No. ID-037

OFFICE OF INDUSTRIES WORKING PAPER
U.S. International Trade Commission

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June 2014

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U.S. INTERNATIONAL TRADE COMMISSION
WASHINGTON, DC 20436 USA

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ABSTRACT

The global market for "smart grid" equipment and services has expanded rapidly in recent years and is expected to continue its strong growth over the next decade. This paper examines an important segment of the smart grid—smart electricity meters. Government policies, particularly mandates and fiscal incentives, have been key drivers of market adoption of smart meters, which can enhance electricity grid reliability, efficiency, and security. U.S.-based firms are currently among the leading global suppliers of smart electricity meters and are active in many large and emerging markets. The paper discusses the factors that drive supply and demand for smart electricity meters, trade flows, and tariff and nontariff barriers that affect firms' ability to operate abroad. The paper also provides profiles of several leading and potential smart meter markets in the EU, Asia, and the Americas.

[1] This paper represents solely the views of the authors and is not meant to represent the views of the U.S. International Trade Commission or any of its commissioners. Please direct all correspondence to Robert Carr, Office of Industries, U.S. International Trade Commission, 500 E Street, SW, Washington, DC 20436, telephone: 202-205-3402, fax: 202-205-2217, email: robert.carr@usitc.gov.

Global Market for Smart Electricity Meters: Government Policies Driving Strong Growth

Executive Summary

Development of an integrated, information technology (IT)-enabled, national electric power grid offers significant benefits for any country. Such a "smart grid" supports the expansion of distributed, often renewable, electricity production; lowers costs; promotes energy efficiency; and improves both the reliability and security of the entire production, transmission, and distribution system. Smart electricity meters, with either one- or two-way electronic communication capabilities, are an important part of such a system, as they provide system operators an IT-enabled interface with residential and commercial consumers as well as with power generators, who are also increasingly producers of distributed electricity.

The use of such smart meters has been growing quickly in recent years. In fact, certain market observers estimate the global market for smart meters will rise from $4 billion in 2011 to approximately $20 billion in 2018. Government policy mandates and fiscal incentives have been the primary drivers of demand for smart electricity meters in a multitude of markets, and tend to attract manufacturers that are seeking to expand their global presence. A number of U.S.-based firms are among the world's leading producers and are actively supplying the leading foreign markets, principally by manufacturing in or close to those markets. Direct U.S. exports of smart meters also have shown solid growth in recent years, albeit from a small base, rising from an estimated $180 million to $240 million during 2008–13.[2]

This paper examines the U.S. and global markets for smart electricity meters, focusing on factors that drive supply and demand, as well as key manufacturers, trade flows, and tariff and nontariff barriers that affect firms' ability to operate abroad. The paper also includes profiles of several leading and potential smart meter markets.

Smart Grid and the Role of Smart Meters

Worldwide, most countries share common challenges when it comes to energy: demand is rising, while security and environmental concerns are changing the way that energy is generated and distributed. As a result, utilities around the world are seeking more efficient, reliable, and secure ways to manage energy generation, transmission, and distribution. The "smart grid" has emerged as an effective approach to aligning the supply of energy in a given market with demand, while reducing waste. Utilities adopt smart grid technology so they can attain several goals: (1) to better manage peak energy load; (2) to better incorporate the intermittent power supply from some renewable energy sources; and (3) to permit greater consumer control over household energy usage.[3] In many developing countries, curtailing energy theft is another strong motivator for adopting smart grid technology—more specifically, smart electricity meters.[4]

Electricity meters are the point of interface between the utility and the consumer. The household or business equipped with a smart meter can monitor its electricity usage and make adjustments that

[2] Specific data on trade, production, and consumption of smart electricity meters are largely unavailable, and it is not clear whether the value of services related to those meters is included in the available data. Trade data for smart electricity meters is generally included in Harmonized System (HS) heading 902830 (Electricity Supply or Production Meters). Parts and subassemblies of smart meters fall under HS 902890 (Parts and Accessories of Gas, Liquid, or Electricity Supply or Production Meters, Including Calibrating Meters).

[3] Global Smart Grid Federation, *Global Smart Grid Federation Report 2012*, 2012, 4.

[4] Theft of electricity occurs when users tap into the grid without paying the utility. Smart meters allows utilities to more precisely detect where and when electricity is being consumed. Additionally, many smart meters incorporate detection capabilities that notify utilities if they have been tampered with. Industry representatives, telephone interviews by USITC staff, September 11 and 19, 2013.

reduce overall usage and/or shift usage to non-peak hours when rates may be lower (e.g., running a washing machine at night rather than in the afternoon).[5] This also benefits the utility, because the lower demand during peak hours reduces the amount of electricity it needs to produce at maximum cost, and limits the new capital investments that it would have had to make to handle higher peak-hour demand.

In recent years, a number of countries have made substantial investments in smart grid technology, and the global market is expected to continue to grow throughout the decade. According to one industry source, the global market for smart grid equipment and services was valued at approximately $60 billion in 2013, a figure that is expected to rise to more than $400 billion by 2020. The majority of that growth will take place in North America, though the largest single-country market is expected to be China, which should account for one-quarter of the global market smart grid for equipment and services by 2020. Within the broader smart grid framework, the biggest opportunities for growth are anticipated in analytic services,[6] associated software, and advanced metering infrastructure, such as smart meters.[7]

Global Market for Smart Meters

Smart meters were introduced in the United States and grew in market share compared with analog meters during the 1980s and 1990s, while such developments as the Internet and better energy storage helped to improve the technology.[8] There are two main types of smart meters: automatic meter reading (AMR) and advanced metering infrastructure (AMI). AMR meters use one-way communication and primarily act as digital "meter readers," while AMI meters can use two-way communication to both transmit usage information and perform observation and maintenance tasks. Smart meter manufacturers often produce both AMI and AMR meters and sell them to multiple types of utility customers, including buyers of gas and water, as well as electricity; many firms also make modular meters that are assembled according to final use.[9] Many markets, including the United States, are primarily installing AMI smart meters.[10] The demand for smart meters that specifically monitor electricity has experienced strong growth over the past five years as regions and utilities adopt the technology.

The global smart meter market has been growing significantly in recent years. Worldwide, the market for smart meters was valued at approximately $4 billion in 2011, and is expected to grow to an estimated $20 billion by 2018.[11] The largest markets have been North America, Europe and eastern Asia (particularly China). However, with the exception of China, the pace of installation in the global market will reportedly slow in the near term, due in large part to a decline in the pace of meter rollouts in the United States and delayed implementation of large projects planned for Europe and Brazil. Nonetheless, the global market is projected to continue expanding as countries that have yet to adopt smart grid technology begin to do so, and as large rollouts that have been delayed—most notably in the United Kingdom and France—move forward. It is estimated that annual global shipments of smart meters will reach their peak in 2018 at 131 million units.[12]

[5] Some utilities have introduced time-of-use pricing alongside the deployment of smart meters, which places a premium price on energy consumed during peak-load times and discounted rates for usage during non-peak hours.

[6] Analysis of the enterprises, grid characteristics, and consumers of smart grid services in order to optimize operational efficiencies, predict equipment failures and outages, and improve customer relationships. *Smart Grid Technology*, "Data Analytics Buying Guide Part 1: What's in Big Data for you?" Nov. 5, 2012. (accessed May 16, 2014).

[7] Fowler, "Smart Grid Market to Surpass $400 Billion," April 13, 2013.

[8] Roche, "AMR vs AMI," October 1, 2008.

[9] Industry representatives, telephone interviews by USