventories/total shipments (fn1)	***	***	***	***	***	***	***	***	***	***
Production workers	***	***	***	***	***	***	***	***	***	***
Hours worked (1,000s)	***	***	***	***	***	***	***	***	***	***
Wages paid ($1,000)	***	***	***	***	***	***	***	***	***	***
Hourly wages (dollars)	***	***	***	***	***	***	***	***	***	***
Productivity (watts per hour)	***	***	***	***	***	***	***	***	***	***
Unit labor costs	***	***	***	***	***	***	***	***	***	***
Net sales: (fn7)										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Cost of goods sold (COGS)	***	***	***	***	***	***	***	***	***	***
Gross profit or (loss)	***	***	***	***	***	***	***	***	***	***
SG&A expenses	***	***	***	***	***	***	***	***	***	***
Operating income or (loss)	***	***	***	***	***	***	***	***	***	***
Net income or (loss)	***	***	***	***	***	***	***	***	***	***
Unit COGS	***	***	***	***	***	***	***	***	***	***
Unit SG&A expenses	***	***	***	***	***	***	***	***	***	***
Unit operating income or (loss)	***	***	***	***	***	***	***	***	***	***
Unit net income or (loss)	***	***	***	***	***	***	***	***	***	***
COGS/sales (fn1)	***	***	***	***	***	***	***	***	***	***
Operating income or (loss)/sales (fn1)	***	***	***	***	***	***	***	***	***	***
Net income or (loss)/sales (fn1)	***	***	***	***	***	***	***	***	***	***

Notes:

fn1.--Reported data are in percent and period changes are in percentage points.
fn2.--Undefined.
fn3.--Generally the data for U.S. producers in this table are limited to U.S.-origin cells and modules containing U.S.-origin cells.
fn4.--U.S. producers' U.S. shipments include U.S. producers' exports of cells that have been re-imported after being formed into modules and/or laminates in other countries.
fn5.--The value of U.S. producers' U.S. shipments includes value added to foreign-origin cells. See part IV for details.
fn6.--The average unit values of U.S. producers' U.S. shipments are calculated exclusive of the value added to foreign-origin cells. See part IV for details.
fn7.--Financial results in this table include derived module revenue and costs based on relative production using U.S.-origin cells plus the data from merchant market cell operations.

Source: Compiled from data submitted in response to Commission questionnaires.

Table C-1b
CSPV products: Summary data concerning the U.S. market with country-of-origin of imports based on cell manufacture location except modules assembled in NAFTA countries, 2012-16

* * * * * * *

Table C-2
CSPV products: Summary data concerning the merchant U.S. market for cells, 2012-16

* * * * * * *

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Table C-3a
CSPV products: Summary data concerning the total U.S. market for modules with country-of-origin of imports based on cell manufacture location, 2012-16
(Quantity=kW; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes				
	Calendar year					Between calendar years				
	2012	2013	2014	2015	2016	2012-16	2012-13	2013-14	2014-15	2015-16
U.S. consumption quantity:										
Amount	***	***	***	***	***	***	***	***	***	***
Producers' share (fn1)	***	***	***	***	***	***	***	***	***	***
Importers' share (fn1):										
Canada	***	***	***	***	***	***	***	***	***	***
China	***	***	***	***	***	***	***	***	***	***
Germany	***	***	***	***	***	***	***	***	***	***
Indonesia	***	***	***	***	***	***	***	***	***	***
Japan	***	***	***	***	***	***	***	***	***	***
Korea	***	***	***	***	***	***	***	***	***	***
Malaysia	***	***	***	***	***	***	***	***	***	***
Mexico	***	***	***	***	***	***	***	***	***	***
Philippines	***	***	***	***	***	***	***	***	***	***
Singapore	***	***	***	***	***	***	***	***	***	***
Taiwan	***	***	***	***	***	***	***	***	***	***
Thailand	***	***	***	***	***	***	***	***	***	***
Vietnam	***	***	***	***	***	***	***	***	***	***
All other sources	***	***	***	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***	***	***	***
U.S. consumption value:										
Amount	***	***	***	***	***	***	***	***	***	***
Producers' share (fn1)	***	***	***	***	***	***	***	***	***	***
Importers' share (fn1):										
Canada	***	***	***	***	***	***	***	***	***	***
China	***	***	***	***	***	***	***	***	***	***
Germany	***	***	***	***	***	***	***	***	***	***
Indonesia	***	***	***	***	***	***	***	***	***	***
Japan	***	***	***	***	***	***	***	***	***	***
Korea	***	***	***	***	***	***	***	***	***	***
Malaysia	***	***	***	***	***	***	***	***	***	***
Mexico	***	***	***	***	***	***	***	***	***	***
Philippines	***	***	***	***	***	***	***	***	***	***
Singapore	***	***	***	***	***	***	***	***	***	***
Taiwan	***	***	***	***	***	***	***	***	***	***
Thailand	***	***	***	***	***	***	***	***	***	***
Vietnam	***	***	***	***	***	***	***	***	***	***
All other sources	***	***	***	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***	***	***	***
U.S. imports from:										
Canada:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
China:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Germany:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Indonesia:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Japan:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Korea:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Malaysia:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Mexico:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Philippines:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Signapore:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Taiwan:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Thailand:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Vietnam:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
All other sources:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
All import sources:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***

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Table C-3a--Continued
CSPV products: Summary data concerning the total U.S. market for modules with country-of-origin of imports based on cell manufacture location, 2012-16
(Quantity=kW; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes				
	Calendar year					Between calendar years				
	2012	2013	2014	2015	2016	2012-16	2012-13	2013-14	2014-15	2015-16
U.S. producers': (fn3)										
Average capacity quantity	929,827	913,452	716,900	871,603	1,245,807	34.0	(1.8)	(21.5)	21.6	42.9
Production quantity	538,633	447,129	440,259	552,968	669,089	24.2	(17.0)	(1.5)	25.6	21.0
Capacity utilization (fn1)	57.9	48.9	61.4	63.4	53.7	(4.2)	(9.0)	12.5	2.0	(9.7)
U.S. shipments:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Export shipments:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Inventories/total shipments (fn1) (fn3)	***	***	***	***	***	***	***	***	***	***
Production workers	1,293	1,080	956	1,038	1,253	(3.1)	(16.5)	(11.5)	8.6	20.7
Hours worked (1,000s)	3,041	2,335	1,781	2,095	2,364	(22.3)	(23.2)	(23.7)	17.6	12.8
Wages paid ($1,000)	***	***	***	***	***	***	***	***	***	***
Hourly wages (dollars)	***	***	***	***	***	***	***	***	***	***
Productivity (watts per hour)	***	***	***	***	***	***	***	***	***	***
Unit labor costs	***	***	***	***	***	***	***	***	***	***
Net sales:										
Quantity	581,762	464,771	472,355	527,683	623,846	7.2	(20.1)	1.6	11.7	18.2
Value	607,615	410,608	420,661	476,920	484,359	(20.3)	(32.4)	2.4	13.4	1.6
Unit value	$1,044	$883	$891	$904	$776	(25.7)	(15.4)	0.8	1.5	(14.1)
Cost of goods sold (COGS)	858,747	545,848	422,575	432,924	488,577	(43.1)	(36.4)	(22.6)	2.4	12.9
Gross profit or (loss)	(251,132)	(135,240)	(1,914)	43,996	(4,218)	(98.3)	(46.1)	(98.6)	[fn2]	[fn2]
SG&A expenses	125,946	68,803	56,642	54,526	210,773	67.4	(45.4)	(17.7)	(3.7)	286.6
Operating income or (loss)	(377,078)	(204,043)	(58,556)	(10,530)	(214,991)	(43.0)	(45.9)	(71.3)	(82.0)	1,941.7
Net income or (loss)	(551,170)	(217,135)	(54,504)	(21,071)	(224,873)	(59.2)	(60.6)	(74.9)	(61.3)	967.2
Unit COGS	$1,476	$1,174	$895	$820	$783	(46.9)	(20.4)	(23.8)	(8.3)	(4.5)
Unit SG&A expenses	$216	$148	$120	$103	$338	56.1	(31.6)	(19.0)	(13.8)	227.0
Unit operating income or (loss)	$(648)	$(439)	$(124)	$(20)	$(345)	(46.8)	(32.3)	(71.8)	(83.9)	1,627.0
Unit net income or (loss)	$(947)	$(467)	$(115)	$(40)	$(360)	(62.0)	(50.7)	(75.3)	(65.4)	802.7
COGS/sales (fn1)	141.3	132.9	100.5	90.8	100.9	(40.5)	(8.4)	(32.5)	(9.7)	10.1
Operating income or (loss)/sales (fn1)	(62.1)	(49.7)	(13.9)	(2.2)	(44.4)	17.7	12.4	35.8	11.7	(42.2)
Net income or (loss)/sales (fn1)	(90.7)	(52.9)	(13.0)	(4.4)	(46.4)	44.3	37.8	39.9	8.5	(42.0)

Notes:

Note.--Share and ratios shown as "0.0" represent values greater than zero but less than "0.05" percent.

fn1.--Reported data are in percent and period changes are in percentage points.
fn2.--Undefined.
fn3.--U.S. producers' data in this table includes modules assembled from U.S.-origin cells and from foreign-origin cells.

Source: Compiled from data submitted in response to Commission questionnaires.

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CSPV modules: Total market: COO NAFTA

Table C-3b
CSPV products: Summary data concerning the total U.S. market for modules with country-of-origin of imports based on cell manufacture location except modules assembled in NAFTA countries, 2012-16
(Quantity=kW; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes				
	Calendar year					Between calendar years				
	2012	2013	2014	2015	2016	2012-16	2012-13	2013-14	2014-15	2015-16
U.S. consumption quantity:										
Amount	***	***	***	***	***	***	***	***	***	***
Producers' share (fn1)	***	***	***	***	***	***	***	***	***	***
Importers' share (fn1):										
Canada	***	***	***	***	***	***	***	***	***	***
China	***	***	***	***	***	***	***	***	***	***
Germany	***	***	***	***	***	***	***	***	***	***
Indonesia	***	***	***	***	***	***	***	***	***	***
Japan	***	***	***	***	***	***	***	***	***	***
Korea	***	***	***	***	***	***	***	***	***	***
Malaysia	***	***	***	***	***	***	***	***	***	***
Mexico	***	***	***	***	***	***	***	***	***	***
Philippines	***	***	***	***	***	***	***	***	***	***
Singapore	***	***	***	***	***	***	***	***	***	***
Taiwan	***	***	***	***	***	***	***	***	***	***
Thailand	***	***	***	***	***	***	***	***	***	***
Vietnam	***	***	***	***	***	***	***	***	***	***
All other sources	***	***	***	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***	***	***	***
U.S. consumption value:										
Amount	***	***	***	***	***	***	***	***	***	***
Producers' share (fn1)	***	***	***	***	***	***	***	***	***	***
Importers' share (fn1):										
Canada	***	***	***	***	***	***	***	***	***	***
China	***	***	***	***	***	***	***	***	***	***
Germany	***	***	***	***	***	***	***	***	***	***
Indonesia	***	***	***	***	***	***	***	***	***	***
Japan	***	***	***	***	***	***	***	***	***	***
Korea	***	***	***	***	***	***	***	***	***	***
Malaysia	***	***	***	***	***	***	***	***	***	***
Mexico	***	***	***	***	***	***	***	***	***	***
Philippines	***	***	***	***	***	***	***	***	***	***
Singapore	***	***	***	***	***	***	***	***	***	***
Taiwan	***	***	***	***	***	***	***	***	***	***
Thailand	***	***	***	***	***	***	***	***	***	***
Vietnam	***	***	***	***	***	***	***	***	***	***
All other sources	***	***	***	***	***	***	***	***	***	***
All import sources	***	***	***	***	***	***	***	***	***	***
U.S. imports from:										
Canada:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
China:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Germany:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Indonesia:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Japan:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Korea:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Malaysia:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Mexico:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Philippines:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Signapore:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Taiwan:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Thailand:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Vietnam:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
All other sources:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
All import sources:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***

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Table C-3b--Continued
CSPV products: Summary data concerning the total U.S. market for modules with country-of-origin of imports based on cell manufacture location except modules assembled in NAFTA countries, 2012-16
(Quantity=kW; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes				
	Calendar year					Between calendar years				
	2012	2013	2014	2015	2016	2012-16	2012-13	2013-14	2014-15	2015-16
U.S. producers': (fn3)										
Average capacity quantity	929,827	913,452	716,900	871,603	1,245,807	34.0	(1.8)	(21.5)	21.6	42.9
Production quantity	538,633	447,129	440,259	552,968	669,089	24.2	(17.0)	(1.5)	25.6	21.0
Capacity utilization (fn1)	57.9	48.9	61.4	63.4	53.7	(4.2)	(9.0)	12.5	2.0	(9.7)
U.S. shipments:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Export shipments:										
Quantity	***	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***	***
Ending inventory quantity	***	***	***	***	***	***	***	***	***	***
Inventories/total shipments (fn1) (fn3)	***	***	***	***	***	***	***	***	***	***
Production workers	1,293	1,080	956	1,038	1,253	(3.1)	(16.5)	(11.5)	8.6	20.7
Hours worked (1,000s)	3,041	2,335	1,781	2,095	2,364	(22.3)	(23.2)	(23.7)	17.6	12.8
Wages paid ($1,000)	***	***	***	***	***	***	***	***	***	***
Hourly wages (dollars)	***	***	***	***	***	***	***	***	***	***
Productivity (watts per hour)	***	***	***	***	***	***	***	***	***	***
Unit labor costs	***	***	***	***	***	***	***	***	***	***
Net sales:										
Quantity	581,762	464,771	472,355	527,683	623,846	7.2	(20.1)	1.6	11.7	18.2
Value	607,615	410,608	420,661	476,920	484,359	(20.3)	(32.4)	2.4	13.4	1.6
Unit value	$1,044	$883	$891	$904	$776	(25.7)	(15.4)	0.8	1.5	(14.1)
Cost of goods sold (COGS)	858,747	545,848	422,575	432,924	488,577	(43.1)	(36.4)	(22.6)	2.4	12.9
Gross profit or (loss)	(251,132)	(135,240)	(1,914)	43,996	(4,218)	(98.3)	(46.1)	(98.6)	[fn2]	[fn2]
SG&A expenses	125,946	68,803	56,642	54,526	210,773	67.4	(45.4)	(17.7)	(3.7)	286.6
Operating income or (loss)	(377,078)	(204,043)	(58,556)	(10,530)	(214,991)	(43.0)	(45.9)	(71.3)	(82.0)	1,941.7
Net income or (loss)	(551,170)	(217,135)	(54,504)	(21,071)	(224,873)	(59.2)	(60.6)	(74.9)	(61.3)	967.2
Unit COGS	$1,476	$1,174	$895	$820	$783	(46.9)	(20.4)	(23.8)	(8.3)	(4.5)
Unit SG&A expenses	$216	$148	$120	$103	$338	56.1	(31.6)	(19.0)	(13.8)	227.0
Unit operating income or (loss)	$(648)	$(439)	$(124)	$(20)	$(345)	(46.8)	(32.3)	(71.8)	(83.9)	1,627.0
Unit net income or (loss)	$(947)	$(467)	$(115)	$(40)	$(360)	(62.0)	(50.7)	(75.3)	(65.4)	802.7
COGS/sales (fn1)	141.3	132.9	100.5	90.8	100.9	(40.5)	(8.4)	(32.5)	(9.7)	10.1
Operating income or (loss)/sales (fn1)	(62.1)	(49.7)	(13.9)	(2.2)	(44.4)	17.7	12.4	35.8	11.7	(42.2)
Net income or (loss)/sales (fn1)	(90.7)	(52.9)	(13.0)	(4.4)	(46.4)	44.3	37.8	39.9	8.5	(42.0)

Notes:

Note.--Share and ratios shown as "0.0" represent values greater than zero but less than "0.05" percent.

fn1.--Reported data are in percent and period changes are in percentage points.
fn2.--Undefined.
fn3.--U.S. producers' data in this table includes modules assembled from U.S.-origin cells and from foreign-origin cells.

Source: Compiled from data submitted in response to Commission questionnaires.

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Table C-4
CSPV products: Apparent consumption and market shares for by channel for modules, 2012-16

*	*	*	*	*	*	*

Table C-5
CSPV products: Apparent consumption and market shares by 60-cell vs 72-cell modules, 2012-16

*	*	*	*	*	*	*

Table C-6
CSPV products: Apparent consumption and market shares by mono- vs multi-crystaline cell modules 2012-16

*	*	*	*	*	*	*

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Two U.S. producers and 31 importers provided usable pricing data for sales of the requested products, although not all firms reported pricing for all products for all quarters.[43] [44] Pricing data reported by these firms accounted for approximately 83.3 percent of U.S. producers' U.S. shipments of CSPV products and 74.1 percent of U.S. importers' U.S. shipments of CSPV products in 2016.[45] [46]

The pricing product definitions consisted of a monocrystalline cell with an efficiency range of 5 percent, and four modules, each with peak power range of 50 watts. U.S. producers and importers reported their commercial shipment volumes for these pricing products, broken into narrower efficiency and wattage ranges. As shown in table V-11, U.S. producers and importers generally reported sales of CSPV cells and modules within similar efficiency and wattage ranges.[47]

Table V-11
CSPV products: Sales of U.S. produced and imported cells and modules, by wattage ranges, 2012-16

* * * * * * *

U.S. producers' price data volumes for sales of monocrystalline modules *** accounted for the *** of reported price data. Importers reported price data primarily for sales of multicrystalline modules, with products 2 and 4 accounting for the majority of price data volumes of foreign-origin product. Both U.S. producers and importers reported *** quantities of sales of monocrystalline cells (product 1), accounting for *** of domestic price data and in 2016 and *** of importers' price data in 2015.

Price data for products 1-5 are presented in tables V-12 to V-16 and figures V-8 to V-12. Prices are reported by import source in Appendix G.

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[43] Per-unit pricing data are calculated from total quantity and total value data provided by U.S. producers and importers. The precision and variation of these figures may be affected by rounding, limited quantities, and producer or importer estimates.

[44] Price data were requested by the origin of the cell. U.S. module assemblers that used imported cells were requested to report their price data in the importer questionnaire.

[45] U.S. importer *** revised its pricing data on August 31, 2016. These revisions changed the prices and quantities for product 1. See email from *** and *** revised importer questionnaire response, section III-2.

[46] Products 2-5 overlap with the pricing products 1-8 from the previous AD/CVD investigations. The wider wattage ranges in products 2-5 encompass the shifts to higher wattage modules during the five-year period of investigation. Table V-11 provides a breakout of the reported price data by narrower wattage ranges. *Certain Crystalline Silicon Photovoltaic Products from China and Taiwan*, Invs. Nos. 701-TA-511 and 731-TA-1246-1247 (Final) USITC Publication 4519 February 2015 at p. V-5.

[47] For product 5, U.S. producers' reported price data were split between the two wattage categories, while importers' reported price data fell in the lower wattage category in 2015.

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Table V-12
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 1, by quarters, 2012-16

* * * * * * *

Table V-13
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 2,[1] by quarters, 2012-16

Period	U.S.-origin		Foreign-origin	
	Price (dollars per kilowatt)	Quantity (kilowatts)	Price (dollars per kilowatt)	Quantity (kilowatts)
2012: Jan.-Mar.	***	***	1,059	84,005
Apr.-June	***	***	910	151,062
July-Sept.	***	***	837	193,745
Oct.-Dec.	***	***	805	188,753
2013: Jan.-Mar.	***	***	723	178,906
Apr.-June	***	***	713	240,438
July-Sept.	***	***	726	338,025
Oct.-Dec.	***	***	738	259,915
2014: Jan.-Mar.	***	***	735	216,823
Apr.-June	***	***	728	287,980
July-Sept.	***	***	751	289,276
Oct.-Dec.	---	***	735	367,474
2015: Jan.-Mar.	---	***	713	333,306
Apr.-June	---	***	692	494,227
July-Sept.	---	***	674	482,561
Oct.-Dec.	***	***	667	517,662
2016: Jan.-Mar.	---	***	641	360,330
Apr.-June	---	***	632	330,869
July-Sept.	---	***	592	335,198
Oct.-Dec.	---	***	535	265,793

[1] Product 2: 60 cell Multicrystalline silicon module, with a peak power wattage between 240w to 290w, inclusive, P-max or Wp.

Source: Compiled from data submitted in response to Commission questionnaires.

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Table V-14
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 3, by quarters, 2012-16

* * * * * * *

Table V-15
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 4,[1] by quarters, 2012-16

Period	U.S.-origin		Foreign-origin	
	Price (dollars per kilowatt)	Quantity (kilowatts)	Price (dollars per kilowatt)	Quantity (kilowatts)
2012: Jan.-Mar.	--	0	869	67,598
Apr.-June	--	0	***	***
July-Sept.	--	0	749	92,542
Oct.-Dec.	--	0	716	85,968
2013: Jan.-Mar.	--	0	***	***
Apr.-June	--	0	706	244,778
July-Sept.	--	0	697	329,372
Oct.-Dec.	--	0	690	323,929
2014: Jan.-Mar.	--	0	683	413,580
Apr.-June	--	0	687	666,572
July-Sept.	--	0	721	469,675
Oct.-Dec.	--	0	713	408,065
2015: Jan.-Mar.	--	0	716	310,628
Apr.-June	--	0	682	675,210
July-Sept.	--	0	652	1,221,632
Oct.-Dec.	--	0	641	1,763,922
2016: Jan.-Mar.	--	0	626	1,820,336
Apr.-June	--	0	623	2,130,333
July-Sept.	--	0	605	1,880,659
Oct.-Dec.	--	0	472	1,253,620

[1] Product 4: 72 cell Multicrystalline silicon module, with a peak power wattage between 290w to 340w, inclusive, P-max or Wp.

Source: Compiled from data submitted in response to Commission questionnaires.

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Table V-16
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 5, by quarters, 2012-16

* * * * * * *

Figure V-8
CSPV products: Weighted-average prices and quantities of domestic and imported product 1, by quarters, 2012-16

* * * * * * *

Figure V-9
CSPV products: Weighted-average prices and quantities of domestic and imported product 2, by quarters, 2012-16

* * * * * * *

Figure V-10
CSPV products: Weighted-average prices and quantities of domestic and imported product 3, by quarters, 2012-16

* * * * * * *

Figure V-11
CSPV products: Weighted-average prices and quantities of domestic and imported product 4, by quarters, 2012-16

* * * * * * *

Figure V-12
CSPV products: Weighted-average prices and quantities of domestic and imported product 5, by quarters, 2012-16

* * * * * * *

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Thirty-one importers reported price data. Twenty importers provided price data for Taiwan, 13 for China, 11 for Korea, 11 for Malaysia, 9 for German, 9 for Vietnam, 6 for Thailand, 1 for Singapore, and 7 for all other sources (Netherlands, India, Japan, Portugal, and Turkey).[1] These price items and accompanying data are comparable to those presented in tables V-12 to V-16. Price and quantity data for individual country sources are shown in tables G-1 to G-5.

Table G-1
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 1,[1] by quarters, 2012-16

* * * * * * *

Table G-2
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 2,[1] by quarters, 2012-16

* * * * * * *

Table G-3
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 3,[1] by quarters, 2012-16

* * * * * * *

Table G-4
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 4,[1] by quarters, 2012-16

* * * * * * *

Table G-5
CSPV products: Weighted-average f.o.b. prices and quantities of domestic and imported product 5,[1] by quarters, 2012-16

* * * * * * *

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[1] There are antidumping and countervailing duty orders in place on imports from China and Taiwan. Antidumping and countervailing duty orders associated with the *CSPV 1* investigations became effective December 7, 2012. Antidumping and countervailing duty orders associated with the *CSPV 2* investigations became effective February 18, 2015.

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REMEDY RECOMMENDATIONS

In order to address the serious injury to the domestic industry producing CSPV products and be most effective in facilitating the efforts of the domestic industry to make a positive adjustment to import competition, the Commission recommended a series of actions.

With regard to CSPV cells, Chairman Schmidtlein recommends a tariff-rate quota with an in-quota tariff rate of 10 percent ad valorem and an in-quota volume level of 0.5 gigawatts. For U.S. imports of cells that exceed the 0.5 gigawatts volume level, she recommends a tariff rate of 30 percent ad valorem. Chairman Schmidtlein recommends that this tariff-rate quota be implemented for four years and that the in-quota level be incrementally raised and the tariff rate be incrementally reduced during the remedy period. With regard to CSPV modules, she recommends an ad valorem tariff rate of 35 percent to be incrementally reduced during the 4-year remedy period. Chairman Schmidtlein also recommends that the President initiate international negotiations to address the underlying cause of the increase in imports of CSPV products and alleviate the serious injury thereof. Having made findings that U.S. imports from Australia, the CAFTA-DR countries, Colombia, Israel, Jordan, Panama, Peru, Singapore, and the beneficiary countries under CBERA were not a substantial cause of the serious injury experienced by the domestic industry, Chairman Schmidtlein recommends to the President that U.S. imports from these countries be excluded from the remedy.

Chairman Schmidtlein's Recommended Remedy				
	Year 1	Year 2	Year 3	Year 4
Cells: Tariff rate Quota				
In-Quota Tariff Rate	10%	9.5%	9.0%	8.5%
In-Quota Volume Level	0.5 gigawatts	0.6 gigawatts	0.7 gigawatts	0.8 gigawatts
Out-of-Quota Tariff Rate	30%	29%	28%	27%
Modules: Tariff (Ad Valorem)	35%	34%	33%	32%

Vice Chairman David S. Johanson and Commissioner Irving A. Williamson recommend that for a 4-year period the President impose (1) a tariff-rate quota on imports of CSPV products in cell form, and (2) increased rates of duty on imports of CSPV products in module form. For imports of CSPV products in cell form, they recommend an additional 30 percent ad valorem tariff on imports in excess of 1 gigawatt. In each subsequent year, they recommend that this tariff rate decrease by five percentage points and that the in-quota amount increase by 0.2 gigawatts. The rate of duty on in-quota CSPV products in cell form will remain unchanged. For imports of CSPV products in module form, Vice Chairman Johanson and Commissioner Williamson recommend an additional 30 percent ad valorem tariff, to be phased down by five percentage points per year in each of the subsequent years. Having made a negative finding with respect to imports from Canada under section 311(a) of the North American Free Trade Agreement Implementation Act, they recommend that such imports be excluded from the above tariff-rate quota and increased rates of duty. Further, Vice Chairman Johanson and Commissioner Williamson recommend that the above tariff-rate quota and

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increased rates of duty not apply to imports from the following countries with which the United States has FTAs: Australia, Colombia, Costa Rica, the Dominican Republic, El Salvador, Guatemala, Honduras, Israel, Jordan, Nicaragua, Panama, Peru, and Singapore. They also recommend that the tariff-rate quota and increased rates of duty not apply to imports from the CBERA beneficiary countries. Vice Chairman Johanson and Commissioner Williamson recommend that the President direct the United States Department of Labor and the United States Department of Commerce to provide expedited consideration of any application for trade adjustment assistance for workers and/or firms that are affected by subject imports. They recommend the President's consideration of the product exclusions requested by Respondents to which Petitioners have not objected and have indicated they would work to draft appropriate product-specific exclusions. Finally, they recommend that the President also consider any appropriate funding mechanisms that may facilitate a positive adjustment to import competition.

Commissioner Meredith M. Broadbent recommends that the President impose a quantitative restriction on imports of CSPV products into the United States, including cells and modules, for a four-year period, administered on a global basis. She recommends that the quantitative restriction be set at 8.9 gigawatts in the first year and increase by 1.4 gigawatts each subsequent year. In accordance with section 1102 of the Trade Agreements Act of 1979 (19 U.S.C. § 2581) and the President's authority in section 203(a)(3)(F) of the Trade Act of 1974 (19 U.S.C. § 2253(a)(3)(F)), she also recommends that the President administer these quantitative restrictions by selling import licenses at public auction at a minimum price of one cent per watt. She recommends that the President, to the extent permitted by law, authorize the use of funds equal to the amount generated by import license auctions to provide development assistance to domestic CSPV product manufacturers for the duration of the remedy period, such as through authorized programs at the United States Department of Energy (DOE). Commissioner Broadbent also recommends that the President implement other appropriate adjustment measures, including the provision of trade adjustment assistance by the United States Department of Labor and the United States Department of Commerce to workers and firms affected by import competition. Having made an affirmative finding with respect to imports from Mexico under section 311(a) of the NAFTA Implementation Act, she recommends that the President allocate no less than 720 megawatts to Mexico during the first year within the global quantitative restriction, which would expand by 115 megawatts each year. Having made a negative finding with respect to imports from Canada under section 311(a) of the NAFTA Implementation Act, Commissioner Broadbent recommends that such imports be excluded from the quantitative restriction. Furthermore, she recommends that this quantitative restriction not apply to imports from Australia, the CAFTA-DR countries, Colombia, Israel, Jordan, Panama, Peru, Singapore, and the CBERA beneficiary countries.

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Attachment 1

Remedy Recommendations of Vice Chairman David S. Johanson and Commissioner Irving A. Williamson

Table 1 summarizes the remedy recommendation for each of the four years in the remedy period.

Table 1: Summary of Remedy Recommendations

	Year 1	Year 2	Year 3	Year 4
Ad Valorem Tariff on Imported Modules	30%	25%	20%	15%
Quota Amount in TRQ on Imported Cells	1 GW	1.2 GW	1.4 GW	1.6 GW
In-Quota Rate in the TRQ on Imported Cells	0%	0%	0%	0%
Out-of-Quota Rate in the TRQ on Imported Cells	30%	25%	20%	15%

Based on these assumptions, we estimated the recommended remedy will have the effects reported in table 2:

Table 2: Estimated Economic Effects over the 4 Years of the Recommended Remedy

	Year 1	Year 2	Year 3	Year 4
% Change in the Quantity of Imported Cells*	***	***	***	***
Change in the GW of Imported Cells	***	***	***	***
% Change in the Quantity of Imported Modules	***	***	***	***
Change in the GW of Imported Modules	***	***	***	***
% Change in the Quantity of U.S. Modules Using U.S. Cells	***	***	***	***
Change in the GW of U.S. Modules Using U.S. Cells	***	***	***	***
% Change in the Price of U.S. Modules Using U.S. Cells	***	***	***	***
% Change in the Overall Price of Modules in the U.S. Market	***	***	***	***
% Change in the Deployment of Modules in the U.S. Market	***	***	***	***
Change in Revenue from U.S. Modules Using U.S. Cells (million dollars)	***	***	***	***
Change in Operating Income from U.S. Modules Using U.S. Cells (million dollars)	***	***	***	***
Change in Revenue from U.S. Cells Used in Foreign Modules Exported to the United States (million dollars)	***	***	***	***
Change in Operating Income from U.S. Cells Used in Foreign Modules Exported to the United States (million dollars)	***	***	***	***
Change in Revenue from U.S. Modules Using Foreign Cells (million dollars)	***	***	***	***
Change in Operating Income from U.S. Modules Using Foreign Cells (million dollars)	***	***	***	***
Combined Change in Revenue from U.S. Production (million dollars)	***	***	***	***
Combined Change in Operating Income from U.S. Producers (million dollars)	***	***	***	***
Change in U.S. Tariff Revenues (million dollars)	***	***	***	***

Note: These effects are rounded to 0.1.

*This is the percentage change in the quantity of imported cells used in U.S. modules.

Assumptions used in the model:

- The baseline data for each year is based on GTM Research projected growth in total CSPV deployment in the U.S. market, assuming that the first year of the remedy is 2018 and the fourth year of the remedy is 2021.
- The price elasticity of total demand in the market is -1.
- The domestic supply elasticity is 4.
- The other elasticity values in the model are at the mid-points of the ranges in the final staff report.
- The remedy does not apply to imports from Canada or Singapore.

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Appendix: Modeling Results and Estimated Effects of Various Remedies

The modeling results presented here are from three remedy scenarios, which are:

- **Broadbent remedy**: My remedy includes a one cent per watt minimum import license auction price and a quota on all CSPV products that will not likely be binding under current demand projections. Therefore, I use a $0.01/watt specific tariff on both CSPV modules and cells as a proxy for estimating the economic effects of my remedy.

- **25/0 % AVT**: I considered a 25 percent ad valorem tariff on CSPV modules and a 0 tariff on CSPV cells to assess the effects of a more moderate remedy than that proposed by petitioners.

- **Petitioner remedy**: SolarWorld's proposed remedies, which Suniva agreed with, include a $0.32/watt specific tariff and 5.70 GW quota on CSPV modules as well as a $0.25/watt specific tariff and 0.22 GW quota on CSPV cells.

Additional notes and assumptions:

- All remedies modeled here assume exclusion of imports from Singapore and Canada. All other imports excluded from the remedy recommendations are *de minimis* or zero, and therefore are not excluded from the model.

- Estimates of downstream employment are derived from my own calculations based on modeling results for CSPV deployment. I assumed that downstream employment in the BOS manufacturing and project development/installation sectors would decline proportionally with CSPV deployment.

- All results are for the first year of the remedy, which would correspond most directly with 2018 based on the timing of this investigation.

- Baseline quantity and employment estimates are ***.

- I use a domestic supply elasticity of ***, an import supply elasticity of ***, and a demand elasticity of *** for all scenarios.

- Imports of modules, as presented in the results below, include CSPV modules imported from covered sources subject to the remedies, in addition to imports from countries not covered by the remedies and imports of CSPV modules made from U.S. cells.

Quantities (***)

Factor	***	***	***	***
U.S. modules made from U.S. cells	***	***	***	***
U.S. modules made from foreign cells	***	***	***	***
Imports of modules	***	***	***	***
Total CSPV module deployments	***	***	***	***

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Change in Quantities (***)

Factor	***	***	***	***
U.S. modules made from U.S. cells	***	***	***	***
U.S. modules made from foreign cells	***	***	***	***
Imports of modules	***	***	***	***
Total CSPV module deployments	***	***	***	***

Change in Quantities (%)

Factor	***	***	***	***
U.S. modules made from U.S. cells	***	***	***	***
U.S. modules made from foreign cells	***	***	***	***
Imports of modules	***	***	***	***
Total CSPV module deployments	***	***	***	***

Change in Prices (%)

Factor	***	***	***	***
U.S. modules made from U.S. cells	***	***	***	***
Imports of cells	***	***	***	***
Imports of modules	***	***	***	***
All CSPV modules	***	***	***	***

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Change in Operating Income ($ *)**

Factor	***	***	***	***
U.S. modules made from U.S. cells	***	***	***	***
U.S. modules made from foreign cells	***	***	***	***
U.S. cells used in foreign-produced imported modules	***	***	***	***
Total U.S. operating income	***	***	***	***
***				

Estimates of Downstream Employment (Number of Workers)

Factor	***	***	***	***
Project Development/Installation	***	***	***	***
Balance of System Manufacturing	***	***	***	***
Total Downstream Employment	***	***	***	***

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U.S. producers were asked whether their firm has undertaken or planned any efforts to compete more effectively in the U.S. market for CSPV cells (whether or not partially or fully assembled into other products) ("CSPV products") since 2012. The following five U.S. producers that together represented *** percent of reported U.S. CSPV module production during January 2012-December 2016 responded that they had not made any efforts to compete more effectively since 2012: ***. None of these firms manufactured CSPV cells in the United States during the period of investigation. The following eight U.S. producers that together represented *** percent of reported U.S. CSPV cell production and *** percent of reported U.S. CSPV module production during January 2012-December 2016 responded that they had made efforts to compete more effectively since 2012: ***. The aggregate reported expenditures involved in these U.S. producers' efforts to compete was $***. U.S. producers were further instructed to provide a description of (1) the efforts made since 2012 to compete more effectively, (2) the year in which the effort was made, (3) the expenditure involved, and (4) the specific competitive advantage sought or acquired. The responses of the U.S. producers to this request are presented in table D-1.

Table D-1
CSPV products: U.S. producers' efforts to compete more effectively in the U.S. market, by reporting firm, January 2012 – June 2017

* * * * * * *

U.S. producers were asked if they were to receive import relief as a result of this safeguard investigation, would the firm and/or its workers make adjustments in its operations producing CSPV products that would permit it to compete more effectively with imports of CSPV products. The following six U.S. producers that together represented *** percent of

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reported U.S. CSPV cell production and *** percent of reported U.S. CSPV module production during January 2012-December 2016 responded that they would not make any adjustments in their operations if they were to receive import relief: ***. The following seven U.S. producers that together represented *** percent of reported U.S. CSPV cell production and *** percent of reported U.S. CSPV module production during January 2012-December 2016 responded that if they were to receive import relief, they would make adjustments in their operations: ***. The aggregate reported anticipated expenditures involved were $***. U.S. producers were also instructed to describe (1) the specific adjustment actions that they would make during any period of relief that would permit them to compete more effectively with imports, (2) the anticipated expenditure involved, and (3) the specific competitive advantage expected to be gained by the adjustment. The firms were asked to include adjustment actions that were in addition to those that they would incur notwithstanding any relief under section 202 and which was described in the previous table above. The responses of the U.S. producers to this request are presented in table D-2.

Table D-2
CSPV products: U.S. producers' anticipated adjustments under safeguard import relief

* * * * * * *

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Cell and Modules; All Producers; Total Market

Table C-1
CSPV products: Summary data concerning the U.S. total market, 2016-18, January to June 2018, and January to June 2019
(Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes			
	Calendar year			January to June		Calendar year			Jan-Jun
	2016	2017	2018	2018	2019	2016-18	2016-17	2017-18	2018-19
U.S. consumption quantity:									
Amount	***	***	***	***	***	▼***	▼***	▼***	▲***
Producers' share (fn1)	***	***	***	***	***	▼***	▼***	▼***	▼***
Importers' share (based on origin of cell) (fn1):									
Canada	***	***	***	***	***	▲***	▲***	▼***	▼***
China	***	***	***	***	***	▼***	▼***	▼***	▼***
Germany	***	***	***	***	***	▼***	▼***	▼***	▼***
India	***	***	***	***	***	▲***	▼***	▲***	▼***
Indonesia	***	***	***	***	***	▼***	▲***	▼***	▲***
Japan	***	***	***	***	***	▲***	▲***	▲***	▲***
Korea	***	***	***	***	***	▲***	▲***	▲***	▼***
Malaysia	***	***	***	***	***	▲***	▲***	▼***	▲***
Mexico	***	***	***	***	***	***	***	***	▲***
Philippines	***	***	***	***	***	▲***	▲***	▲***	▼***
Singapore	***	***	***	***	***	▲***	▲***	▲***	▼***
Taiwan	***	***	***	***	***	▼***	▼***	▼***	▲***
Thailand	***	***	***	***	***	▲***	▲***	▼***	▼***
Turkey	***	***	***	***	***	▲***	***	▲***	▲***
Vietnam	***	***	***	***	***	▲***	▲***	▼***	▲***
Other developing countries	***	***	***	***	***	***	***	***	▲***
Other non-developing countries	***	***	***	***	***	▼***	▼***	▼***	▼***
All import sources	***	***	***	***	***	▲***	▲***	▲***	▲***
Importers' share (based on location of module assembly) (fn1):									
Canada	***	***	***	***	***	▲***	▲***	▲***	▼***
China	***	***	***	***	***	▼***	▼***	▼***	▼***
Mexico	***	***	***	***	***	▲***	▼***	▲***	▼***
U.S. consumption value:									
Amount	***	***	***	***	***	▼***	▼***	▼***	▲***
Producers' share (fn1)									
Fully domestic value	***	***	***	***	***	▼***	▼***	▼***	▼***
Value added to imports	***	***	***	***	***	▲***	▼***	▲***	▲***
Total	***	***	***	***	***	▲***	▼***	▲***	▲***
Importers' share (based on origin of cell) (fn1):									
Canada	***	***	***	***	***	▲***	▲***	▼***	▼***
China	***	***	***	***	***	▼***	▼***	▼***	▼***
Germany	***	***	***	***	***	▼***	▼***	▼***	▼***
India	***	***	***	***	***	▲***	▲***	▲***	▼***
Indonesia	***	***	***	***	***	▼***	▲***	▼***	▼***
Japan	***	***	***	***	***	▲***	▲***	▲***	▲***
Korea	***	***	***	***	***	▲***	▲***	▲***	▼***
Malaysia	***	***	***	***	***	▲***	▲***	▼***	▲***
Mexico	***	***	***	***	***	***	***	***	▲***
Philippines	***	***	***	***	***	▲***	▼***	▲***	▼***
Singapore	***	***	***	***	***	▲***	▼***	▲***	▼***
Taiwan	***	***	***	***	***	▼***	▼***	▼***	▲***
Thailand	***	***	***	***	***	▲***	▲***	▼***	▼***
Turkey	***	***	***	***	***	▲***	***	▲***	▲***
Vietnam	***	***	***	***	***	▲***	▲***	▼***	▲***
Other developing countries	***	***	***	***	***	***	***	***	▲***
Other non-developing countries	***	***	***	***	***	▼***	▼***	▼***	▼***
All import sources	***	***	***	***	***	▼***	▲***	▼***	▼***
Importers' share (based on location of module assembly) (fn1):									
Canada	***	***	***	***	***	▲***	▲***	▲***	▼***
China	***	***	***	***	***	▼***	▼***	▼***	▼***
Mexico	***	***	***	***	***	▲***	▼***	▲***	▼***

Table continued on next page.

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Table C-1--Continued
CSPV products: Summary data concerning the U.S. total market, 2016-18, January to June 2018, and January to June 2019
(Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes			
	Calendar year			January to June		Calendar year			Jan-Jun
	2016	2017	2018	2018	2019	2016-18	2016-17	2017-18	2018-19
U.S. imports (based on origin of cell) from:									
Canada:									
Quantity	***	***	***	***	***	▲***	▲***	▼***	▼***
Value	***	***	***	***	***	▲***	▲***	▼***	▼***
Unit value	***	***	***	***	***	▲***	▲***	▼***	▼***
China:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Value	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
Germany:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Value	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit value	***	***	***	***	***	▲***	▼***	▲***	▼***
India:									
Quantity	***	***	***	***	***	▲***	▼***	▲***	▼***
Value	***	***	***	***	***	▲***	▲***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▲***	▼***	▼***
Indonesia:									
Quantity	***	***	***	***	***	▼***	▲***	▼***	▲***
Value	***	***	***	***	***	▼***	▲***	▼***	▲***
Unit value	***	***	***	***	***	▼***	▲***	▼***	▼***
Japan:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▲***
Value	***	***	***	***	***	▲***	▲***	▲***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Korea:									
Quantity	***	***	***	***	***	▼***	▲***	▼***	▲***
Value	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Malaysia:									
Quantity	***	***	***	***	***	▼***	▲***	▼***	▲***
Value	***	***	***	***	***	▼***	▼***	▼***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Mexico:									
Quantity	***	***	***	***	***	***	***	***	▲***
Value	***	***	***	***	***	***	***	***	▲***
Unit value	***	***	***	***	***	***	***	***	▲***
Philippines:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▼***
Value	***	***	***	***	***	▼***	▼***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▲***
Singapore:									
Quantity	***	***	***	***	***	▼***	▼***	▲***	▼***
Value	***	***	***	***	***	▼***	▼***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
Taiwan:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▲***
Value	***	***	***	***	***	▼***	▼***	▼***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Thailand:									
Quantity	***	***	***	***	***	▼***	▲***	▼***	▲***
Value	***	***	***	***	***	▼***	▲***	▼***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
Turkey:									
Quantity	***	***	***	***	***	▲***	***	▲***	▲***
Value	***	***	***	***	***	▲***	***	▲***	▲***
Unit value	***	***	***	***	***	▲***	***	▲***	▼***
Vietnam:									
Quantity	***	***	***	***	***	▲***	▲***	▼***	▲***
Value	***	***	***	***	***	▼***	▲***	▼***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***

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Table C-1--Continued

CSPV products: Summary data concerning the U.S. total market, 2016-18, January to June 2018, and January to June 2019

(Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes			
	Calendar year			January to June		Calendar year			Jan-Jun
	2016	2017	2018	2018	2019	2016-18	2016-17	2017-18	2018-19
U.S. imports (based on origin of cell) from:--Continued									
All other developing countries:									
Quantity	***	***	***	***	***	***	***	***	▲***
Value	***	***	***	***	***	***	***	***	▲***
Unit value	***	***	***	***	***	***	***	***	▲***
All other non-developing countries:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Value	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▲***
All import sources:									
Quantity	11,856,373	10,066,330	6,136,626	2,682,400	5,033,392	▼(48.2)	▼(15.1)	▼(39.0)	▲87.6
Value	6,923,693	4,113,432	2,479,151	1,177,300	1,570,461	▼(64.2)	▼(40.6)	▼(39.7)	▲33.4
Unit value	$584	$409	$404	$439	$312	▼(30.8)	▼(30.0)	▼(1.1)	▼(28.9)
U.S. imports (based on location of module assembly) from:									
Canada:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Value	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
China:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▲***
Value	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
Mexico:									
Quantity	***	***	***	***	***	▼***	▼***	▲***	▼***
Value	***	***	***	***	***	▼***	▼***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
U.S. producers':									
Cells: Average capacity quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Cells: Production quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Cells: Capacity utilization (fn1)	***	***	***	***	***	▼***	▼***	▼***	▲***
Modules: Average capacity quantity	***	***	***	***	***	▼***	▼***	▲***	▲***
Modules: Production quantity	***	***	***	***	***	▼***	▼***	▲***	▲***
Modules: Capacity utilization (fn1)	***	***	***	***	***	▼***	▼***	▲***	▲***
U.S. shipments (fn2):									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Value:									
Fully domestic value	***	***	***	***	***	▼***	▼***	▼***	▼***
Valued added to imports	***	***	***	***	***	▲***	▼***	▲***	▲***
Total value	***	***	***	***	***	▼***	▼***	▲***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Export shipments:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▲***
Value	***	***	***	***	***	▼***	▼***	▼***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Ending inventory quantity	***	***	***	***	***	▼***	▼***	▼***	▲***
Inventories/total shipments (fn1)	***	***	***	***	***	▼***	▼***	▲***	▲***
Production workers	***	***	***	***	***	▼***	▼***	▼***	▲***
Hours worked (1,000s)	***	***	***	***	***	▼***	▼***	▲***	▲***
Wages paid ($1,000)	***	***	***	***	***	▼***	▼***	▲***	▲***
Hourly wages (dollars per hour)	***	***	***	***	***	▲***	▲***	▲***	▼***
Cells: Productivity (kilowatts per hour)	***	***	***	***	***	▲***	▲***	▼***	▼***
Cells: Unit labor costs	***	***	***	***	***	▼***	▼***	▼***	▲***
Modules: Productivity (kilowatts per hour)	***	***	***	***	***	▲***	▼***	▲***	▲***
Modules: Unit labor costs	***	***	***	***	***	▲***	▲***	▼***	▼***

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Table C-1--Continued

CSPV products: Summary data concerning the U.S. total market, 2016-18, January to June 2018, and January to June 2019

(Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes			
	Calendar year			January to June		Calendar year			Jan-Jun
	2016	2017	2018	2018	2019	2016-18	2016-17	2017-18	2018-19
U.S. cell and U.S. module producers' results: Regardless of origin of cells:									
Net sales:									
Quantity	***	***	***	***	***	▼***	▼***	▲***	▲***
Value	***	***	***	***	***	▼***	▼***	▲***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
Cost of goods sold (COGS)	***	***	***	***	***	▼***	▼***	▲***	▲***
Gross profit or (loss) (fn3)	***	***	***	***	***	▼***	▼***	▲***	▲***
SG&A expenses	***	***	***	***	***	▼***	▼***	▼***	▲***
Operating income or (loss) (fn3)	***	***	***	***	***	▲***	▲***	▲***	▼***
Net income or (loss) (fn3)	***	***	***	***	***	▲***	▲***	▼***	▲***
Capital expenditures	***	***	***	***	***	▲***	▼***	▲***	▲***
Unit COGS	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit SG&A expenses	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit operating income or (loss) (fn3)	***	***	***	***	***	▲***	▼***	▲***	▲***
Unit net income or (loss) (fn3)	***	***	***	***	***	▲***	▼***	▲***	▲***
COGS/sales (fn1)	***	***	***	***	***	▲***	▲***	▼***	▼***
Operating income or (loss)/sales (fn1)	***	***	***	***	***	▲***	▼***	▲***	▲***
Net income or (loss)/sales (fn1)	***	***	***	***	***	▼***	▼***	▲***	▲***
U.S. cell and U.S. module producers' results: Using U.S.-origin cells:									
Net sales:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Value	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
Cost of goods sold (COGS)	***	***	***	***	***	▼***	▼***	▼***	▼***
Gross profit or (loss) (fn3)	***	***	***	***	***	▼***	▼***	▲***	▼***
SG&A expenses	***	***	***	***	***	▼***	▼***	▼***	▼***
Operating income or (loss) (fn3)	***	***	***	***	***	▲***	▼***	▲***	▲***
Net income or (loss) (fn3)	***	***	***	***	***	▼***	▼***	▼***	▲***
Unit COGS	***	***	***	***	***	▲***	▲***	▲***	▲***
Unit SG&A expenses	***	***	***	***	***	▲***	▲***	▲***	▼***
Unit operating income or (loss) (fn3)	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit net income or (loss) (fn3)	***	***	***	***	***	▼***	▼***	▼***	▲***
COGS/sales (fn1)	***	***	***	***	***	▲***	▲***	▲***	▲***
Operating income or (loss)/sales (fn1)	***	***	***	***	***	▼***	▼***	▼***	▼***
Net income or (loss)/sales (fn1)	***	***	***	***	***	▼***	▼***	▼***	▼***
U.S. module producers' results: Using Foreign-origin cells:									
Net sales:									
Quantity	***	***	***	***	***	▲***	▼***	▲***	▲***
Value	***	***	***	***	***	▲***	▼***	▲***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
Cost of goods sold (COGS)	***	***	***	***	***	▲***	▼***	▲***	▲***
Gross profit or (loss) (fn3)	***	***	***	***	***	▲***	▼***	▲***	▲***
SG&A expenses	***	***	***	***	***	▼***	▼***	▼***	▲***
Operating income or (loss) (fn3)	***	***	***	***	***	▲***	▲***	▲***	▼***
Net income or (loss) (fn3)	***	***	***	***	***	▲***	▲***	▲***	▼***
Unit COGS	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit SG&A expenses	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit operating income or (loss) (fn3)	***	***	***	***	***	▲***	▲***	▲***	▲***
Unit net income or (loss) (fn3)	***	***	***	***	***	▲***	▲***	▲***	▲***
COGS/sales (fn1)	***	***	***	***	***	▼***	▲***	▼***	▼***
Operating income or (loss)/sales (fn1)	***	***	***	***	***	▲***	▲***	▲***	▲***
Net income or (loss)/sales (fn1)	***	***	***	***	***	▲***	▲***	▲***	▲***

Notes:

Note.--Shares and ratios shown as "0.0" percent represent non-zero values less than "0.05" percent (if positive) and greater than (0.05)" percent (if negative). Zeroes, null values, and undefined calculations are suppressed and shown as "---". Period changes preceded by a "▲" represent an increase, while period changes preceded by a "▼" represent a decrease.

fn1.--Reported data are in percent and period changes are in percentage points.
fn2.-- The quantity for U.S. producers' U.S. shipments reflects the quantity of Solar panels sold in the United States. The value for U.S. producers' reflects the value of Solar panels sold in the United States from producers~ plus the additional value added to either domestic or imported Solar panels from producers. The average unit values presente for U.S. producers' U.S. shipments excluded the value added to imported Solar panels. In measuring consumption and market share this methodology avoids reclassifying and/or double counting merchandise already reported once either by a domestic producer or an impor
fn3.--Percent changes only calculated when both comparison values represent profits; The directional change in profitability provided when one or both comparison values represent a loss.

Source: Compiled from data submitted in response to Commission questionnaires.

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Modules Only, Total Market

Table C-2
CSPV modules: Summary data concerning the U.S. total market, 2016-18, January to June 2018, and January to June 2019
(Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes			
	Calendar year			January to June		Calendar year			Jan-Jun
	2016	2017	2018	2018	2019	2016-18	2016-17	2017-18	2018-19
U.S. consumption quantity:									
Amount	***	***	***	***	***	▼***	▼***	▼***	▲***
Producers' share (fn1)	***	***	***	***	***	▲***	▼***	▲***	▲***
Importers' share (fn1):									
Canada	***	***	***	***	***	▲***	▲***	▼***	▼***
China	***	***	***	***	***	▼***	▼***	▼***	▼***
Germany	***	***	***	***	***	▼***	▼***	▼***	▼***
India	***	***	***	***	***	▲***	▼***	▲***	▼***
Indonesia	***	***	***	***	***	▼***	▲***	▼***	▲***
Japan	***	***	***	***	***	▲***	▲***	▼***	▼***
Korea	***	***	***	***	***	▲***	▲***	▲***	▼***
Malaysia	***	***	***	***	***	▲***	▲***	▼***	▲***
Mexico	***	***	***	***	***	***	***	***	▲***
Philippines	***	***	***	***	***	▲***	▲***	▲***	▼***
Singapore	***	***	***	***	***	▲***	▲***	▲***	▼***
Taiwan	***	***	***	***	***	▼***	▼***	▼***	▲***
Thailand	***	***	***	***	***	▲***	▲***	▼***	▼***
Turkey	***	***	***	***	***	▲***	***	▲***	▲***
Vietnam	***	***	***	***	***	▲***	▲***	▼***	▲***
Other developing countries	***	***	***	***	***	***	***	***	▲***
Other non-developing countries	***	***	***	***	***	▼***	▼***	▼***	▼***
All import sources	***	***	***	***	***	▼***	▲***	▼***	▼***
Importers' share (based on location of module assembly) (fn1):									
Canada	***	***	***	***	***	▲***	▲***	▲***	▼***
China	***	***	***	***	***	▼***	▼***	▼***	▼***
Mexico	***	***	***	***	***	▲***	▼***	▲***	▼***
U.S. consumption value:									
Amount	***	***	***	***	***	▼***	▼***	▼***	▲***
Producers' share (fn1)	***	***	***	***	***	▲***	▼***	▲***	▲***
Importers' share (fn1):									
Canada	***	***	***	***	***	▲***	▲***	▼***	▼***
China	***	***	***	***	***	▼***	▼***	▼***	▼***
Germany	***	***	***	***	***	▼***	▼***	▼***	▼***
India	***	***	***	***	***	▲***	▲***	▲***	▼***
Indonesia	***	***	***	***	***	▼***	▲***	▼***	▼***
Japan	***	***	***	***	***	▲***	▲***	▼***	▼***
Korea	***	***	***	***	***	▲***	▲***	▲***	▼***
Malaysia	***	***	***	***	***	▲***	▲***	▼***	▲***
Mexico	***	***	***	***	***	***	***	***	▲***
Philippines	***	***	***	***	***	▲***	▼***	▲***	▼***
Singapore	***	***	***	***	***	▲***	▲***	▲***	▼***
Taiwan	***	***	***	***	***	▼***	▼***	▼***	▲***
Thailand	***	***	***	***	***	▲***	▲***	▼***	▼***
Turkey	***	***	***	***	***	▲***	***	▲***	▲***
Vietnam	***	***	***	***	***	▲***	▲***	▼***	▲***
Other developing countries	***	***	***	***	***	***	***	***	▲***
Other non-developing countries	***	***	***	***	***	▼***	▼***	▼***	▼***
All import sources	***	***	***	***	***	▼***	▲***	▼***	▼***
Importers' share (based on location of module assembly) (fn1):									
Canada	***	***	***	***	***	▲***	▲***	▲***	▼***
China	***	***	***	***	***	▼***	▼***	▼***	▼***
Mexico	***	***	***	***	***	▲***	▼***	▲***	▼***

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Table C-2--Continued
CSPV modules: Summary data concerning the U.S. total market, 2016-18, January to June 2018, and January to June 2019
(Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes			
	Calendar year			January to June		Calendar year			Jan-Jun
	2016	2017	2018	2018	2019	2016-18	2016-17	2017-18	2018-19
U.S. imports from:									
Canada:									
Quantity	***	***	***	***	***	▲***	▲***	▼***	▼***
Value	***	***	***	***	***	▲***	▲***	▼***	▼***
Unit value	***	***	***	***	***	▲***	▲***	▼***	▼***
China:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Value	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit value	***	***	***	***	***	▲***	▼***	▲***	▲***
Germany:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Value	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit value	***	***	***	***	***	▲***	▲***	▲***	▼***
India:									
Quantity	***	***	***	***	***	▲***	▼***	▲***	▼***
Value	***	***	***	***	***	▲***	▲***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▲***	▼***	▼***
Indonesia:									
Quantity	***	***	***	***	***	▼***	▲***	▼***	▲***
Value	***	***	***	***	***	▼***	▲***	▼***	▲***
Unit value	***	***	***	***	***	▼***	▲***	▼***	▼***
Japan:									
Quantity	***	***	***	***	***	▲***	▲***	▼***	▼***
Value	***	***	***	***	***	▲***	▲***	▼***	▼***
Unit value	***	***	***	***	***	▲***	▼***	▲***	▼***
Korea:									
Quantity	***	***	***	***	***	▼***	▲***	▼***	▼***
Value	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Malaysia:									
Quantity	***	***	***	***	***	▼***	▲***	▼***	▲***
Value	***	***	***	***	***	▼***	▼***	▼***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Mexico:									
Quantity	***	***	***	***	***	***	***	***	▲***
Value	***	***	***	***	***	***	***	***	▲***
Unit value	***	***	***	***	***	***	***	***	▲***
Philippines:									
Quantity	***	***	***	***	***	▲***	▼***	▲***	▼***
Value	***	***	***	***	***	▼***	▼***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▲***
Singapore:									
Quantity	***	***	***	***	***	▼***	▼***	▲***	▼***
Value	***	***	***	***	***	▼***	▼***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
Taiwan:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▲***
Value	***	***	***	***	***	▼***	▼***	▼***	▲***
Unit value	***	***	***	***	***	▲***	▼***	▲***	▼***
Thailand:									
Quantity	***	***	***	***	***	▼***	▲***	▼***	▲***
Value	***	***	***	***	***	▼***	▲***	▼***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
Turkey:									
Quantity	***	***	***	***	***	▲***	***	▲***	▲***
Value	***	***	***	***	***	▲***	***	▲***	▲***
Unit value	***	***	***	***	***	▲***	***	▲***	▼***
Vietnam:									
Quantity	***	***	***	***	***	▼***	▲***	▼***	▲***
Value	***	***	***	***	***	▼***	▲***	▼***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***

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Table C-2--Continued
CSPV modules: Summary data concerning the U.S. total market, 2016-18, January to June 2018, and January to June 2019
(Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes			
	Calendar year			January to June		Calendar year			Jan-Jun
	2016	2017	2018	2018	2019	2016-18	2016-17	2017-18	2018-19
U.S. imports from:--Continued									
All other developing countries:									
Quantity	***	***	***	***	***	***	***	***	▲***
Value	***	***	***	***	***	***	***	***	▲***
Unit value	***	***	***	***	***	***	***	***	▲***
All other non-developing countries:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Value	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▲***
All import sources:									
Quantity	11,590,991	9,787,904	5,299,723	2,374,064	4,082,389	▼(54.3)	▼(15.6)	▼(45.9)	▲72.0
Value	6,826,665	4,020,795	2,218,159	1,069,576	1,386,176	▼(67.5)	▼(41.1)	▼(44.8)	▲29.6
Unit value	$589	$411	$419	$451	$340	▼(28.9)	▼(30.3)	▲1.9	▼(24.6)
U.S. imports (based on location of module assembly) from:									
Canada:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Value	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
China:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Value	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit value	***	***	***	***	***	▲***	▼***	▲***	▼***
Mexico:									
Quantity	***	***	***	***	***	▼***	▼***	▲***	▼***
Value	***	***	***	***	***	▼***	▼***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
U.S. producers':									
Average capacity quantity	***	***	***	***	***	▼***	▼***	▲***	▲***
Production quantity	***	***	***	***	***	▼***	▼***	▲***	▲***
Capacity utilization (fn1)	***	***	***	***	***	▼***	▼***	▲***	▲***
U.S. shipments:									
Quantity	***	***	***	***	***	▼***	▼***	▲***	▲***
Value:	***	***	***	***	***	▼***	▼***	▲***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
Export shipments:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Value	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Ending inventory quantity	***	***	***	***	***	▼***	▼***	▼***	▲***
Inventories/total shipments (fn1)	***	***	***	***	***	▼***	▼***	▼***	▲***
Production workers	***	***	***	***	***	▼***	▼***	▼***	▲***
Hours worked (1,000s)	***	***	***	***	***	▼***	▼***	▲***	▲***
Wages paid ($1,000)	***	***	***	***	***	▼***	▼***	▲***	▲***
Hourly wages (dollars per hour)	***	***	***	***	***	▲***	▲***	▲***	▼***
Productivity (kilowatts per hour)	***	***	***	***	***	▲***	▼***	▲***	▲***
Unit labor costs	***	***	***	***	***	▲***	▲***	▼***	▼***

Table continued on next page.

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Table C-2--Continued

CSPV modules: Summary data concerning the U.S. total market, 2016-18, January to June 2018, and January to June 2019

(Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes			
	Calendar year			January to June		Calendar year			Jan-Jun
	2016	2017	2018	2018	2019	2016-18	2016-17	2017-18	2018-19
U.S. module producers' results: Regardless of origin of cells:									
Net sales:									
Quantity	***	***	***	***	***	▼***	▼***	▲***	▲***
Value	***	***	***	***	***	▼***	▼***	▲***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
Cost of goods sold (COGS)	***	***	***	***	***	▼***	▼***	▲***	▲***
Gross profit or (loss) (fn2)	***	***	***	***	***	▲***	▼***	▲***	▲***
SG&A expenses	***	***	***	***	***	▼***	▼***	▼***	▲***
Operating income or (loss) (fn2)	***	***	***	***	***	▲***	▲***	▲***	▲***
Net income or (loss) (fn2)	***	***	***	***	***	▲***	▲***	▲***	▲***
Capital expenditures	***	***	***	***	***	▲***	▼***	▲***	▲***
Unit COGS	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit SG&A expenses	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit operating income or (loss) (fn2)	***	***	***	***	***	▲***	▼***	▲***	▲***
Unit net income or (loss) (fn2)	***	***	***	***	***	▲***	▼***	▲***	▲***
COGS/sales (fn1)	***	***	***	***	***	▲***	▲***	▼***	▼***
Operating income or (loss)/sales (fn1)	***	***	***	***	***	▲***	▼***	▲***	▲***
Net income or (loss)/sales (fn1)	***	***	***	***	***	▲***	▼***	▲***	▲***
U.S. module producers' results: Using U.S.-origin cells:									
Net sales:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Value	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▲***
Cost of goods sold (COGS)	***	***	***	***	***	▼***	▼***	▼***	▼***
Gross profit or (loss) (fn2)	***	***	***	***	***	▼***	▼***	▲***	▲***
SG&A expenses	***	***	***	***	***	▼***	▼***	▼***	▼***
Operating income or (loss) (fn2)	***	***	***	***	***	▲***	▼***	▲***	▲***
Net income or (loss) (fn2)	***	***	***	***	***	▼***	▼***	▼***	▲***
Unit COGS	***	***	***	***	***	▼***	▼***	▼***	▲***
Unit SG&A expenses	***	***	***	***	***	▲***	▲***	▲***	▲***
Unit operating income or (loss) (fn2)	***	***	***	***	***	▼***	▼***	▼***	▲***
Unit net income or (loss) (fn2)	***	***	***	***	***	▼***	▼***	▼***	▲***
COGS/sales (fn1)	***	***	***	***	***	▲***	▲***	▼***	▼***
Operating income or (loss)/sales (fn1)	***	***	***	***	***	▼***	▼***	▲***	▲***
Net income or (loss)/sales (fn1)	***	***	***	***	***	▼***	▼***	▼***	▲***
U.S. module producers' results: Using Foreign-origin cells:									
Net sales:									
Quantity	***	***	***	***	***	▲***	▼***	▲***	▲***
Value	***	***	***	***	***	▲***	▼***	▲***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
Cost of goods sold (COGS)	***	***	***	***	***	▲***	▼***	▲***	▲***
Gross profit or (loss) (fn2)	***	***	***	***	***	▲***	▼***	▲***	▲***
SG&A expenses	***	***	***	***	***	▼***	▼***	▼***	▲***
Operating income or (loss) (fn2)	***	***	***	***	***	▲***	▲***	▲***	▼***
Net income or (loss) (fn2)	***	***	***	***	***	▲***	▲***	▲***	▼***
Unit COGS	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit SG&A expenses	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit operating income or (loss) (fn2)	***	***	***	***	***	▲***	▲***	▲***	▲***
Unit net income or (loss) (fn2)	***	***	***	***	***	▲***	▲***	▲***	▲***
COGS/sales (fn1)	***	***	***	***	***	▼***	▲***	▼***	▼***
Operating income or (loss)/sales (fn1)	***	***	***	***	***	▲***	▲***	▲***	▲***
Net income or (loss)/sales (fn1)	***	***	***	***	***	▲***	▲***	▲***	▲***

Notes:

Note.--Shares and ratios shown as "0.0" percent represent non-zero values less than "0.05" percent (if positive) and greater than (0.05)" percent (if negative). Zeroes, null values, and undefined calculations are suppressed and shown as "---". Period changes preceded by a ▲" represent an increase, while period changes preceded by a "▼" represent a decrease.

fn1.--Reported data are in percent and period changes are in percentage points.
fn2.--Percent changes only calculated when both comparison values represent profits; The directional change in profitability provided when one or both comparison values represent a loss.

Source: Compiled from data submitted in response to Commission questionnaires.

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Cells Only, Merchant Market

Table C-3
CSPV cells: Summary data concerning the U.S. merchant market, 2016-18, January to June 2018, and January to June 2019
(Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes			
	Calendar year			January to June		Calendar year			Jan-Jun
	2016	2017	2018	2018	2019	2016-18	2016-17	2017-18	2018-19
U.S. consumption quantity:									
Amount	***	***	***	***	***	▲***	▲***	▲***	▲***
Producers' share (fn1)	***	***	***	***	***	▲***	▲***	▲***	▼***
Importers' share (fn1):									
Canada	***	***	***	***	***	***	***	***	***
China	***	***	***	***	***	▲***	▲***	▲***	▼***
Germany	***	***	***	***	***	▼***	▼***	▼***	▼***
India	***	***	***	***	***	***	***	***	***
Indonesia	***	***	***	***	***	***	***	***	***
Japan	***	***	***	***	***	▲***	▲***	▼***	▼***
Korea	***	***	***	***	***	▲***	▼***	▲***	▲***
Malaysia	***	***	***	***	***	▲***	▲***	▲***	▼***
Mexico	***	***	***	***	***	***	***	***	***
Philippines	***	***	***	***	***	▲***	▲***	▼***	▼***
Singapore	***	***	***	***	***	***	***	***	***
Taiwan	***	***	***	***	***	▼***	▼***	▼***	▲***
Thailand	***	***	***	***	***	▲***	▼***	▲***	▼***
Turkey	***	***	***	***	***	***	***	***	***
Vietnam	***	***	***	***	***	▲***	▲***	▼***	▼***
Other developing countries	***	***	***	***	***	***	***	***	***
Other non-developing countries	***	***	***	***	***	▼***	▼***	***	***
All import sources	***	***	***	***	***	▼***	▼***	▼***	▲***
U.S. consumption value:									
Amount	***	***	***	***	***	▲***	▼***	▲***	▲***
Producers' share (fn1)	***	***	***	***	***	▲***	▼***	▲***	▼***
Importers' share (fn1):									
Canada	***	***	***	***	***	***	***	***	***
China	***	***	***	***	***	▲***	▲***	▲***	▼***
Germany	***	***	***	***	***	▼***	▼***	▼***	▼***
India	***	***	***	***	***	***	***	***	***
Indonesia	***	***	***	***	***	***	***	***	***
Japan	***	***	***	***	***	▲***	▲***	▼***	▲***
Korea	***	***	***	***	***	▲***	▼***	▲***	▲***
Malaysia	***	***	***	***	***	▲***	▲***	▲***	▼***
Mexico	***	***	***	***	***	***	***	***	***
Philippines	***	***	***	***	***	▲***	▲***	▼***	▼***
Singapore	***	***	***	***	***	***	***	***	***
Taiwan	***	***	***	***	***	▼***	▼***	▼***	▲***
Thailand	***	***	***	***	***	▲***	▼***	▲***	▼***
Turkey	***	***	***	***	***	***	***	***	***
Vietnam	***	***	***	***	***	▲***	▲***	▼***	▲***
Other developing countries	***	***	***	***	***	***	***	***	***
Other non-developing countries	***	***	***	***	***	▼***	▼***	***	***
All import sources	***	***	***	***	***	▼***	▲***	▼***	▲***

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Table C-3--Continued

CSPV cells: Summary data concerning the U.S. merchant market, 2016-18, January to June 2018, and January to June 2019

(Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes			
	Calendar year			January to June		Calendar year			Jan-Jun
	2016	2017	2018	2018	2019	2016-18	2016-17	2017-18	2018-19
U.S. imports from:									
Canada:									
Quantity	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***
China:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▲***
Value	***	***	***	***	***	▲***	▲***	▲***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Germany:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Value	***	***	***	***	***	▼***	▼***	▼***	▼***
Unit value	***	***	***	***	***	▲***	▼***	▲***	▼***
India:									
Quantity	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***
Indonesia:									
Quantity	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***
Japan:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▲***
Value	***	***	***	***	***	▲***	▲***	▲***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Korea:									
Quantity	***	***	***	***	***	▲***	▼***	▲***	▲***
Value	***	***	***	***	***	▲***	▼***	▲***	▲***
Unit value	***	***	***	***	***	▲***	▲***	▲***	▼***
Malaysia:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▲***
Value	***	***	***	***	***	▲***	▲***	▲***	▼***
Unit value	***	***	***	***	***	▲***	▲***	▲***	▼***
Mexico:									
Quantity	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***
Philippines:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▼***
Value	***	***	***	***	***	▲***	▲***	▲***	▼***
Unit value	***	***	***	***	***	▲***	▲***	▼***	▼***
Singapore:									
Quantity	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***
Taiwan:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▲***
Value	***	***	***	***	***	▼***	▼***	▼***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Thailand:									
Quantity	***	***	***	***	***	▲***	▼***	▲***	▼***
Value	***	***	***	***	***	▲***	▼***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▲***	▼***	▼***
Turkey:									
Quantity	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***
Vietnam:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▲***
Value	***	***	***	***	***	▲***	▲***	▲***	▲***
Unit value	***	***	***	***	***	▲***	▲***	▼***	▼***

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Table C-3--Continued

CSPV cells: Summary data concerning the U.S. merchant market, 2016-18, January to June 2018, and January to June 2019

(Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes			
	Calendar year			January to June		Calendar year			Jan-Jun
	2016	2017	2018	2018	2019	2016-18	2016-17	2017-18	2018-19
U.S. imports from:--Continued									
All other developing countries:									
Quantity	***	***	***	***	***	***	***	***	***
Value	***	***	***	***	***	***	***	***	***
Unit value	***	***	***	***	***	***	***	***	***
All other non-developing countries:									
Quantity	***	***	***	***	***	▼***	▼***	***	***
Value	***	***	***	***	***	▼***	▼***	***	***
Unit value	***	***	***	***	***	▼***	▼***	***	***
All import sources:									
Quantity	265,382	278,426	836,903	308,336	951,003	▲215.4	▲4.9	▲200.6	▲208.4
Value	97,028	92,637	260,992	107,724	184,285	▲169.0	▼(4.5)	▲181.7	▲71.1
Unit value	$366	$333	$312	$349	$194	▼(14.7)	▼(9.0)	▼(6.3)	▼(44.5)
U.S. cell producers':									
Average capacity quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Production quantity	***	***	***	***	***	▼***	▼***	▼***	▼***
Capacity utilization (fn1)	***	***	***	***	***	▼***	▼***	▼***	▲***
Commercial U.S. shipments:									
Quantity	***	***	***	***	***	▲***	▲***	▲***	▼***
Value:	***	***	***	***	***	▲***	▼***	▲***	▼***
Unit value	***	***	***	***	***	▼***	▼***	▲***	▼***
Export shipments:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▲***
Value	***	***	***	***	***	▼***	▼***	▼***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Ending inventory quantity	***	***	***	***	***	▼***	▼***	▼***	▲***
Inventories/total shipments (fn1)	***	***	***	***	***	▼***	▼***	▼***	▲***
Production workers	***	***	***	***	***	▼***	▼***	▼***	▲***
Hours worked (1,000s)	***	***	***	***	***	▼***	▼***	▼***	▲***
Wages paid ($1,000)	***	***	***	***	***	▼***	▼***	▼***	▼***
Hourly wages (dollars per hour)	***	***	***	***	***	▼***	▲***	▼***	▼***
Productivity (kilowatts per hour)	***	***	***	***	***	▲***	▲***	▼***	▼***
Unit labor costs	***	***	***	***	***	▼***	▼***	▼***	▲***
U.S. cell producers' merchant market results:									
Net sales:									
Quantity	***	***	***	***	***	▼***	▼***	▼***	▲***
Value	***	***	***	***	***	▼***	▼***	▼***	▲***
Unit value	***	***	***	***	***	▼***	▼***	▼***	▼***
Cost of goods sold (COGS)	***	***	***	***	***	▼***	▼***	▲***	▲***
Gross profit or (loss) (fn2)	***	***	***	***	***	▼***	▼***	▼***	▼***
SG&A expenses	***	***	***	***	***	▼***	▼***	▼***	▲***
Operating income or (loss) (fn2)	***	***	***	***	***	▼***	▲***	▼***	▼***
Net income or (loss) (fn2)	***	***	***	***	***	▼***	▲***	▼***	▼***
Capital expenditures	***	***	***	***	***	▲***	▼***	▲***	▼***
Unit COGS	***	***	***	***	***	▲***	▼***	▲***	▼***
Unit SG&A expenses	***	***	***	***	***	▲***	▼***	▲***	▼***
Unit operating income or (loss) (fn2)	***	***	***	***	***	▼***	▼***	▼***	▲***
Unit net income or (loss) (fn2)	***	***	***	***	***	▼***	▼***	▼***	▲***
COGS/sales (fn1)	***	***	***	***	***	▲***	▲***	▲***	▼***
Operating income or (loss)/sales (fn1)	***	***	***	***	***	▼***	▼***	▼***	▲***
Net income or (loss)/sales (fn1)	***	***	***	***	***	▼***	▼***	▼***	▲***

Notes:

Note.--Shares and ratios shown as "0.0" percent represent non-zero values less than "0.05" percent (if positive) and greater than (0.05)" percent (if negative). Zeroes, null values, and undefined calculations are suppressed and shown as "---". Period changes preceded by a "▲" represent an increase, while period changes preceded by a "▼" represent a decrease.

fn1.--Reported data are in percent and period changes are in percentage points.
fn2.--Percent changes only calculated when both comparison values represent profits; The directional change in profitability provided when one or both comparison values represent a loss.

Source: Compiled from data submitted in response to Commission questionnaires.

Reproduced from USITC report in monitoring investigation, USITC Publication 5021

Table C-4
CSPV products: Channels of distribution by type for U.S. producers and importers, 2016-18, January to June 2018, and January to June 2019
(Quantity=kilowatts; Value=1,000 dollars; Unit values, unit labor costs, and unit expenses=dollars per kilowatt; Period changes=percent--exceptions noted)

	Reported data					Period changes			
	Calendar year			January to June		Calendar year			Jan-Jun
	2016	2017	2018	2018	2019	2016-18	2016-17	2017-18	2018-19
Commercial and Residential:									
Quantity:									
United States	***	***	***	***	***	▼***	▼***	▼***	▲***
Import sources	***	***	***	***	***	▼***	▼***	▼***	▲***
All sources	***	***	***	***	***	▼***	▼***	▼***	▲***
Share of quantity (fn1)									
United States	***	***	***	***	***	▼***	▼***	▲***	▲***
Import sources	***	***	***	***	***	▲***	▲***	▼***	▼***
All sources	***	***	***	***	***	***	***	***	***
Ratio to overall apparent consumption (fn1)									
United States	***	***	***	***	***	▼***	▼***	▲***	▲***
Import sources	***	***	***	***	***	▲***	▲***	▲***	▼***
All sources	***	***	***	***	***	▲***	▲***	▲***	▼***
Utilities:									
Quantity:									
United States	***	***	***	***	***	▼***	▼***	▲***	▲***
Import sources	***	***	***	***	***	▼***	▼***	▼***	▲***
All sources	***	***	***	***	***	▼***	▼***	▼***	▲***
Share of quantity (fn1)									
United States	***	***	***	***	***	▲***	▼***	▲***	▲***
Import sources	***	***	***	***	***	▼***	▲***	▼***	▼***
All sources	***	***	***	***	***	***	***	***	***
Ratio to overall apparent consumption (fn1)									
United States	***	***	***	***	***	▲***	▼***	▲***	▲***
Import sources	***	***	***	***	***	▼***	▼***	▼***	▲***
All sources	***	***	***	***	***	▼***	▼***	▼***	▲***

Notes:

Note.--Shares and ratios shown as "0.0" percent represent non-zero values less than "0.05" percent (if positive) and greater than (0.05)" percent (if negative). Zeroes, null values, and undefined calculations are suppressed and shown as "---". Period changes preceded by a "▲" represent an increase, while period changes preceded by a "▼" represent a decrease.

fn1.--Reported data are in percent and period changes are in percentage points.

Source: Compiled from data submitted in response to Commission questionnaires.

Reproduced from USITC report in monitoring investigation, USITC Publication 5021

APPENDIX E

SECTION 232 AND SECTION 301 PROCEEDINGS

Section 232 investigations (Commerce)[1]

Steel

On April 19, 2017, Commerce initiated an investigation under section 232 of the Trade Expansion Act of 1962 as amended (19 U.S.C. 1862), to assess the impact of steel imports on the national security of the United States.[2] [3] Commerce submitted the results of the investigations to the President on January 11, 2018.[4] On March 8, 2018, the President announced his decision to impose 25 percent ad valorem duties on specified steel mill products from all U.S. trading partners, except Canada and Mexico.[5] [6]

On March 22, 2018, the President authorized the suspension of tariffs on steel and aluminum products of the following countries: Argentina, Australia, Brazil, Canada, Mexico, member countries of the European Union, and Korea.[7] On April 30, 2018, the President announced that the expiration of exemptions on tariffs on steel and aluminum imports from Canada, the European Union member states, and Mexico would occur on May 31, 2018.[8] The President also announced the exemptions were extended permanently for Korea in return for agreeing to product-specific quotas beginning on January 1, 2019.[9] Exemptions for Argentina, Australia, and Brazil were also extended until alternative restraints could be finalized.[10]

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[1] The information in this appendix is primarily from *Large Residential Washers: Monitoring Developments in the Domestic Industry, Inv. Nos. TA-204-013,* USITC Publication 4941, August 2019, pp. F-3–F-9.

[2] U.S. Department of Commerce website: https://www.commerce.gov/news/press-releases/2018/01/statement-department-commerce-submission-steel-section-232-report, retrieved December 11, 2018.

[3] Section 232 of the Trade Expansion Act of 1962 (19 U.S.C. §1862) authorizes the Secretary of Commerce to conduct these investigations.

[4] U.S. Department of Commerce website: https://www.commerce.gov/news/pressreleases/2018/01/statement-department-commerce-submission-steel-section-232-report, retrieved December 11, 2018.

[5] 83 FR 11625, March 15, 2018.

[6] For the purposes of this proclamation, "articles of iron or steel" are defined at the Harmonized Tariff Schedule (HTS) six-digit level as: 7206.10 through 7216.50, 7216.99 through 7301.10, 7302.10, 7302.40 through 7302.90, and 7304.10 through 7306.90, including any subsequent revisions to these HTS classifications.

[7] 83 FR 13361, March 28, 2018.

[8] 83 FR 20683, May 7, 2018.

[9] 83 FR 20683, May 7, 2018.

[10] 83 FR 20683, May 7, 2018.

On May 31, 2018, under a Presidential Proclamation issued under Section 232 of the Trade Expansion Act of 1962, the President announced tariffs would no longer be suspended for steel and aluminum imports from Mexico, Canada, and the European Union, effective July 1, 2018. Steel products from these countries became subject to a 25 percent ad valorem duty.[11]

A subsequent Presidential proclamation established absolute quotas for Argentina, Brazil, and Korea as an alternate to the 25 percent ad valorem duty for imports of steel mill articles, effective June 1, 2018 (leaving Australia as the only country exempt from both tariffs and quotas).[12] [13] On August 10, 2018, the President authorized adjusting the ad valorem tariff on steel imports from Turkey from 25 percent to 50 percent.[14]

In the President's proclamation establishing the tariff under Section 232, the Secretary of Commerce was authorized to provide relief from the 25 percent ad valorem duties for any steel articles determined "not to be produced in the United States in a sufficient and reasonably available amount or of a satisfactory quality and is also authorized to provide such relief based upon specific national security considerations. Such relief shall be provided for any article only after a request for exclusion is made by a directly affected party located in the United States."[15] Approved exclusions are made on a product specific basis and are limited to the individual or organization that submitted the specific exclusion request, unless Commerce approves a broader application of the product based exclusion request for additional importers.[16]

On June 20, 2018, Commerce announced its first set of product exclusions granted from Section 232 tariffs on steel imports. Forty-two exclusion requests were granted, covering seven companies importing steel products from Japan, Sweden, Belgium, Germany, and China.[17]

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[11] 83 FR 25857, June 5, 2018.

[12] U.S. Customs and Border Protection, "QB 18-126 Absolute Quotas for Steel Mill Articles: Argentina, Brazil and Korea," https://www.cbp.gov/trade/quota/bulletins/qb-18-126-absolute-quota-aluminum-products-argentina-brazil-south-korea, retrieved December 11, 2018.

[13] U.S. Customs and Border Protection, "Section 232 Tariffs on Aluminum and Steel," https://www.cbp.gov/trade/programs-administration/entry-summary/232-tariffs-aluminum-and-steel, retrieved December 11, 2018.

[14] 83 FR 40429, August 15, 2018.

[15] *U.S. Department of Commerce, Bureau of Industry and Security, "Section 232 National Security Investigation of Steel Imports Information on the Exclusion and Objection Process,"* https://www.bis.doc.gov/index.php/232-steel, retrieved December 11, 2018.

[16] 83 FR 12106, March 19, 2018.

[17] The seven companies receiving the exclusions are: Schick Manufacturing, Inc. of Shelton, Connecticut; Nachi America Inc. of Greenwood, Indiana; Hankev International of Buena Park, California; Zapp Precision Wire of Summerville, South Carolina; U.S. Leakless, Inc. of Athens, Alabama; Woodings Industrial Corporation of Mars, Pennsylvania; and PolyVision Corporation of Atlanta, Georgia. The exempted products were not specified. U.S. Department of Commerce, "Department of Commerce Grants First Product Exclusion Requests from Section 232 Tariffs on Steel Imports," https://www.commerce.gov/news/press-releases/2018/06/department-commerce-grants-first-product-exclusion-requests-section-232, retrieved December 11, 2018.

On May 16, 2019, the President modified proclamation 9705 to remove the higher tariff on steel imports from Turkey imposed by Proclamation 9772, and to instead impose a 25 percent ad valorem tariff on steel imports from Turkey, commensurate with the tariff imposed on such articles by the Section 232 remedy imported from most other countries.[18]

On May 19, 2019, the President issued two Proclamations adjusting Proclamations 9704 and 9705 after the United States announced an agreement with Canada and Mexico to remove the Section 232 tariffs for steel imports from those countries.[19]

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[18] White House website: https://www.whitehouse.gov/presidential-actions/proclamation-adjusting-imports-steel-united-states/, retrieved June 6, 2019.

[19] White House website: https://www.whitehouse.gov/presidential-actions/proclamation-adjusting-imports-steel-united-states-2/, retrieved June 6, 2019.

Table E-1
Section 232 actions: Presidential proclamations affecting imports of steel articles, since 2018

Item	Action and duration (effective dates)	Federal Register Notice
General action	The President implemented 25 percent ad valorem national-security duties on U.S. steel imports— March 23, 2018 to present.	83 FR 11625
Argentina	Exempted from duties— March 23, 2018 to April 30, 2018.	83 FR 13361
Argentina	Exemption from duties continued— May 1, 2018 to May 31, 2018.	83 FR 20683
Argentina	Exemption from duties continued, but subject to annual quota limits— June 1, 2018 to present.	83 FR 25857
Australia	Exempted from duties— March 23, 2018 to April 30, 2018.	83 FR 13361
Australia	Exemption from duties continued— May 1, 2018 to May 31, 2018.	83 FR 20683
Australia	Exemption from duties continued— June 1, 2018 to present.	83 FR 40429
Brazil	Exempted from duties— March 23, 2018 to April 30, 2018	83 FR 13361
Brazil	Exemption from duties continued— May 1, 2018 to May 31, 2018	83 FR 20683
Brazil	Exemption from duties continued, but subject to annual quota limits— June 1, 2018 to present.	83 FR 25857
Canada	Exempted from duties— March 23, 2018 to May 31, 2018.	83 FR 11625
Canada	Exemption from duties not continued— June 1, 2018 to May 19, 2019.	83 FR 20683
Canada	Exemption from duties reinstated— May 20, 2019 to present.	84 FR 23987
EU member countries	Exempted from duties— March 23, 2018 to April 30, 2018.	83 FR 13361
EU	Exemption from duties continued— May 1, 2018 to May 31, 2018.	83 FR 20683
EU	Exemption from duties not continued— June 1, 2018 to present.	83 FR 20683
Korea	Exempted from duties— March 23, 2018 to April 30, 2018.	83 FR 13361
Korea	Exemption from duties continued, but subject to annual quota limits— May 1, 2018 to present.	83 FR 20683
Mexico	Exempted from duties— March 23, 2018 to May 31, 2018.	83 FR 11625
Mexico	Exemption from duties not continued— June 1, 2018 to May 19, 2019.	83 FR 20683
Mexico	Exemption from duties reinstated— May 20, 2019 to present.	84 FR 23987
Turkey	Duty rate doubled to 50 percent ad valorem— August 13, 2018 to May 20, 2019.	83 FR 40429
Turkey	Duty rate reduced from 50 percent to 25 percent ad valorem— May 21, 2019 to present.	84 FR 23421

Source: *Adjusting Imports of Steel Into the United States*, Presidential Proclamation 9705, March 8, 2018, 83 FR 11625, March 15, 2018; *Adjusting Imports of Steel Into the United States*, Presidential Proclamation 9711, March 22, 2018, 83 FR 13361, March 28, 2018; *Adjusting Imports of Steel Into the United States*, Presidential Proclamation 9740, April 30, 2018, 83 FR 20683, May 7, 2018; *Adjusting Imports of Steel Into the United States*, Presidential Proclamation 9759, May 31, 2018, 83 FR 25857, June 5, 2018; *Adjusting Imports of Steel Into the United States*, Presidential Proclamation 9772, August 10, 2018, 83 FR 40429, August 15, 2018; *Adjusting Imports of Steel Into the United States*, Presidential Proclamation 9894, May 19, 2019, 84 FR 23987, May 23, 2019; *Adjusting Imports of Steel Into the United States*, Presidential Proclamation 9886, May 16, 2019, 84 FR 23421, May 21, 2019.

Note.--Presidential Proclamation 9705 (clause (1)) defined "steel articles" at the Harmonized Tariff Schedule of the United States ("HTS") 6-digit level as: 7206.10 through 7216.50, 7216.99 through 7301.10, 7302.10, 7302.40 through 7302.90, and 7304.10 through 7306.90, including any subsequent revisions to these HTS classifications.

Aluminum

On April 26, 2017, Commerce initiated an investigation under section 232 of the Trade Expansion Act of 1962 as amended (19 U.S.C. 1862), to assess the impact of aluminum imports on the national security of the United States.[20] [21] Commerce submitted the results of the investigations to the President on January 19, 2018.[22] On March 8, 2018, the President announced his decision to impose 10 percent ad valorem duties on specified aluminum products from all U.S. trading partners, except Canada and Mexico.[23] [24]

On March 22, 2018, the President authorized the suspension of tariffs on steel and aluminum products of the following countries: Argentina, Australia, Brazil, Canada, Mexico, member countries of the European Union, and Korea.[25] On April 30, 2018, the President announced that the expiration of exemptions on tariffs on steel and aluminum imports from Canada, the European Union member states, and Mexico would occur on May 31, 2018.[26] Exemptions for Argentina, Australia, and Brazil were also extended until alternative restraints could be finalized.[27]

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[20] U.S. Department of Commerce website: https://www.commerce.gov/issues/trade-enforcement/section-232-aluminum#memo, retrieved December 19, 2018.

[21] Section 232 of the Trade Expansion Act of 1962 (19 U.S.C. §1862) authorizes the Secretary of Commerce to conduct these investigations.

[22] White House website: https://www.whitehouse.gov/presidential-actions/presidential-proclamation-adjusting-imports-aluminum-united-states/, retrieved December 19, 2018.

[23] 83 FR 11619, December 19, 2018.

[24] For the purposes of this proclamation, "articles of aluminum" are defined at the Harmonized Tariff Schedule (HTS) as: 7601, 7604, 7605, 7606, 7607, 7608, 7609, 7616.99.51.60, and 7616.99.51.70, including any subsequent revisions to these HTS classifications.

[25] 83 FR 13355, December 19, 2018.

[26] 83 FR 20677, December 19, 2018.

[27] Ibid.

On May 31, 2018, under a Presidential Proclamation issued under Section 232 of the Trade Expansion Act of 1962, the President announced tariffs will no longer be suspended for steel and aluminum imports from Brazil, Mexico, Canada, and the European Union, effective July 1, 2018. Aluminum products from these countries will be subject to a 10 percent ad valorem duty.[28]

A subsequent Presidential proclamation established absolute quotas for Argentina, as an alternate to the 10 percent ad valorem duty for imports of aluminum articles, effective June 1, 2018 (leaving Australia as the only country exempt from both tariffs and quotas).[29]

In the President's proclamation establishing the tariff under Section 232, the Secretary of Commerce was authorized to provide relief from the 10 percent ad valorem duties for any steel articles determined "not to be produced in the United States in a sufficient and reasonably available amount or of a satisfactory quality and is also authorized to provide such relief based upon specific national security considerations. Such relief shall be provided for any article only after a request for exclusion is made by a directly affected party located in the United States."[30] Approved exclusions are made on a product specific basis and are limited to the individual or organization that submitted the specific exclusion request, unless Commerce approves a broader application of the product based exclusion request for additional importers.[31]

On June 20, 2018, Commerce announced its first set of product exclusions granted from Section 232 tariffs on aluminum imports. Sixty-two exclusion requests were granted, with the following companies receiving the exclusions: Ball Metal Beverage Container Corp. of Broomfield, Colorado; Bemis Company, Inc. of Neenah, Wisconsin; Channel Alloys of Norwalk, Connecticut; Constellium-UACJ ABS LLC of Bowling Green, Kentucky; Cornell Dubilier Marketing of Liberty, South Carolina; Garmco, Inc. of Winter Garden, Florida; Generac Power Systems of Waukesha, Wisconsin; International Converter, LLC of Caldwell, Ohio; Mandel Metals, Inc. of Franklin Park, Illinois; ProAmpac Intermediate Inc. of Cincinnati, Ohio; Schluter Systems of Plattsburgh, New York; Trinidad/Benham Corp. of Denver, Colorado.[32] The exempted products

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[28] 83 FR 25849, December 19, 2018.

[29] U.S. Customs and Border Protection, "Section 232 Tariffs on Aluminum and Steel," https://www.cbp.gov/trade/programs-administration/entry-summary/232-tariffs-aluminum-and-steel, retrieved December 11, 2018.

[30] *U.S. Department of Commerce Announces Steel and Aluminum Tariff Exclusion Process* https://www.commerce.gov/news/press-releases/2018/03/us-department-commerce-announces-steel-and-aluminum-tariff-exclusion, retrieved December 19, 2018.

[31] 83 FR 12106, March 19, 2018.

[32] U.S. Department of Commerce, *Requirements for Submissions Requesting Exclusions from the Remedies Instituted in Presidential Proclamations Adjusting Imports of Steel into the United States and Adjusting Imports of Aluminum into the United States; and the Filing Objections to Submitted Exclusion request for Steel and Aluminum,* Docket ID BIS-2018-0002, https://www.regulations.gov/docket?D=BIS-2018-0002, retrieved December 20, 2018.

include 6020 T8 Cold finished aluminum bars, high purity etched and "formed foil, and cansheet body stock of 3104/H19 alloy.[33]

On May 19, 2019, the President issued two Proclamations adjusting Proclamations 9704 and 9705 after the United States announced an agreement with Canada and Mexico to remove the Section 232 tariffs for aluminum imports from those countries.[34]

Section 301 proceeding

Section 301 of the Trade Act of 1974, as amended ("Trade Act"),[35] authorizes the USTR, at the direction of the President, to take appropriate action to respond to a foreign country's unfair trade practices. On August 18, 2017, the USTR initiated an investigation into certain policies and practices of the Government of China related to technology transfer, intellectual property, and innovation.[36] On April 6, 2018, the USTR published its determination that the acts, policies, and practices of China under investigation are unreasonable or discriminatory and burden or restrict U.S. commerce, and are thus actionable under section 301(b) of the Trade Act.[37] The USTR determined that it was appropriate and feasible to take action and proposed the imposition of an additional 25 percent duty on products from China with an annual trade value of approximately $50 billion. The additional duties were initially proposed in two lists. List 1 covered 818 tariff subheadings, with an approximate annual trade value of $34 billion.[38] Tranche 2 covered 279 tariff subheadings, with an approximate annual trade value of $16 billion.

On September 21, 2018, the USTR published List 3 in the *Federal Register* modifying its prior action in accordance with the specific direction of the President under his authority pursuant to section 307(a)(1) of the Trade Act, determining to include 5,745 full and partial tariff subheadings with an approximate annual trade value of $200 billion, while maintaining the prior action. The USTR determined that the rate of additional duty is initially 10 percent ad valorem, effective September 24, 2018.[39] On August 20, 2019, the USTR published List 4 List A and List B in the Federal Register with an approximate annual trade value which totaled approximately $300 billion. List 1 covered 3,229 full HTS tariff subheadings and 4 partial HTS subheadings while List 2 covered 542 full HTS tariff subheadings and 8 partial HTS subheadings.

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[33] S&P Global, "US Commerce grants first Section 232 aluminum product exclusion," https://www.spglobal.com/platts/en/market-insights/latest-news/metals/071318-us-commerce-grants-first-section-232-aluminum-product-exclusions, retrieved December 20, 2018.

[34] White House website: https://www.whitehouse.gov/presidential-actions/proclamation-adjusting-imports-aluminum-united-states/, retrieved June 6, 2019.

[35] 19 U.S.C. § 2411.

[36] 82 FR 40213, August 24, 2017.

[37] 83 FR 14906, April 6, 2018.

[38] 83 FR 28710, June 20, 2018.

[39] 83 FR 47974, September 21, 2018.

List 4 imposed an additional duty rate of 10 percent ad valorem duties on imports.[40] See Table E-2 for further tariff actions on List 1 – 4 products.

[40] 84 FR 43304, August 20, 2019.

Table E-2
Section 301 tariff actions: Office of the United States Trade Representative ("USTR") proceedings, 2018–20

List	Effective date	Tariff action
List 1	July 6, 2018	**Enacted:** Additional 25 percent ad valorem duties on approximately $34 billion of imports classifiable under 818 HTS tariff subheadings (Annex A to 83 FR 28710).
List 2	August 23, 2018	**Enacted:** Additional 25 percent ad valorem duties on approximately $16 billion of imports classifiable under 279 HTS tariff subheadings (Annex A to 83 FR 40823).
List 3	September 24, 2018	**Enacted:** Additional 10 percent ad valorem duties on approximately $200 billion of imports classifiable under 5,745 HTS tariff subheadings and partial subheadings (Annex A to 83 FR 47974), which are scheduled to increase to 25 percent on January 1, 2019 (Annex B to 83 FR 47974).
List 3	October 1, 2018	**Amendment:** Fourteen HTS tariff subheadings in chapter 44 (under Annex A to 83 FR 47974, September 21, 2018) were removed and replaced by 38 corresponding new HTS subheadings to conform to the International Convention on the Harmonized Commodity Description and Coding System.
List 3	March 2, 2019	**Postponed:** Duty increases from 10 percent to 25 percent were rescheduled (83 FR 65198).
List 3	Not applicable	**Postponed:** Additional ad valorem duties to remain at 10 percent until further notice (84 FR 7966).
List 3	May 10, 2019	**Enacted:** Duty increases from 10 percent to 25 percent ad valorem were rescheduled (84 FR 20459).
List 3	Prior to June 1, 2019	**Enacted:** Delayed duty increases from 10 percent to 25 percent ad valorem enacted May 10, 2019 on certain products exported from China before May 10, 2019, that enter into the United States before June 1, 2019 (84 FR 21892).
List 3	Prior to June 15, 2019	**Enacted:** The date was extended for the delayed duty increase from 10 percent to 25 percent ad valorem on certain products exported from China before May 10, 2019 that enter into the United States before June 15, 2019.
List 4A	September 1, 2019	**Enacted:** Additional 10 percent ad valorem duties on imports classifiable under 3,229 full HTS tariff subheadings and 4 partial HTS subheadings (Annexes A and B to 84 FR 43304). Imports on products classifiable under HTS subheadings on lists 1 and 2 totaled approximately $300 billion.
List 4B	December 15, 2019	**Enacted:** Additional 10 percent ad valorem duties on imports classifiable under 542 full HTS tariff subheadings and 8 partial HTS subheadings (Annexes C and D to 84 FR 43304). Imports on products classifiable under HTS subheadings on lists 1 and 2 totaled approximately $300 billion.
List 4A	September 1, 2019	**Amendment:** Additional 10 percent ad valorem duties were increased to 15 percent ad valorem on products covered by Annex A (84 FR 45821).
List 4B	December 15, 2019	**Amendment:** Additional 10 percent ad valorem duties were increased to 15 percent ad valorem on products covered by Annex C (84 FR 45821).
Lists 1, 2, and 3	October 1, 2019	**Proposed:** Additional 25 percent ad valorem duties to be increased 30 percent ad valorem on products covered by Annex C – List 3, Part 1 (84 FR 46212).
List 4B	December 15, 2019	**Amendment:** Additional 15 percent ad valorem duties were suspended on products covered by Annex C (84 FR 69447)
List 4A	February 14, 2020	**Amendment:** Additional 15 percent ad valorem duties were decreased to 7.5 percent ad valorem on products covered by Annex A (85 FR 3741).

Source: USTR, *Notice of Action and Request for Public Comment Concerning Proposed Determination of Action Pursuant to Section 301 Action: China's Acts, Policies, and Practices Related to Technology*

Transfer, Intellectual Property, and Innovation, 83 FR 28710, June 20, 2018; USTR, *Notice of Action Pursuant to Section 301: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 83 FR 40823, August 16, 2018; USTR, *Notice of Modification of Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 83 FR 47974, September 21, 2018; USTR, *Conforming Amendment and Modification to Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 83 FR 49153, September 28, 2018; USTR, *Notice of Modification of Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 83 FR 65198, December 19, 2018; USTR, *Notice of Modification of Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 84 FR 7966, March 5, 2019; USTR, *Notice of Modification of Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 84 FR 20459, May 9, 2019; USTR, *Implementing Modification to Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 84 FR 21892, May 15, 2019; USTR, *Request for Comments Concerning Proposed Modification of Action Pursuant to Section 301: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 84 FR 26930, June 10, 2019; USTR, *Notice of Modification of Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 84 FR 43304, August 20, 2019; USTR, *Notice of Modification of Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 84 FR 45821, August 30, 2019; USTR, *Notice of Modification of Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 84 FR 46212, September 3, 2019; USTR, *Notice of Modification of Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 84 FR 69447, December 18, 2019; USTR, *Notice of Modification of Section 301 Action: China's Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation*, 85 FR 3741, January 22, 2020.

APPENDIX F

U.S. PRODUCERS' BUSINESS MODELS

Table F-1
CSPV products: *'s business model, by period**

Quantity in kilowatts; ratios in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cell production	Quantity	***	***	***	***	***
Module production: U.S. cells	Quantity	***	***	***	***	***
Module production: Foreign cells	Quantity	***	***	***	***	***
Module production: All cells	Quantity	***	***	***	***	***
Cell imports: All sources	Quantity	***	***	***	***	***
Module imports: All sources	Quantity	***	***	***	***	***
CSPV product imports: All sources	Quantity	***	***	***	***	***
Ratio to production: Cell imports	Ratio	***	***	***	***	***
Ratio to production: Module imports	Ratio	***	***	***	***	***
Ratio to production: CSPV product imports	Ratio	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Production ratios are imports by product type to overall domestic module production.

Table F-2
CSPV products: *'s business model, by period**

Quantity in kilowatts; ratios in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cell production	Quantity	***	***	***	***	***
Module production: U.S. cells	Quantity	***	***	***	***	***
Module production: Foreign cells	Quantity	***	***	***	***	***
Module production: All cells	Quantity	***	***	***	***	***
Cell imports: All sources	Quantity	***	***	***	***	***
Module imports: All sources	Quantity	***	***	***	***	***
CSPV product imports: All sources	Quantity	***	***	***	***	***
Ratio to production: Cell imports	Ratio	***	***	***	***	***
Ratio to production: Module imports	Ratio	***	***	***	***	***
Ratio to production: CSPV product imports	Ratio	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Production ratios are imports by product type to overall domestic module production.

Table F-3
CSPV products: *'s business model, by period**

Quantity in kilowatts; ratios in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cell production	Quantity	***	***	***	***	***
Module production: U.S. cells	Quantity	***	***	***	***	***
Module production: Foreign cells	Quantity	***	***	***	***	***
Module production: All cells	Quantity	***	***	***	***	***
Cell imports: All sources	Quantity	***	***	***	***	***
Module imports: All sources	Quantity	***	***	***	***	***
CSPV product imports: All sources	Quantity	***	***	***	***	***
Ratio to production: Cell imports	Ratio	***	***	***	***	***
Ratio to production: Module imports	Ratio	***	***	***	***	***
Ratio to production: CSPV product imports	Ratio	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Production ratios are imports by product type to overall domestic module production.

Table F-4
CSPV products: *'s business model, by period**

Quantity in kilowatts; ratios in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cell production	Quantity	***	***	***	***	***
Module production: U.S. cells	Quantity	***	***	***	***	***
Module production: Foreign cells	Quantity	***	***	***	***	***
Module production: All cells	Quantity	***	***	***	***	***
Cell imports: All sources	Quantity	***	***	***	***	***
Module imports: All sources	Quantity	***	***	***	***	***
CSPV product imports: All sources	Quantity	***	***	***	***	***
Ratio to production: Cell imports	Ratio	***	***	***	***	***
Ratio to production: Module imports	Ratio	***	***	***	***	***
Ratio to production: CSPV product imports	Ratio	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Production ratios are imports by product type to overall domestic module production.

Table F-5
CSPV products: *'s business model, by period**

Quantity in kilowatts; ratios in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cell production	Quantity	***	***	***	***	***
Module production: U.S. cells	Quantity	***	***	***	***	***
Module production: Foreign cells	Quantity	***	***	***	***	***
Module production: All cells	Quantity	***	***	***	***	***
Cell imports: All sources	Quantity	***	***	***	***	***
Module imports: All sources	Quantity	***	***	***	***	***
CSPV product imports: All sources	Quantity	***	***	***	***	***
Ratio to production: Cell imports	Ratio	***	***	***	***	***
Ratio to production: Module imports	Ratio	***	***	***	***	***
Ratio to production: CSPV product imports	Ratio	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Production ratios are imports by product type to overall domestic module production.

Table F-6
CSPV products: *'s business model, by period**

Quantity in kilowatts; ratios in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cell production	Quantity	***	***	***	***	***
Module production: U.S. cells	Quantity	***	***	***	***	***
Module production: Foreign cells	Quantity	***	***	***	***	***
Module production: All cells	Quantity	***	***	***	***	***
Cell imports: All sources	Quantity	***	***	***	***	***
Module imports: All sources	Quantity	***	***	***	***	***
CSPV product imports: All sources	Quantity	***	***	***	***	***
Ratio to production: Cell imports	Ratio	***	***	***	***	***
Ratio to production: Module imports	Ratio	***	***	***	***	***
Ratio to production: CSPV product imports	Ratio	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Production ratios are imports by product type to overall domestic module production.

Table F-7
CSPV products: *'s business model, by period**

Quantity in kilowatts; ratios in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cell production	Quantity	***	***	***	***	***
Module production: U.S. cells	Quantity	***	***	***	***	***
Module production: Foreign cells	Quantity	***	***	***	***	***
Module production: All cells	Quantity	***	***	***	***	***
Cell imports: All sources	Quantity	***	***	***	***	***
Module imports: All sources	Quantity	***	***	***	***	***
CSPV product imports: All sources	Quantity	***	***	***	***	***
Ratio to production: Cell imports	Ratio	***	***	***	***	***
Ratio to production: Module imports	Ratio	***	***	***	***	***
Ratio to production: CSPV product imports	Ratio	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Production ratios are imports by product type to overall domestic module production.

Table F-8
CSPV products: *'s business model, by period**

Quantity in kilowatts; ratios in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cell production	Quantity	***	***	***	***	***
Module production: U.S. cells	Quantity	***	***	***	***	***
Module production: Foreign cells	Quantity	***	***	***	***	***
Module production: All cells	Quantity	***	***	***	***	***
Cell imports: All sources	Quantity	***	***	***	***	***
Module imports: All sources	Quantity	***	***	***	***	***
CSPV product imports: All sources	Quantity	***	***	***	***	***
Ratio to production: Cell imports	Ratio	***	***	***	***	***
Ratio to production: Module imports	Ratio	***	***	***	***	***
Ratio to production: CSPV product imports	Ratio	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Production ratios are imports by product type to overall domestic module production.

Table F-9
CSPV products: *'s business model, by period**

Quantity in kilowatts; ratios in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cell production	Quantity	***	***	***	***	***
Module production: U.S. cells	Quantity	***	***	***	***	***
Module production: Foreign cells	Quantity	***	***	***	***	***
Module production: All cells	Quantity	***	***	***	***	***
Cell imports: All sources	Quantity	***	***	***	***	***
Module imports: All sources	Quantity	***	***	***	***	***
CSPV product imports: All sources	Quantity	***	***	***	***	***
Ratio to production: Cell imports	Ratio	***	***	***	***	***
Ratio to production: Module imports	Ratio	***	***	***	***	***
Ratio to production: CSPV product imports	Ratio	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Production ratios are imports by product type to overall domestic module production.

Table F-10
CSPV products: *'s business model, by period**

Quantity in kilowatts; ratios in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cell production	Quantity	***	***	***	***	***
Module production: U.S. cells	Quantity	***	***	***	***	***
Module production: Foreign cells	Quantity	***	***	***	***	***
Module production: All cells	Quantity	***	***	***	***	***
Cell imports: All sources	Quantity	***	***	***	***	***
Module imports: All sources	Quantity	***	***	***	***	***
CSPV product imports: All sources	Quantity	***	***	***	***	***
Ratio to production: Cell imports	Ratio	***	***	***	***	***
Ratio to production: Module imports	Ratio	***	***	***	***	***
Ratio to production: CSPV product imports	Ratio	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Production ratios are imports by product type to overall domestic module production.

Table F-11
CSPV products: *'s business model, by period**

Quantity in kilowatts; ratios in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cell production	Quantity	***	***	***	***	***
Module production: U.S. cells	Quantity	***	***	***	***	***
Module production: Foreign cells	Quantity	***	***	***	***	***
Module production: All cells	Quantity	***	***	***	***	***
Cell imports: All sources	Quantity	***	***	***	***	***
Module imports: All sources	Quantity	***	***	***	***	***
CSPV product imports: All sources	Quantity	***	***	***	***	***
Ratio to production: Cell imports	Ratio	***	***	***	***	***
Ratio to production: Module imports	Ratio	***	***	***	***	***
Ratio to production: CSPV product imports	Ratio	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Production ratios are imports by product type to overall domestic module production.

Table F-12
CSPV products: *'s business model, by period**

Quantity in kilowatts; ratios in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cell production	Quantity	***	***	***	***	***
Module production: U.S. cells	Quantity	***	***	***	***	***
Module production: Foreign cells	Quantity	***	***	***	***	***
Module production: All cells	Quantity	***	***	***	***	***
Cell imports: All sources	Quantity	***	***	***	***	***
Module imports: All sources	Quantity	***	***	***	***	***
CSPV product imports: All sources	Quantity	***	***	***	***	***
Ratio to production: Cell imports	Ratio	***	***	***	***	***
Ratio to production: Module imports	Ratio	***	***	***	***	***
Ratio to production: CSPV product imports	Ratio	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Production ratios are imports by product type to overall domestic module production.

Table F-13
CSPV products: *'s business model, by period**

Quantity in kilowatts; ratios in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cell production	Quantity	***	***	***	***	***
Module production: U.S. cells	Quantity	***	***	***	***	***
Module production: Foreign cells	Quantity	***	***	***	***	***
Module production: All cells	Quantity	***	***	***	***	***
Cell imports: All sources	Quantity	***	***	***	***	***
Module imports: All sources	Quantity	***	***	***	***	***
CSPV product imports: All sources	Quantity	***	***	***	***	***
Ratio to production: Cell imports	Ratio	***	***	***	***	***
Ratio to production: Module imports	Ratio	***	***	***	***	***
Ratio to production: CSPV product imports	Ratio	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Production ratios are imports by product type to overall domestic module production.

Table F-14
CSPV products: *'s business model, by period**

Quantity in kilowatts; ratios in percent

Item	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cell production	Quantity	***	***	***	***	***
Module production: U.S. cells	Quantity	***	***	***	***	***
Module production: Foreign cells	Quantity	***	***	***	***	***
Module production: All cells	Quantity	***	***	***	***	***
Cell imports: All sources	Quantity	***	***	***	***	***
Module imports: All sources	Quantity	***	***	***	***	***
CSPV product imports: All sources	Quantity	***	***	***	***	***
Ratio to production: Cell imports	Ratio	***	***	***	***	***
Ratio to production: Module imports	Ratio	***	***	***	***	***
Ratio to production: CSPV product imports	Ratio	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Production ratios are imports by product type to overall domestic module production.

Table F-15
CSPV products: U.S. producers' reasons for imports, by firm

Firm	Firm's reported reason(s) for importing
***	***
***	***
***	***
***	***
***	***
***	***
***	***
***	***
***	***
***	***
***	***
***	***

Firm	Firm's reported reason(s) for importing
***	***
***	***

Source: Compiled from data submitted in response to Commission questionnaires.

APPENDIX G

APPENDIX FOR PART IV

Table G-1
CSPV products: Firm-by-firm total net sales quantity, by firm and period

Net sales quantity

Quantity in kilowatts

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***
All producers	481,156	2,048,798	2,191,402	1,152,826	1,114,087

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm total net sales value, by firm and period

Net sales value

Value in 1,000 dollars

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***
All producers	261,380	900,356	904,397	484,262	451,082

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm cost of goods sold ("COGS"), by firm and period

COGS

Value in 1,000 dollars

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***
All producers	300,098	896,089	933,735	513,472	459,893

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm gross profit or (loss), by firm and period

Gross profit or (loss)

Value in 1,000 dollars

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***
All producers	(38,718)	4,267	(29,338)	(29,210)	(8,811)

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm selling, general, and administrative ("SG&A") expenses, by firm and period

SG&A expenses

Value in 1,000 dollars

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***
All producers	37,912	62,376	56,941	26,932	28,109

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm operating income or (loss), by firm and period

Operating income or (loss)

Value in 1,000 dollars

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***
All producers	(76,630)	(58,109)	(86,279)	(56,142)	(36,920)

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm net income or (loss), by firm and period

Net income or (loss)

Value in 1,000 dollars

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***
All producers	(163,503)	(65,280)	(89,209)	(59,038)	(35,920)

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm ratio of COGS to net sales value, by firm and period

COGS to net sales ratio

Ratios in percent

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***
All producers	114.8	99.5	103.2	106.0	102.0

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm ratio of gross profit or (loss) to net sales value, by firm and period

Gross profit or (loss) to net sales ratio

Ratios in percent

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***
All producers	(14.8)	0.5	(3.2)	(6.0)	(2.0)

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm ratio of SG&A expenses to net sales value, by firm and period

SG&A expenses to net sales ratio

Ratios in percent

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***
All producers	14.5	6.9	6.3	5.6	6.2

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm ratio of operating income or (loss) to net sales value, by firm and period

Operating income or (loss) to net sales ratio

Ratios in percent

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***
All producers	(29.3)	(6.5)	(9.5)	(11.6)	(8.2)

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm ratio of net income or (loss) to net sales value, by firm and period

Net income or (loss) to net sales ratio

Ratios in percent

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***
All producers	(62.6)	(7.3)	(9.9)	(12.2)	(8.0)

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm unit net sales value, by firm and period

Unit net sales value

Unit values in dollars per kilowatt

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm unit raw material cost, by firm and period

Unit raw material costs

Unit values in dollars per kilowatt

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm unit direct labor cost, by firm and period

Unit direct labor costs

Unit values in dollars per kilowatt

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm unit other factory costs, by firm and period

Unit other factory costs

Unit values in dollars per kilowatt

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm unit COGS, by firm and period

Unit COGS

Unit values in dollars per kilowatt

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm unit gross profit or (loss), by firm and period

Unit gross profit or (loss)

Unit values in dollars per kilowatt

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm unit SG&A expenses, by firm and period

Unit SG&A expenses

Unit values in dollars per kilowatt

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm unit operating income or (loss), by firm and period

Unit operating income or (loss)

Unit values in dollars per kilowatt

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***

Table continued.

Table G-1 Continued
CSPV products: Firm-by-firm unit net income or (loss), by firm and period

Unit net income or (loss)

Unit values in dollars per kilowatt

Firm	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Panasonic	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Yingli	***	***	***	***	***
All cell producers	***	***	***	***	***
Auxin	***	***	***	***	***
Hanwha	***	***	***	***	***
Heliene	***	***	***	***	***
Jinko	***	***	***	***	***
LG	***	***	***	***	***
Mission	***	***	***	***	***
Panasonic	***	***	***	***	***
PowerFilm	***	***	***	***	***
SBM	***	***	***	***	***
Silfab	***	***	***	***	***
Sunpower (pre-acquisition)	***	***	***	***	***
Sunpower (post-acquisition)	***	***	***	***	***
Tesla	***	***	***	***	***
All module producers	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: See footnotes 30 and 32 in Part IV of the staff report, respectively, regarding *** and the absence of ***.

APPENDIX H

OFFICIAL U.S. IMPORT STATISTICS

Table H-1
CSPV products: U.S. imports, by country and by period

Value in 1,000 dollars; Shares in percent.

Source	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Malaysia	Value	1,268,765	2,877,651	2,879,481	1,537,894	1,523,527
Vietnam	Value	451,179	1,884,575	2,615,990	1,280,211	1,395,941
Thailand	Value	198,605	578,411	1,501,027	807,809	737,776
Korea	Value	639,223	741,942	1,042,408	617,423	428,376
China	Value	26,367	124,574	397,662	360,266	10,524
Singapore	Value	175,308	207,673	208,967	113,610	124,252
India	Value	72,090	137,949	93,833	63,089	59,147
Mexico	Value	328,480	151,759	89,937	27,918	631
Turkey	Value	69,938	105,134	82,520	59,558	19,015
Taiwan	Value	27,942	115,760	66,091	47,700	30,574
Canada	Value	42,049	28,139	41,036	19,952	8,300
Japan	Value	134,991	79,323	19,549	18,928	5,540
Philippines	Value	33,756	8,057	15,490	14,611	9,883
Indonesia	Value	5,353	6,363	4,271	1,157	4,163
Germany	Value	4,473	2,824	3,887	685	5,191
All other sources	Value	13,840	28,406	184,363	63,626	99,328
All import sources	Value	3,492,361	7,078,540	9,246,512	5,034,437	4,462,169
Malaysia	Share of value	36.3	40.7	31.1	30.5	34.1
Vietnam	Share of value	12.9	26.6	28.3	25.4	31.3
Thailand	Share of value	5.7	8.2	16.2	16.0	16.5
Korea	Share of value	18.3	10.5	11.3	12.3	9.6
China	Share of value	0.8	1.8	4.3	7.2	0.2
Singapore	Share of value	5.0	2.9	2.3	2.3	2.8
India	Share of value	2.1	1.9	1.0	1.3	1.3
Mexico	Share of value	9.4	2.1	1.0	0.6	0.0
Turkey	Share of value	2.0	1.5	0.9	1.2	0.4
Taiwan	Share of value	0.8	1.6	0.7	0.9	0.7
Canada	Share of value	1.2	0.4	0.4	0.4	0.2
Japan	Share of value	3.9	1.1	0.2	0.4	0.1
Philippines	Share of value	1.0	0.1	0.2	0.3	0.2
Indonesia	Share of value	0.2	0.1	0.0	0.0	0.1
Germany	Share of value	0.1	0.0	0.0	0.0	0.1
All other sources	Share of value	0.4	0.4	2.0	1.3	2.2
All import sources	Share of value	100.0	100.0	100.0	100.0	100.0

Source: Compiled from official U.S. import statistics of the U.S. Department of Commerce using statistical reporting numbers 8541.40.6015, 8541.40.6020, 8541.40.6025, 8541.40.6030, 8541.40.6035, and 8541.40.6045, accessed October 19, 2021.

Note: Data prior to July 2018 in 8541.40.6020 and 8541.40.6030 and subsequently for 8541.40.6035 and 8541.40.6045 includes out-of-scope thin film products, and therefore official import data are likely overstated.

Table H-2
CSPV products: U.S. imports, by type

Value in 1,000 dollars; Shares in percent.

Source	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Cells	Value	304,033	452,571	497,123	285,586	250,445
Modules	Value	3,188,329	6,625,969	8,749,389	4,748,850	4,211,724
Products	Value	3,492,361	7,078,540	9,246,512	5,034,437	4,462,169
Cells	Share of value	8.7	6.4	5.4	5.7	5.6
Modules	Share of value	91.3	93.6	94.6	94.3	94.4
Products	Share of value	100.0	100.0	100.0	100.0	100.0

Source: Compiled from official U.S. import statistics of the U.S. Department of Commerce using statistical reporting numbers 8541.40.6015, 8541.40.6020, 8541.40.6025, 8541.40.6030, 8541.40.6035, and 8541.40.6045, accessed October 19, 2021.

Note: Data prior to July 2018 in 8541.40.6020 and 8541.40.6030 and subsequently for 8541.40.6035 and 8541.40.6045 includes out-of-scope thin film products, and therefore official import data are likely overstated. The statistical reporting number used for cells in the table over the period include: 8541.40.6025, 8541.40.6030, and 8541.40.6045. The statistical reporting number used for modules in the table over the period include: 8541.40.6015, 8541.40.6020, and 8541.40.6035.

Table H-3
CSPV cells: U.S. imports, by source

Value in 1,000 dollars; Shares in percent

Source	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Korea	Value	98,682	253,600	312,423	173,184	138,522
China	Value	2,237	16,376	48,253	44,667	325
Malaysia	Value	48,439	34,729	46,010	10,403	55,048
Vietnam	Value	31,130	35,591	35,838	24,307	32,207
Taiwan	Value	23,245	47,621	27,710	14,933	14,352
Japan	Value	46,269	57,235	9,256	8,961	78
India	Value	15,026	2,575	7,648	7,018	67
Thailand	Value	1,713	21	4,270	915	4,763
Germany	Value	521	1,885	3,368	575	419
Indonesia	Value	742	7	720	---	3,040
Philippines	Value	31,872	745	425	98	212
Canada	Value	133	116	166	44	31
Mexico	Value	291	726	132	129	78
Singapore	Value	---	13	15	15	333
Turkey	Value	1,411	56	---	---	---
All other sources	Value	2,321	1,276	890	338	971
All import sources	Value	304,033	452,571	497,123	285,586	250,445
Korea	Share of value	32.5	56.0	62.8	60.6	55.3
China	Share of value	0.7	3.6	9.7	15.6	0.1
Malaysia	Share of value	15.9	7.7	9.3	3.6	22.0
Vietnam	Share of value	10.2	7.9	7.2	8.5	12.9
Taiwan	Share of value	7.6	10.5	5.6	5.2	5.7
Japan	Share of value	15.2	12.6	1.9	3.1	0.0
India	Share of value	4.9	0.6	1.5	2.5	0.0
Thailand	Share of value	0.6	0.0	0.9	0.3	1.9
Germany	Share of value	0.2	0.4	0.7	0.2	0.2
Indonesia	Share of value	0.2	0.0	0.1	---	1.2
Philippines	Share of value	10.5	0.2	0.1	0.0	0.1
Canada	Share of value	0.0	0.0	0.0	0.0	0.0
Mexico	Share of value	0.1	0.2	0.0	0.0	0.0
Singapore	Share of value	---	0.0	0.0	0.0	0.1
Turkey	Share of value	0.5	0.0	---	---	---
All other sources	Share of value	0.8	0.3	0.2	0.1	0.4
All import sources	Share of value	100.0	100.0	100.0	100.0	100.0

Source: Compiled from official U.S. import statistics of the U.S. Department of Commerce using statistical reporting numbers 8541.40.6025, 8541.40.6030, and 8541.40.6045, accessed October 19, 2021.

Table H-4
CSPV cells: U.S. imports, by source

Quantity in kilowatts; Value in 1,000 dollars.

Source	Measure	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Korea	Quantity	1,301,153	1,316,615	724,358	796,716
Malaysia	Quantity	219,876	238,076	52,030	327,178
China	Quantity	171,136	236,868	225,259	662
Vietnam	Quantity	231,983	196,717	134,346	195,297
Taiwan	Quantity	394,767	146,716	81,421	64,788
Thailand	Quantity	229	35,586	8,082	32,601
Japan	Quantity	185,503	32,090	30,747	10
India	Quantity	7,819	21,517	20,019	48
Indonesia	Quantity	3,780	2,783	---	3,297
Philippines	Quantity	55,237	779	399	668
Mexico	Quantity	1,692	224	223	242
Canada	Quantity	161	133	1	0
Germany	Quantity	686	54	10	41
Singapore	Quantity	519	1	1	1,907
Turkey	Quantity	3	---	---	---
All other sources	Quantity	3,006	3,249	12	808
All import sources	Quantity	2,577,551	2,231,408	1,276,907	1,424,262
Korea	Value	253,600	312,423	173,184	138,522
Malaysia	Value	34,729	46,010	10,403	55,048
China	Value	16,376	48,253	44,667	325
Vietnam	Value	35,591	35,838	24,307	32,207
Taiwan	Value	47,621	27,710	14,933	14,352
Thailand	Value	21	4,270	915	4,763
Japan	Value	57,235	9,256	8,961	78
India	Value	2,575	7,648	7,018	67
Indonesia	Value	7	720	---	3,040
Philippines	Value	745	425	98	212
Mexico	Value	726	132	129	78
Canada	Value	116	166	44	31
Germany	Value	1,885	3,368	575	419
Singapore	Value	13	15	15	333
Turkey	Value	56	---	---	---
All other sources	Value	1,276	890	338	971
All import sources	Value	452,571	497,123	285,586	250,445

Table continued.

Table H-4 Continued
CSPV cells: U.S. imports, by source

Unit value in dollars per kilowatt; Share in percent.

Source	Measure	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Korea	Unit value	195	237	239	174
Malaysia	Unit value	158	193	200	168
China	Unit value	96	204	198	491
Vietnam	Unit value	153	182	181	165
Taiwan	Unit value	121	189	183	222
Thailand	Unit value	94	120	113	146
Japan	Unit value	309	288	291	8,066
India	Unit value	329	355	351	1,376
Indonesia	Unit value	2	259	---	922
Philippines	Unit value	13	545	245	317
Mexico	Unit value	429	590	578	323
Canada	Unit value	720	1,251	83,367	89,156
Germany	Unit value	2,748	62,592	56,735	10,249
Singapore	Unit value	25	12,465	12,465	175
Turkey	Unit value	16,135	---	---	---
All other sources	Unit value	425	274	28,378	1,202
All import sources	Unit value	176	223	224	176
Korea	Share of quantity	50.5	59.0	56.7	55.9
Malaysia	Share of quantity	8.5	10.7	4.1	23.0
China	Share of quantity	6.6	10.6	17.6	0.0
Vietnam	Share of quantity	9.0	8.8	10.5	13.7
Taiwan	Share of quantity	15.3	6.6	6.4	4.5
Thailand	Share of quantity	0.0	1.6	0.6	2.3
Japan	Share of quantity	7.2	1.4	2.4	0.0
India	Share of quantity	0.3	1.0	1.6	0.0
Indonesia	Share of quantity	0.1	0.1	---	0.2
Philippines	Share of quantity	2.1	0.0	0.0	0.0
Mexico	Share of quantity	0.1	0.0	0.0	0.0
Canada	Share of quantity	0.0	0.0	0.0	0.0
Germany	Share of quantity	0.0	0.0	0.0	0.0
Singapore	Share of quantity	0.0	0.0	0.0	0.1
Turkey	Share of quantity	0.0	---	---	---
All other sources	Share of quantity	0.1	0.1	0.0	0.1
All import sources	Share of quantity	100.0	100.0	100.0	100.0

Table continued.

Table H-4 Continued
CSPV cells: U.S. imports, by source

Shares and ratios in percent.

Source	Measure	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Korea	Share of value	56.0	62.8	60.6	55.3
Malaysia	Share of value	7.7	9.3	3.6	22.0
China	Share of value	3.6	9.7	15.6	0.1
Vietnam	Share of value	7.9	7.2	8.5	12.9
Taiwan	Share of value	10.5	5.6	5.2	5.7
Thailand	Share of value	0.0	0.9	0.3	1.9
Japan	Share of value	12.6	1.9	3.1	0.0
India	Share of value	0.6	1.5	2.5	0.0
Indonesia	Share of value	0.0	0.1	---	1.2
Philippines	Share of value	0.2	0.1	0.0	0.1
Mexico	Share of value	0.2	0.0	0.0	0.0
Canada	Share of value	0.0	0.0	0.0	0.0
Germany	Share of value	0.4	0.7	0.2	0.2
Singapore	Share of value	0.0	0.0	0.0	0.1
Turkey	Share of value	0.0	---	---	---
All other sources	Share of value	0.3	0.2	0.1	0.4
All import sources	Share of value	100.0	100.0	100.0	100.0
Korea	Ratio	1,665.8	6,243.1	3,434.8	n.c.
Malaysia	Ratio	281.5	1,128.9	246.7	n.c.
China	Ratio	219.1	1,123.2	1,068.1	n.c.
Vietnam	Ratio	297.0	932.8	637.0	n.c.
Taiwan	Ratio	505.4	695.7	386.1	n.c.
Thailand	Ratio	0.3	168.7	38.3	n.c.
Japan	Ratio	237.5	152.2	145.8	n.c.
India	Ratio	10.0	102.0	94.9	n.c.
Indonesia	Ratio	4.8	13.2	---	n.c.
Philippines	Ratio	70.7	3.7	1.9	n.c.
Mexico	Ratio	2.2	1.1	1.1	n.c.
Canada	Ratio	0.2	0.6	0.0	n.c.
Germany	Ratio	0.9	0.3	0.0	n.c.
Singapore	Ratio	0.7	0.0	0.0	n.c.
Turkey	Ratio	0.0	---	---	n.c.
All other sources	Ratio	3.8	15.4	0.1	n.c.
All import sources	Ratio	3,299.9	10,580.9	6,054.9	n.c.

Source: Compiled from official U.S. import statistics of the U.S. Department of Commerce using statistical reporting numbers 8541.40.6025 and 8541.40.6045, accessed October 19, 2021.

Note: Full-year 2018 data not available. Ratios represent ratios to U.S. production. Fields marked “n.c.” were not calculable.

Table H-5
CSPV modules: U.S. imports, by source

Value in 1,000 dollars; Shares in percent

Source	Measure	2018	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Malaysia	Value	1,220,326	2,842,923	2,833,472	1,527,491	1,468,479
Vietnam	Value	420,050	1,848,984	2,580,151	1,255,904	1,363,734
Thailand	Value	196,892	578,390	1,496,758	806,894	733,013
Korea	Value	540,541	488,342	729,984	444,239	289,854
China	Value	24,129	108,198	349,409	315,599	10,200
Singapore	Value	175,308	207,660	208,952	113,596	123,919
Mexico	Value	328,189	151,033	89,804	27,789	553
India	Value	57,064	135,374	86,185	56,071	59,080
Turkey	Value	68,528	105,078	82,520	59,558	19,015
Canada	Value	41,916	28,023	40,870	19,908	8,270
Taiwan	Value	4,697	68,140	38,380	32,767	16,222
Philippines	Value	1,884	7,312	15,066	14,513	9,671
Japan	Value	88,722	22,088	10,293	9,966	5,461
Indonesia	Value	4,611	6,357	3,552	1,157	1,123
Germany	Value	3,952	939	519	110	4,772
All other sources	Value	11,519	27,130	183,474	63,289	98,357
All import sources	Value	3,188,329	6,625,969	8,749,389	4,748,850	4,211,724
Malaysia	Share of value	38.3	42.9	32.4	32.2	34.9
Vietnam	Share of value	13.2	27.9	29.5	26.4	32.4
Thailand	Share of value	6.2	8.7	17.1	17.0	17.4
Korea	Share of value	17.0	7.4	8.3	9.4	6.9
China	Share of value	0.8	1.6	4.0	6.6	0.2
Singapore	Share of value	5.5	3.1	2.4	2.4	2.9
Mexico	Share of value	10.3	2.3	1.0	0.6	0.0
India	Share of value	1.8	2.0	1.0	1.2	1.4
Turkey	Share of value	2.1	1.6	0.9	1.3	0.5
Canada	Share of value	1.3	0.4	0.5	0.4	0.2
Taiwan	Share of value	0.1	1.0	0.4	0.7	0.4
Philippines	Share of value	0.1	0.1	0.2	0.3	0.2
Japan	Share of value	2.8	0.3	0.1	0.2	0.1
Indonesia	Share of value	0.1	0.1	0.0	0.0	0.0
Germany	Share of value	0.1	0.0	0.0	0.0	0.1
All other sources	Share of value	0.4	0.4	2.1	1.3	2.3
All import sources	Share of value	100.0	100.0	100.0	100.0	100.0

Source: Compiled from official U.S. import statistics of the U.S. Department of Commerce using statistical reporting numbers 8541.40.6015, 8541.40.6020, and 8541.40.6035, accessed October 19, 2021.

Table H-6
CSPV modules: U.S. imports, by source

Quantity in kilowatts; Value in 1,000 dollars.

Source	Measure	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Malaysia	Quantity	7,446,831	9,104,021	5,116,869	4,491,368
Vietnam	Quantity	5,849,350	7,517,278	3,392,245	4,511,938
Thailand	Quantity	1,463,048	4,310,293	2,217,670	4,518,679
Korea	Quantity	1,357,851	2,251,800	1,333,904	884,113
China	Quantity	360,776	1,160,701	970,694	78,839
Singapore	Quantity	693,612	667,667	373,673	353,140
Turkey	Quantity	323,071	269,268	193,535	68,518
Canada	Quantity	149,812	203,030	102,729	98,568
Mexico	Quantity	287,632	189,028	67,577	5,256
Taiwan	Quantity	330,891	183,331	127,073	200,250
India	Quantity	185,289	174,042	126,358	39,409
Philippines	Quantity	23,298	46,345	44,345	14,865
Indonesia	Quantity	23,841	15,913	7,823	5,458
Japan	Quantity	13,073	9,234	5,316	23,732
Germany	Quantity	2,982	291	197	232
All other sources	Quantity	97,244	644,929	178,238	426,166
All import sources	Quantity	18,608,601	26,747,172	14,258,247	15,720,532
Malaysia	Value	2,842,923	2,833,472	1,527,491	1,468,479
Vietnam	Value	1,848,984	2,580,151	1,255,904	1,363,734
Thailand	Value	578,390	1,496,758	806,894	733,013
Korea	Value	488,342	729,984	444,239	289,854
China	Value	108,198	349,409	315,599	10,200
Singapore	Value	207,660	208,952	113,596	123,919
Turkey	Value	105,078	82,520	59,558	19,015
Canada	Value	28,023	40,870	19,908	8,270
Mexico	Value	151,033	89,804	27,789	553
Taiwan	Value	135,374	86,185	56,071	59,080
India	Value	68,140	38,380	32,767	16,222
Philippines	Value	7,312	15,066	14,513	9,671
Indonesia	Value	6,357	3,552	1,157	1,123
Japan	Value	22,088	10,293	9,966	5,461
Germany	Value	939	519	110	4,772
All other sources	Value	27,130	183,474	63,289	98,357
All import sources	Value	6,625,969	8,749,389	4,748,850	4,211,724

Table continued.

Table H-6-Continued
CSPV modules: U.S. imports, by source

Unit value in dollars per kilowatt; Share in percent.

Source	Measure	2019	2020	Jan-Jun 2020	Jan-Jun 2021
Malaysia	Unit value	382	311	299	327
Vietnam	Unit value	316	343	370	302
Thailand	Unit value	395	347	364	162
Korea	Unit value	360	324	333	328
China	Unit value	300	301	325	129
Singapore	Unit value	299	313	304	351
Mexico	Unit value	325	306	308	278
Turkey	Unit value	187	201	194	84
Canada	Unit value	525	475	411	105
Taiwan	Unit value	409	470	441	295
India	Unit value	368	221	259	412
Philippines	Unit value	314	325	327	651
Indonesia	Unit value	267	223	148	206
Japan	Unit value	1,690	1,115	1,875	230
Germany	Unit value	315	1,784	555	20,603
All other sources	Unit value	279	284	355	231
All import sources	Unit value	356	327	333	268
Malaysia	Share of quantity	40.0	34.0	35.9	28.6
Vietnam	Share of quantity	31.4	28.1	23.8	28.7
Thailand	Share of quantity	7.9	16.1	15.6	28.7
Korea	Share of quantity	7.3	8.4	9.4	5.6
China	Share of quantity	1.9	4.3	6.8	0.5
Singapore	Share of quantity	3.7	2.5	2.6	2.2
Mexico	Share of quantity	1.7	1.0	1.4	0.4
Turkey	Share of quantity	0.8	0.8	0.7	0.6
Canada	Share of quantity	1.5	0.7	0.5	0.0
Taiwan	Share of quantity	1.8	0.7	0.9	1.3
India	Share of quantity	1.0	0.7	0.9	0.3
Philippines	Share of quantity	0.1	0.2	0.3	0.1
Indonesia	Share of quantity	0.1	0.1	0.1	0.0
Japan	Share of quantity	0.1	0.0	0.0	0.2
Germany	Share of quantity	0.0	0.0	0.0	0.0
All other sources	Share of quantity	0.5	2.4	1.3	2.7
All import sources	Share of quantity	100.0	100.0	100.0	100.0

Table continued.

Table H-6-Continued
CSPV modules: U.S. imports, by source

Shares and ratios in percent.

Source	Measure	2019	2020	Jan-Jun 2020	Jan-Jun 2020
Malaysia	Share of value	42.9	32.4	32.2	34.9
Vietnam	Share of value	27.9	29.5	26.4	32.4
Thailand	Share of value	8.7	17.1	17.0	17.4
Korea	Share of value	7.4	8.3	9.4	6.9
China	Share of value	1.6	4.0	6.6	0.2
Singapore	Share of value	3.1	2.4	2.4	2.9
Mexico	Share of value	1.6	0.9	1.3	0.5
Turkey	Share of value	0.4	0.5	0.4	0.2
Canada	Share of value	2.3	1.0	0.6	0.0
Taiwan	Share of value	2.0	1.0	1.2	1.4
India	Share of value	1.0	0.4	0.7	0.4
Philippines	Share of value	0.1	0.2	0.3	0.2
Indonesia	Share of value	0.1	0.0	0.0	0.0
Japan	Share of value	0.3	0.1	0.2	0.1
Germany	Share of value	0.0	0.0	0.0	0.1
All other sources	Share of value	0.4	2.1	1.3	2.3
All import sources	Share of value	100.0	100.0	100.0	100.0
Malaysia	Ratio	358.5	410.7	440.7	402.1
Vietnam	Ratio	281.6	339.1	292.2	403.9
Thailand	Ratio	70.4	194.4	191.0	404.5
Korea	Ratio	65.4	101.6	114.9	79.1
China	Ratio	17.4	52.4	83.6	7.1
Singapore	Ratio	33.4	30.1	32.2	31.6
Mexico	Ratio	15.6	12.1	16.7	6.1
Turkey	Ratio	7.2	9.2	8.8	8.8
Canada	Ratio	13.8	8.5	5.8	0.5
Taiwan	Ratio	15.9	8.3	10.9	17.9
India	Ratio	8.9	7.9	10.9	3.5
Philippines	Ratio	1.1	2.1	3.8	1.3
Indonesia	Ratio	1.1	0.7	0.7	0.5
Japan	Ratio	0.6	0.4	0.5	2.1
Germany	Ratio	0.1	0.0	0.0	0.0
All other sources	Ratio	4.7	29.1	15.4	38.2
All import sources	Ratio	895.8	1,206.6	1,228.2	1,407.3

Source: Compiled from official U.S. import statistics of the U.S. Department of Commerce using statistical reporting numbers 8541.40.6015 and 8541.40.6035, accessed October 19, 2021.

Note: Full-year 2018 data not available. Ratios represent ratios to U.S. production.

Table H-7
CSPV products: U.S. imports, by month and by type

Quantity in kilowatts.

Month	Measure	Cells	Modules	Products
Jul 2018	Quantity	113,724	446,605	560,328
Aug 2018	Quantity	158,168	472,641	630,809
Sep 2018	Quantity	107,259	568,880	676,139
Oct 2018	Quantity	239,365	607,429	846,795
Nov 2018	Quantity	155,997	630,280	786,278
Dec 2018	Quantity	105,377	509,313	614,690
Jan 2019	Quantity	116,368	346,806	463,174
Feb 2019	Quantity	166,278	478,014	644,292
Mar 2019	Quantity	164,090	591,744	755,834
Apr 2019	Quantity	172,251	668,799	841,049
May 2019	Quantity	293,927	1,080,331	1,374,258
Jun 2019	Quantity	208,740	1,123,886	1,332,626
Jul 2019	Quantity	245,154	1,513,667	1,758,821
Aug 2019	Quantity	332,558	1,448,565	1,781,123
Sep 2019	Quantity	162,472	1,474,858	1,637,329
Oct 2019	Quantity	188,221	1,627,031	1,815,253
Nov 2019	Quantity	274,526	1,709,237	1,983,763
Dec 2019	Quantity	250,907	1,646,707	1,897,614
Jan 2020	Quantity	278,560	1,677,264	1,955,824
Feb 2020	Quantity	264,238	1,897,455	2,161,693
Mar 2020	Quantity	242,119	2,425,846	2,667,965
Apr 2020	Quantity	222,301	1,818,944	2,041,244
May 2020	Quantity	194,526	1,862,189	2,056,715
Jun 2020	Quantity	73,752	2,501,807	2,575,559
Jul 2020	Quantity	124,966	1,869,237	1,994,203
Aug 2020	Quantity	171,019	1,891,854	2,062,874
Sep 2020	Quantity	128,209	1,670,145	1,798,354
Oct 2020	Quantity	216,256	1,731,993	1,948,249
Nov 2020	Quantity	166,661	1,692,399	1,859,060
Dec 2020	Quantity	144,445	1,764,429	1,908,873
Jan 2021	Quantity	180,385	1,505,653	1,686,038
Feb 2021	Quantity	127,066	3,647,275	3,774,342
Mar 2021	Quantity	276,016	2,230,310	2,506,326
Apr 2021	Quantity	420,394	2,090,570	2,510,965
May 2021	Quantity	229,947	2,056,905	2,286,852
Jun 2021	Quantity	189,652	1,943,627	2,133,279

Source: Compiled from official U.S. import statistics of the U.S. Department of Commerce using statistical reporting numbers 8541.40.6025 for cells and 8541.40.6015 for modules, accessed October 19, 2021.

Table H-8
CSPV cells: TRQ fill rates

Quantity in kilowatts; Fill rate in percent.

Period ending	CBP Quota Total (kilowatts)	CBP Limit (kilowatts)	Percent Filled
February 6, 2019	706,980	2,500,000	25.3%
February 6, 2020	2,311,154	2,500,000	92.5%
February 6, 2021	2,098,333	2,500,000	83.9%
February 6, 2022 (as of November 15, 2021)	2,047,409	2,500,000	81.9%

Source: U.S. Customs and Border Protection at https://www.cbp.gov/document/report/commodity-status-report.

Note: The TRQ fill rate for the period ending February 6, 2022 reflects the percent filled through November 15, 2021.

APPENDIX J

U.S. PRODUCER PRICING DATA BY CELL ORIGIN AND IMPORTER PRICING DATA BY COUNTRY SOURCE

One U.S. producer (***) provided pricing data for modules using U.S. cells ***, and nine firms (***) provided pricing data for modules using foreign-origin cells for pricing products 1, 2, 3, 4, and 6. No domestic modules prices were reported for product 5.

Five firms provided pricing data for imported CSPV products from China, 6 firms provided pricing data for imported CSPV products from Korea, 11 firms provided pricing data for imported CSPV products from Malaysia, 2 firms provided pricing data for imported CSPV products from Singapore, 5 firms provided pricing data for imported CSPV products from Thailand, 14 firms provided pricing data for imported CSPV products from Vietnam, and 7 firms provided pricing data for imported CSPV products from all other sources, including Japan, the Netherlands, the Philippines, and Taiwan.[1]

These price items and accompanying data are comparable to those presented in tables VII-2 to VII-7. U.S. producers' price and quantity data for modules by cell source are shown in tables J-1 to J-5. Importers' country-specific price and quantity data are shown in tables J-6 to J-11.

[1] No firms provided pricing data for modules imported from Canada or Mexico.

Table J-1
CSPV products: U.S. producers' weighted-average f.o.b. prices and quantities of product 1, by quarter and by cell origin, January 2018-June 2021

Price in dollars per kilowatt, quantity in kilowatts

Period	U.S. price (U.S. origin cells)	U.S. quantity (U.S. origin cells)	U.S. price (Foreign origin cells)	U.S. quantity (Foreign origin cells)	U.S. price (All cell origins)	U.S. quantity (All cell origins)
2018 Q1	***	***	***	***	***	***
2018 Q2	***	***	***	***	***	***
2018 Q3	***	***	***	***	***	***
2018 Q4	***	***	***	***	***	***
2019 Q1	***	***	***	***	***	***
2019 Q2	***	***	***	***	***	***
2019 Q3	***	***	***	***	***	***
2019 Q4	***	***	***	***	***	***
2020 Q1	***	***	***	***	***	***
2020 Q2	***	***	***	***	***	***
2020 Q3	***	***	***	***	***	***
2020 Q4	***	***	***	***	***	***
2021 Q1	***	***	***	***	***	***
2021 Q2	***	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 1: Monocrystalline silicon module with front-side of less than 1.9 square meters and a peak power wattage between 275w to 325w, inclusive, P-max or Wp as measured under Standard Test Conditions ("STC"), excluding bifacial modules.

Table J-2
CSPV products: U.S. producers' weighted-average f.o.b. prices and quantities of product 2, by quarter and by cell origin, January 2018-June 2021

Price in dollars per kilowatt, quantity in kilowatts

Period	U.S. price (U.S. origin cells)	U.S. quantity (U.S. origin cells)	U.S. price (Foreign origin cells)	U.S. quantity (Foreign origin cells)	U.S. price (All cell origins)	U.S. quantity (All cell origins)
2018 Q1	***	***	***	***	***	***
2018 Q2	***	***	***	***	***	***
2018 Q3	***	***	***	***	***	***
2018 Q4	***	***	***	***	***	***
2019 Q1	***	***	***	***	***	***
2019 Q2	***	***	***	***	***	***
2019 Q3	***	***	***	***	***	***
2019 Q4	***	***	***	***	***	***
2020 Q1	***	***	***	***	***	***
2020 Q2	***	***	***	***	***	***
2020 Q3	***	***	***	***	***	***
2020 Q4	***	***	***	***	***	***
2021 Q1	***	***	***	***	***	***
2021 Q2	***	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 2: Monocrystalline silicon module with front-side area of less than 1.9 square meters and a peak power wattage between 330w to 415w, inclusive, P-max or Wp as measured under Standard Test Conditions ("STC"), excluding bifacial modules.

Table J-3
CSPV products: U.S. producers' weighted-average f.o.b. prices and quantities of product 3, by quarter and by cell origin, January 2018-June 2021

Price in dollars per kilowatt, quantity in kilowatts

Period	U.S. price (U.S. origin cells)	U.S. quantity (U.S. origin cells)	U.S. price (Foreign origin cells)	U.S. quantity (Foreign origin cells)	U.S. price (All cell origins)	U.S. quantity (All cell origins)
2018 Q1	***	***	***	***	***	***
2018 Q2	***	***	***	***	***	***
2018 Q3	***	***	***	***	***	***
2018 Q4	***	***	***	***	***	***
2019 Q1	***	***	***	***	***	***
2019 Q2	***	***	***	***	***	***
2019 Q3	***	***	***	***	***	***
2019 Q4	***	***	***	***	***	***
2020 Q1	***	***	***	***	***	***
2020 Q2	***	***	***	***	***	***
2020 Q3	***	***	***	***	***	***
2020 Q4	***	***	***	***	***	***
2021 Q1	***	***	***	***	***	***
2021 Q2	***	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 3: Monocrystalline silicon module with front-side area of greater than or equal to 1.9 square meters and a peak power wattage between 325w to 375w, inclusive, P-max or Wp as measured under Standard Test Conditions ("STC"), excluding bifacial modules.

Table J-4
CSPV products: U.S. producers' weighted-average f.o.b. prices and quantities of product 4, by quarter and by cell origin, January 2018-June 2021

Price in dollars per kilowatt, quantity in kilowatts

Period	U.S. price (U.S. origin cells)	U.S. quantity (U.S. origin cells)	U.S. price (Foreign origin cells)	U.S. quantity (Foreign origin cells)	U.S. price (All cell origins)	U.S. quantity (All cell origins)
2018 Q1	***	***	***	***	***	***
2018 Q2	***	***	***	***	***	***
2018 Q3	***	***	***	***	***	***
2018 Q4	***	***	***	***	***	***
2019 Q1	***	***	***	***	***	***
2019 Q2	***	***	***	***	***	***
2019 Q3	***	***	***	***	***	***
2019 Q4	***	***	***	***	***	***
2020 Q1	***	***	***	***	***	***
2020 Q2	***	***	***	***	***	***
2020 Q3	***	***	***	***	***	***
2020 Q4	***	***	***	***	***	***
2021 Q1	***	***	***	***	***	***
2021 Q2	***	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 4: Monocrystalline silicon module with front-side area of greater than or equal to 1.9 square meters and a peak power wattage between 380w to 430w, inclusive, P-max or Wp as measured under Standard Test Conditions ("STC"), excluding bifacial modules.

Table J-5
CSPV products: U.S. producers' weighted-average f.o.b. prices and quantities of product 6, by quarter and by cell origin, January 2018-June 2021

Price in dollars per kilowatt, quantity in kilowatts

Period	U.S. price (U.S. origin cells)	U.S. quantity (U.S. origin cells)	U.S. price (Foreign origin cells)	U.S. quantity (Foreign origin cells)	U.S. price (All cell origins)	U.S. quantity (All cell origins)
2018 Q1	***	***	***	***	***	***
2018 Q2	***	***	***	***	***	***
2018 Q3	***	***	***	***	***	***
2018 Q4	***	***	***	***	***	***
2019 Q1	***	***	***	***	***	***
2019 Q2	***	***	***	***	***	***
2019 Q3	***	***	***	***	***	***
2019 Q4	***	***	***	***	***	***
2020 Q1	***	***	***	***	***	***
2020 Q2	***	***	***	***	***	***
2020 Q3	***	***	***	***	***	***
2020 Q4	***	***	***	***	***	***
2021 Q1	***	***	***	***	***	***
2021 Q2	***	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 6: Monocrystalline silicon bifacial module that generates power on both sides of the panel with front-side area of greater than or equal to 1.9 square meters and a peak power wattage greater than or equal to 325w, inclusive, P-max or Wp as measured under Standard Test Conditions ("STC").

Table J-6
CSPV products: U.S. importers' weighted-average f.o.b. prices and quantities of imported product 1, by quarter and source

Price in dollars per kilowatt, quantity in kilowatts

Period	China price	China quantity	Korea price	Korea quantity	Malaysia price	Malaysia quantity
2018 Q1	***	***	***	***	***	***
2018 Q2	***	***	***	***	***	***
2018 Q3	***	***	***	***	***	***
2018 Q4	***	***	***	***	***	***
2019 Q1	***	***	***	***	***	***
2019 Q2	***	***	***	***	***	***
2019 Q3	***	***	***	***	***	***
2019 Q4	***	***	***	***	***	***
2020 Q1	***	***	***	***	***	***
2020 Q2	***	***	***	***	***	***
2020 Q3	***	***	***	***	***	***
2020 Q4	***	***	***	***	***	***
2021 Q1	***	***	***	***	***	***
2021 Q2	***	***	***	***	***	***

Period	Singapore price	Singapore quantity	Thailand price	Thailand quantity	Vietnam price	Vietnam quantity
2018 Q1	***	***	***	***	***	***
2018 Q2	***	***	***	***	***	***
2018 Q3	***	***	***	***	***	***
2018 Q4	***	***	***	***	***	***
2019 Q1	***	***	***	***	***	***
2019 Q2	***	***	***	***	***	***
2019 Q3	***	***	***	***	***	***
2019 Q4	***	***	***	***	***	***
2020 Q1	***	***	***	***	***	***
2020 Q2	***	***	***	***	***	***
2020 Q3	***	***	***	***	***	***
2020 Q4	***	***	***	***	***	***
2021 Q1	***	***	***	***	***	***
2021 Q2	***	***	***	***	***	***

Table continued

Table J-6 Continued
CSPV products: U.S. importers' weighted-average f.o.b. prices and quantities of imported product 1, by quarter and source

Price in dollars per kilowatt, quantity in kilowatts

Period	All other sources price	All other sources quantity	All import sources price	All import sources quantity
2018 Q1	***	***	***	***
2018 Q2	***	***	***	***
2018 Q3	***	***	***	***
2018 Q4	***	***	***	***
2019 Q1	***	***	***	***
2019 Q2	***	***	***	***
2019 Q3	***	***	***	***
2019 Q4	***	***	***	***
2020 Q1	***	***	***	***
2020 Q2	***	***	***	***
2020 Q3	***	***	***	***
2020 Q4	***	***	***	***
2021 Q1	***	***	***	***
2021 Q2	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 1: Monocrystalline silicon module with front-side of less than 1.9 square meters and a peak power wattage between 275w to 325w, inclusive, P-max or Wp as measured under Standard Test Conditions (“STC”), excluding bifacial modules.

Table J-7
CSPV products: U.S. importers' weighted-average f.o.b. prices and quantities of imported product 2, by quarter and source

Price in dollars per kilowatt, quantity in kilowatts

Period	China price	China quantity	Korea price	Korea quantity	Malaysia price	Malaysia quantity
2018 Q1	***	***	***	***	***	***
2018 Q2	***	***	***	***	***	***
2018 Q3	***	***	***	***	***	***
2018 Q4	***	***	***	***	***	***
2019 Q1	***	***	***	***	***	***
2019 Q2	***	***	***	***	***	***
2019 Q3	***	***	***	***	***	***
2019 Q4	***	***	***	***	***	***
2020 Q1	***	***	***	***	***	***
2020 Q2	***	***	***	***	***	***
2020 Q3	***	***	***	***	***	***
2020 Q4	***	***	***	***	***	***
2021 Q1	***	***	***	***	***	***
2021 Q2	***	***	***	***	***	***

Period	Singapore price	Singapore quantity	Thailand price	Thailand quantity	Vietnam price	Vietnam quantity
2018 Q1	***	***	***	***	***	***
2018 Q2	***	***	***	***	***	***
2018 Q3	***	***	***	***	***	***
2018 Q4	***	***	***	***	***	***
2019 Q1	***	***	***	***	***	***
2019 Q2	***	***	***	***	***	***
2019 Q3	***	***	***	***	***	***
2019 Q4	***	***	***	***	***	***
2020 Q1	***	***	***	***	***	***
2020 Q2	***	***	***	***	***	***
2020 Q3	***	***	***	***	***	***
2020 Q4	***	***	***	***	***	***
2021 Q1	***	***	***	***	***	***
2021 Q2	***	***	***	***	***	***

Table continued

Table J-7 Continued
CSPV products: U.S. importers' weighted-average f.o.b. prices and quantities of imported product 2, by quarter and source

Price in dollars per kilowatt, quantity in kilowatts

Period	All other sources price	All other sources quantity	All import sources price	All import sources quantity
2018 Q1	***	***	***	***
2018 Q2	***	***	***	***
2018 Q3	***	***	***	***
2018 Q4	***	***	***	***
2019 Q1	***	***	***	***
2019 Q2	***	***	***	***
2019 Q3	***	***	***	***
2019 Q4	***	***	***	***
2020 Q1	***	***	***	***
2020 Q2	***	***	***	***
2020 Q3	***	***	***	***
2020 Q4	***	***	***	***
2021 Q1	***	***	***	***
2021 Q2	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 2: Monocrystalline silicon module with front-side area of less than 1.9 square meters and a peak power wattage between 330w to 415w, inclusive, P-max or Wp as measured under Standard Test Conditions (“STC”), excluding bifacial modules.

Table J-8
CSPV products: U.S. importers' weighted-average f.o.b. prices and quantities of imported product 3, by quarter and source

Price in dollars per kilowatt, quantity in kilowatts

Period	China price	China quantity	Korea price	Korea quantity	Malaysia price	Malaysia quantity
2018 Q1	***	***	***	***	***	***
2018 Q2	***	***	***	***	***	***
2018 Q3	***	***	***	***	***	***
2018 Q4	***	***	***	***	***	***
2019 Q1	***	***	***	***	***	***
2019 Q2	***	***	***	***	***	***
2019 Q3	***	***	***	***	***	***
2019 Q4	***	***	***	***	***	***
2020 Q1	***	***	***	***	***	***
2020 Q2	***	***	***	***	***	***
2020 Q3	***	***	***	***	***	***
2020 Q4	***	***	***	***	***	***
2021 Q1	***	***	***	***	***	***
2021 Q2	***	***	***	***	***	***

Period	Singapore price	Singapore quantity	Thailand price	Thailand quantity	Vietnam price	Vietnam quantity
2018 Q1	***	***	***	***	***	***
2018 Q2	***	***	***	***	***	***
2018 Q3	***	***	***	***	***	***
2018 Q4	***	***	***	***	***	***
2019 Q1	***	***	***	***	***	***
2019 Q2	***	***	***	***	***	***
2019 Q3	***	***	***	***	***	***
2019 Q4	***	***	***	***	***	***
2020 Q1	***	***	***	***	***	***
2020 Q2	***	***	***	***	***	***
2020 Q3	***	***	***	***	***	***
2020 Q4	***	***	***	***	***	***
2021 Q1	***	***	***	***	***	***
2021 Q2	***	***	***	***	***	***

Table continued

Table J-8 Continued
CSPV products: U.S. importers' weighted-average f.o.b. prices and quantities of imported product 3, by quarter and source

Price in dollars per kilowatt, quantity in kilowatts

Period	All other sources price	All other sources quantity	All import sources price	All import sources quantity
2018 Q1	***	***	***	***
2018 Q2	***	***	***	***
2018 Q3	***	***	***	***
2018 Q4	***	***	***	***
2019 Q1	***	***	***	***
2019 Q2	***	***	***	***
2019 Q3	***	***	***	***
2019 Q4	***	***	***	***
2020 Q1	***	***	***	***
2020 Q2	***	***	***	***
2020 Q3	***	***	***	***
2020 Q4	***	***	***	***
2021 Q1	***	***	***	***
2021 Q2	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 3: Monocrystalline silicon module with front-side area of greater than or equal to 1.9 square meters and a peak power wattage between 325w to 375w, inclusive, P-max or Wp as measured under Standard Test Conditions ("STC"), excluding bifacial modules.

Table J-9
CSPV products: U.S. importers' weighted-average f.o.b. prices and quantities of imported product 4, by quarter and source

Price in dollars per kilowatt, quantity in kilowatts

Period	China price	China quantity	Korea price	Korea quantity	Malaysia price	Malaysia quantity
2018 Q1	***	***	***	***	***	***
2018 Q2	***	***	***	***	***	***
2018 Q3	***	***	***	***	***	***
2018 Q4	***	***	***	***	***	***
2019 Q1	***	***	***	***	***	***
2019 Q2	***	***	***	***	***	***
2019 Q3	***	***	***	***	***	***
2019 Q4	***	***	***	***	***	***
2020 Q1	***	***	***	***	***	***
2020 Q2	***	***	***	***	***	***
2020 Q3	***	***	***	***	***	***
2020 Q4	***	***	***	***	***	***
2021 Q1	***	***	***	***	***	***
2021 Q2	***	***	***	***	***	***

Period	Singapore price	Singapore quantity	Thailand price	Thailand quantity	Vietnam price	Vietnam quantity
2018 Q1	***	***	***	***	***	***
2018 Q2	***	***	***	***	***	***
2018 Q3	***	***	***	***	***	***
2018 Q4	***	***	***	***	***	***
2019 Q1	***	***	***	***	***	***
2019 Q2	***	***	***	***	***	***
2019 Q3	***	***	***	***	***	***
2019 Q4	***	***	***	***	***	***
2020 Q1	***	***	***	***	***	***
2020 Q2	***	***	***	***	***	***
2020 Q3	***	***	***	***	***	***
2020 Q4	***	***	***	***	***	***
2021 Q1	***	***	***	***	***	***
2021 Q2	***	***	***	***	***	***

Table continued

Table J-9 Continued
CSPV products: U.S. importers' weighted-average f.o.b. prices and quantities of imported product 4, by quarter and source

Price in dollars per kilowatt, quantity in kilowatts

Period	All other sources price	All other sources quantity	All import sources price	All import sources quantity
2018 Q1	***	***	***	***
2018 Q2	***	***	***	***
2018 Q3	***	***	***	***
2018 Q4	***	***	***	***
2019 Q1	***	***	***	***
2019 Q2	***	***	***	***
2019 Q3	***	***	***	***
2019 Q4	***	***	***	***
2020 Q1	***	***	***	***
2020 Q2	***	***	***	***
2020 Q3	***	***	***	***
2020 Q4	***	***	***	***
2021 Q1	***	***	***	***
2021 Q2	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 4: Monocrystalline silicon module with front-side area of greater than or equal to 1.9 square meters and a peak power wattage between 380w to 430w, inclusive, P-max or Wp as measured under Standard Test Conditions ("STC"), excluding bifacial modules.

Table J-10
CSPV products: U.S. importers' weighted-average f.o.b. prices and quantities of imported product 5, by quarter and source

Price in dollars per kilowatt, quantity in kilowatts

Period	China price	China quantity	Korea price	Korea quantity	Malaysia price	Malaysia quantity
2018 Q1	***	***	***	***	***	***
2018 Q2	***	***	***	***	***	***
2018 Q3	***	***	***	***	***	***
2018 Q4	***	***	***	***	***	***
2019 Q1	***	***	***	***	***	***
2019 Q2	***	***	***	***	***	***
2019 Q3	***	***	***	***	***	***
2019 Q4	***	***	***	***	***	***
2020 Q1	***	***	***	***	***	***
2020 Q2	***	***	***	***	***	***
2020 Q3	***	***	***	***	***	***
2020 Q4	***	***	***	***	***	***
2021 Q1	***	***	***	***	***	***
2021 Q2	***	***	***	***	***	***

Period	Singapore price	Singapore quantity	Thailand price	Thailand quantity	Vietnam price	Vietnam quantity
2018 Q1	***	***	***	***	***	***
2018 Q2	***	***	***	***	***	***
2018 Q3	***	***	***	***	***	***
2018 Q4	***	***	***	***	***	***
2019 Q1	***	***	***	***	***	***
2019 Q2	***	***	***	***	***	***
2019 Q3	***	***	***	***	***	***
2019 Q4	***	***	***	***	***	***
2020 Q1	***	***	***	***	***	***
2020 Q2	***	***	***	***	***	***
2020 Q3	***	***	***	***	***	***
2020 Q4	***	***	***	***	***	***
2021 Q1	***	***	***	***	***	***
2021 Q2	***	***	***	***	***	***

Table continued

Table J-10 Continued
CSPV products: U.S. importers' weighted-average f.o.b. prices and quantities of imported product 5, by quarter and source

Price in dollars per kilowatt, quantity in kilowatts

Period	All other sources price	All other sources quantity	All import sources price	All import sources quantity
2018 Q1	***	***	***	***
2018 Q2	***	***	***	***
2018 Q3	***	***	***	***
2018 Q4	***	***	***	***
2019 Q1	***	***	***	***
2019 Q2	***	***	***	***
2019 Q3	***	***	***	***
2019 Q4	***	***	***	***
2020 Q1	***	***	***	***
2020 Q2	***	***	***	***
2020 Q3	***	***	***	***
2020 Q4	***	***	***	***
2021 Q1	***	***	***	***
2021 Q2	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 5: Monocrystalline silicon module with front-side area of greater than or equal to 1.9 square meters and a peak power wattage between 440w to 640w, inclusive, P-max or Wp as measured under Standard Test Conditions ("STC"), excluding bifacial modules.

Table J-11
CSPV products: U.S. importers' weighted-average f.o.b. prices and quantities of imported product 6, by quarter and source

Price in dollars per kilowatt, quantity in kilowatts

Period	China price	China quantity	Korea price	Korea quantity	Malaysia price	Malaysia quantity
2018 Q1	***	***	***	***	***	***
2018 Q2	***	***	***	***	***	***
2018 Q3	***	***	***	***	***	***
2018 Q4	***	***	***	***	***	***
2019 Q1	***	***	***	***	***	***
2019 Q2	***	***	***	***	***	***
2019 Q3	***	***	***	***	***	***
2019 Q4	***	***	***	***	***	***
2020 Q1	***	***	***	***	***	***
2020 Q2	***	***	***	***	***	***
2020 Q3	***	***	***	***	***	***
2020 Q4	***	***	***	***	***	***
2021 Q1	***	***	***	***	***	***
2021 Q2	***	***	***	***	***	***
Period	**Singapore price**	**Singapore quantity**	**Thailand price**	**Thailand quantity**	**Vietnam price**	**Vietnam quantity**
2018 Q1	***	***	***	***	***	***
2018 Q2	***	***	***	***	***	***
2018 Q3	***	***	***	***	***	***
2018 Q4	***	***	***	***	***	***
2019 Q1	***	***	***	***	***	***
2019 Q2	***	***	***	***	***	***
2019 Q3	***	***	***	***	***	***
2019 Q4	***	***	***	***	***	***
2020 Q1	***	***	***	***	***	***
2020 Q2	***	***	***	***	***	***
2020 Q3	***	***	***	***	***	***
2020 Q4	***	***	***	***	***	***
2021 Q1	***	***	***	***	***	***
2021 Q2	***	***	***	***	***	***

Table continued

Table J-11 Continued
CSPV products: U.S. importers' weighted-average f.o.b. prices and quantities of imported product 6, by quarter and source

Price in dollars per kilowatt, quantity in kilowatts

Period	All other sources price	All other sources quantity	All import sources price	All import sources quantity
2018 Q1	***	***	***	***
2018 Q2	***	***	***	***
2018 Q3	***	***	***	***
2018 Q4	***	***	***	***
2019 Q1	***	***	***	***
2019 Q2	***	***	***	***
2019 Q3	***	***	***	***
2019 Q4	***	***	***	***
2020 Q1	***	***	***	***
2020 Q2	***	***	***	***
2020 Q3	***	***	***	***
2020 Q4	***	***	***	***
2021 Q1	***	***	***	***
2021 Q2	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 6: Monocrystalline silicon bifacial module that generates power on both sides of the panel with front-side area of greater than or equal to 1.9 square meters and a peak power wattage greater than or equal to 325w, inclusive, P-max or Wp as measured under Standard Test Conditions (“STC”).

APPENDIX K

DATA TABLES ACCOMPANYING REPORT FIGURES

Table K-1
CSPV cells: Global shipments by technology type and by period

Quantity in megawatts; share in percent

Wafer type	Cell type	Measure	2020	January–June 2021
Multicrystalline p-type	Standard	Quantity	***	***
Multicrystalline p-type	PERC	Quantity	***	***
Monocrystalline p-type	Standard/other	Quantity	***	***
Monocrystalline p-type	PERC	Quantity	***	***
Monocrystalline n-type	Heterojunction	Quantity	***	***
Monocrystalline n-type	IBC	Quantity	***	***
Monocrystalline n-type	PERC	Quantity	***	***
Monocrystalline n-type	TOPCon	Quantity	***	***
Monocrystalline n-type	Other	Quantity	***	***
Subtotal	Multicrystalline	Quantity	***	***
Subtotal	Monocrystalline, p-type	Quantity	***	***
Subtotal	Monocrystalline, n-type	Quantity	***	***
Subtotal	All monocrystalline	Quantity	***	***
Total	All products	Quantity	***	***
Multicrystalline p-type	Standard	Share	***	***
Multicrystalline p-type	PERC	Share	***	***
Monocrystalline p-type	Standard/other	Share	***	***
Monocrystalline p-type	PERC	Share	***	***
Monocrystalline n-type	Heterojunction	Share	***	***
Monocrystalline n-type	IBC	Share	***	***
Monocrystalline n-type	PERC	Share	***	***
Monocrystalline n-type	TOPCon	Share	***	***
Monocrystalline n-type	Other	Share	***	***
Subtotal	Multicrystalline	Share	***	***
Subtotal	Monocrystalline, p-type	Share	***	***
Subtotal	Monocrystalline, n-type	Share	***	***
Subtotal	All monocrystalline	Share	***	***
Total	All products	Share	***	***
Multicrystalline p-type	Standard	Quantity	***	***

Source: ***.

Note: ***.

Table K-2
CSPV modules: Global market share by technology type, 2020

Product	Technology type 1 and share	Technology type 2 and share
Full and cut cells (incorporating ≤M10 wafers)	Full cell: About 20 percent	Half cell: About 80 percent
Half cell module sizes (incorporating ≤M10 wafers)	120 half cut cells: <40 percent	144 half cut cells: <60 percent
Monofacial and bifacial	Bifacial: >15 percent	Monofacial: >80 percent

Source: ITRPV, 2020 Results, pp. 46-49, https://itrpv.vdma.org, retrieved September 28, 2021.

Note: Technologies with a small share of the market for which data could not be discerned in the report are not included here.

Table K-3
Net U.S. electricity generation, by sector and by period

Quantity in thousand megawatt hours; share of quantity in percent

Source of electricity generation	Measure	2018	2019	2020	January–June 2021
Coal	Quantity	1,149,487	964,958	773,805	436,852
Natural gas	Quantity	1,469,133	1,585,815	1,616,749	711,680
Nuclear	Quantity	807,084	809,412	789,917	383,709
All other renewables	Quantity	350,467	368,860	410,497	227,721
Solar	Quantity	93,364	106,895	132,633	81,579
All other sources	Quantity	338,281	326,881	327,226	155,567
All sources	Quantity	4,207,816	4,162,821	4,050,827	1,997,108
Coal	Share of quantity	27.3	23.2	19.1	21.9
Natural gas	Share of quantity	34.9	38.1	39.9	35.6
Nuclear	Share of quantity	19.2	19.4	19.5	19.2
All other renewables	Share of quantity	8.3	8.9	10.1	11.4
Solar	Share of quantity	2.2	2.6	3.3	4.1
All other sources	Share of quantity	8.0	7.9	8.1	7.8
All sources	Share of quantity	100.0	100.0	100.0	100.0

Source: U.S. Energy Information Administration, Electricity Data Browser, retrieved October 9, 2021.

Table K-4
Polysilicon ingots and wafers: Global spot prices for polysilicon ingots, in dollars per kilogram, and wafers, in dollars per watt, quarterly

Period	Polysilicon	Multi wafers	Mono wafers
2018 Q1	17.50	0.14	0.14
2018 Q2	15.30	0.12	0.13
2018 Q3	11.70	0.07	0.09
2018 Q4	9.90	0.06	0.08
2019 Q1	9.30	0.06	0.08
2019 Q2	8.90	0.06	0.09
2019 Q3	8.50	0.05	0.08
2019 Q4	8.20	0.05	0.08
2020 Q1	7.92	0.04	0.08
2020 Q2	7.82	0.03	0.08
2020 Q3	8.55	0.04	0.08
2020 Q4	9.25	0.04	0.09

Source: Wood Mackenzie Power Renewables and the Solar Energy Industries Association ("SEIA"), U.S. Solar Market Insight: 2016-2018 Year in Review, Q3 2019, 2020 Year in Review, Executive Summaries, retrieved October 14, 2021.

Table K-5
CSPV cell and module prices: Global spot prices for multicrystalline cells, monocrystalline cells, multicrystalline modules, and monocrystalline modules, and U.S. prices for multicrystalline modules and mono-PERC modules, in dollars per watt, quarterly

Period	Multi cells	Mono cells	Multi modules	Mono modules	U.S. multi modules	U.S. mono PERC modules
2018 Q1	0.20	0.20	0.35	0.40	0.47	0.55
2018 Q2	0.17	0.19	0.33	0.38	0.42	0.47
2018 Q3	0.13	0.14	0.26	0.30	0.34	0.44
2018 Q4	0.11	0.13	0.23	0.27	0.34	0.41
2019 Q1	0.11	0.14	0.23	0.28	0.33	0.40
2019 Q2	0.12	0.12	0.23	0.28	0.32	0.43
2019 Q3	0.11	0.11	0.23	0.26	0.31	0.44
2019 Q4	0.09	0.11	0.20	0.24	0.22	0.42
2020 Q1	0.08	0.11	0.20	0.24	0.21	0.41
2020 Q2	0.07	0.11	0.19	0.22	0.19	0.39
2020 Q3	0.07	0.12	0.18	0.21	0.19	0.34
2020 Q4	0.07	0.12	0.18	0.22	0.19	0.34

Source: Wood Mackenzie Power Renewables and the Solar Energy Industries Association ("SEIA"), U.S. Solar Market Insight: 2016-2018 Year in Review, Q3 2019, 2020 Year in Review, Executive Summaries, retrieved October 14, 2021.

Table K-6
Coal and natural gas: Average cost of coal, in dollars per ton, and natural gas, in dollars per mcf, for electricity generation for all sectors, monthly

Period	Coal	Natural gas
January 2018	39.01	5.23
February 2018	39.27	3.73
March 2018	39.20	3.29
April 2018	39.66	3.24
May 2018	39.50	3.16
June 2018	39.14	3.23
July 2018	38.98	3.34
August 2018	39.16	3.38
September 2018	38.76	3.22
October 2018	39.05	3.55
November 2018	39.02	4.31
December 2018	40.25	4.89
January 2019	40.15	4.13
February 2019	39.38	3.76
March 2019	40.49	3.57
April 2019	40.03	2.98
May 2019	39.76	2.85
June 2019	39.03	2.67
July 2019	38.54	2.63
August 2019	38.30	2.50
September 2019	37.47	2.68
October 2019	37.48	2.58
November 2019	37.27	3.06
December 2019	36.50	3.01
January 2020	36.77	2.72
February 2020	35.99	2.48
March 2020	36.77	2.22
April 2020	36.17	2.18
May 2020	35.22	2.23
June 2020	36.14	2.07
July 2020	36.33	2.09
August 2020	37.14	2.46
September 2020	37.08	2.50
October 2020	36.85	2.57
November 2020	36.66	3.09
December 2020	36.54	3.28
January 2021	36.36	3.30
February 2021	37.07	16.06
March 2021	36.21	3.37
April 2021	36.50	3.11
May 2021	36.24	3.34
June 2021	37.53	3.57

Source: U.S. Energy Information Administration, Electricity Data Browser, retrieved October 14, 2021.

Table K-7
CSPV products: Indexed U.S. producer prices, by product and by quarter

Prices and unit LDP values in dollars per pound; change in percent; prices indexed to the first quarter of 2018

Period	Product 1	Product 2	Product 3	Product 4	Product 5	Product 6
2018 Q1	***	***	***	***	***	***
2018 Q2	***	***	***	***	***	***
2018 Q3	***	***	***	***	***	***
2018 Q4	***	***	***	***	***	***
2019 Q1	***	***	***	***	***	***
2019 Q2	***	***	***	***	***	***
2019 Q3	***	***	***	***	***	***
2019 Q4	***	***	***	***	***	***
2020 Q1	***	***	***	***	***	***
2020 Q2	***	***	***	***	***	***
2020 Q3	***	***	***	***	***	***
2020 Q4	***	***	***	***	***	***
2021 Q1	***	***	***	***	***	***
2021 Q2	***	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

Note: Product 4 is indexed to the second quarter (April-June) of 2018.

Table K-8
CSPV products: Indexed importer prices, by product and by quarter

Prices and unit LDP values in dollars per pound; change in percent; prices indexed to the first quarter of 2018

Period	Product 1	Product 2	Product 3	Product 4	Product 5	Product 6
2018 Q1	***	***	***	***	***	***
2018 Q2	***	***	***	***	***	***
2018 Q3	***	***	***	***	***	***
2018 Q4	***	***	***	***	***	***
2019 Q1	***	***	***	***	***	***
2019 Q2	***	***	***	***	***	***
2019 Q3	***	***	***	***	***	***
2019 Q4	***	***	***	***	***	***
2020 Q1	***	***	***	***	***	***
2020 Q2	***	***	***	***	***	***
2020 Q3	***	***	***	***	***	***
2020 Q4	***	***	***	***	***	***
2021 Q1	***	***	***	***	***	***
2021 Q2	***	***	***	***	***	***

Source: Compiled from data submitted in response to Commission questionnaires.

APPENDIX L

TABLE OF INCORPORATED BRIEFS

This report incorporates by reference the below confidential documents filed on EDIS for this investigation.

Table L-1
List of incorporated briefs

EDIS Document ID	Official Receive Date	Document Title	Firm/Organization	Filed On Behalf Of
755208	10/27/2021	Prehearing Brief on Behalf of Auxin Solar Inc.	Cassidy Levy Kent (USA) LLP	Auxin Solar Inc.
755215	10/27/2021	NextEra Prehearing Brief	Akin Gump Strauss Hauer & Feld, LLP	NextEra Energy Inc.
755216	10/27/2021	CCCME Prehearing Brief (APO-BNF)	Morris, Manning & Martin LLP	China Chamber of Commerce for Import and Export of Machinery and Electronic Products
755225	10/27/2021	Canadian Industry Prehearing Brief - BPI-ODL	Hogan Lovells US LLP	Heliene Inc., Silfab Solar Inc., Canadian Solar Solutions Inc.
755227	10/27/2021	Suniva's Prehearing Brief (BNF)	Schagrin Associates	Suniva, Inc.
755228	10/27/2021	Government of Canada Prehearing Brief - BPI-ODL	Hogan Lovells US LLP	The Government of Canada
755230	10/27/2021	ACP Prehearing Brief (BPI Bracketing Not Final)	Mowry & Grimson, PLLC	American Clean Power Association and its member, Clearway Energy Group LLC
755234	10/27/2021	SEIA and REC Americas Prehearing Brief	Akin Gump Strauss Hauer & Feld, LLP	Solar Energy Industries Association and REC Americas LLC
755241	10/27/2021	Hanwha Q CELLS USA, Inc.'s, LG Electronics USA, Inc.'s & Mission Solar Energy's Pre-Hearing Brief	Arent Fox LLP	Hanwha Q CELLS USA, Inc., LG Electronics USA, Inc. & Mission Solar Energy

EDIS Document ID	Official Receive Date	Document Title	Firm/Organization	Filed On Behalf Of
755259	10/28/2021	Bracketing Changes to Prehearing Brief on Behalf of Auxin Solar Inc.	Cassidy Levy Kent (USA) LLP	Auxin Solar Inc.
755321	10/28/2021	Suniva Replacement Pages for Prehearing Brief (BPI) 10-28-21	Schagrin Associates	Suniva, Inc.
755364	10/28/2021	NextEra Prehearing Brief Replacement Pages	Akin Gump Strauss Hauer & Feld, LLP	NextEra Energy Inc.
755378	10/28/2021	ACP Prehearing Brief Bracketing Corrections (BPI)	Mowry & Grimson, PLLC	American Clean Power Association and its member, Clearway Energy Group LLC
755388	10/28/2021	SEIA and REC Americas Prehearing Brief - Replacement Pages	Akin Gump Strauss Hauer & Feld, LLP	Solar Energy Industries Association and REC Americas LLC
755405	10/28/2021	Hanwha Q CELLS USA, Inc.'s, LG Electronics USA, Inc.'s & Mission Solar Energy's Replacement Pages for Pre-Hearing Brief	Arent Fox LLP	Hanwha Q CELLS USA, Inc.), LG Electronics USA, Inc. and Mission Solar Energy
756259	11/10/2021	Posthearing Brief on Behalf of Auxin Solar Inc.	Cassidy Levy Kent (USA) LLP	Auxin Solar Inc.
756307	11/10/2021	ACP Posthearing Brief	Mowry & Grimson, PLLC	American Clean Power Association and its member, Clearway Energy Group LLC
756310	11/10/2021	SEIA and REC Americas Posthearing Brief	Akin Gump Strauss Hauer & Feld, LLP	Solar Energy Industries Association and REC Americas LLC
756312	11/10/2021	201-075 (E) - 11-10-21 CAN Industry Posthearing Brief	Hogan Lovells US LLP	Heliene Inc., Silfab Solar Inc. and Canadian Solar

EDIS Document ID	Official Receive Date	Document Title	Firm/Organization	Filed On Behalf Of
				Solutions Inc.
756317	11/10/2021	CCCME Posthearing Brief (MMM)	Morris, Manning & Martin LLP	China Chamber of Commerce for Import and Export of Machinery and Electronic Products
756324	11/10/2021	NextEra Post-Hearing Brief (CBI)	Akin Gump Strauss Hauer & Feld, LLP	NextEra Energy, Inc.
756328	11/10/2021	LGEUS Post-Heraring Brief (APO ODL)	Curtis, Mallet-Prevost, Colt & Mosle LLP	LG Electronics USA, Inc. and LG Electronics, Inc.
756341	11/10/2021	Submission of Posthearing Brief	Schagrin Associates	Suniva, Inc.
756354	11/10/2021	Hanwha Q CELLS USA, Inc.'s & Mission Solar Energy's Posthearing Brief	Arent Fox LLP	Hanwha Q CELLS USA, Inc. and Mission Solar Energy
756413	11/12/2021	LGEUS Post-Hearing Brief Replacement Pages (APO)	Curtis, Mallet-Prevost, Colt & Mosle LLP	LG Electronics USA, Inc.
756415	11/12/2021	LGEUS Post-Hearing Brief Replacement Pages (APO)	Curtis, Mallet-Prevost, Colt & Mosle LLP	LG Electronics USA, Inc.
756418	11/12/2021	Replacement Pages for Post-Hearing Brief	Schagrin Associates	Suniva, Inc.
756421	11/12/2021	SEIA and REC Americas Posthearing Brief Replacement Pages	Akin Gump Strauss Hauer & Feld, LLP	Solar Energy Industries Association and REC Americas LLC
756424	11/12/2021	NextEra Posthearing Brief - Replacement Pages	Akin Gump Strauss Hauer & Feld, LLP	NextEra Energy, Inc.

EDIS Document ID	Official Receive Date	Document Title	Firm/Organization	Filed On Behalf Of
756468	11/12/2021	ACP Posthearing Brief Bracketing Changes	Mowry & Grimson, PLLC	American Clean Power Association and its member, Clearway Energy Group LLC
756483	11/12/2021	Bracketing Changes to Posthearing Brief on Behalf of Auxin Solar Inc.	Cassidy Levy Kent (USA) LLP	Auxin Solar Inc.
756495	11/12/2021	Hanwha Q CELLS USA, Inc.'s & Mission Solar Energy's Revised Bracketing Pages to Posthearing Brief	Arent Fox LLP	Hanwha Q CELLS USA, Inc. and Mission Solar Energy
756838	11/17/2021	Auxin's Errata Letter for Posthearing Brief	Cassidy Levy Kent (USA) LLP	Auxin Solar Inc.
757005	11/19/2021	Corrected Posthearing Brief on Behalf of Auxin Solar Inc.	Cassidy Levy Kent (USA) LLP	Auxin Solar Inc.

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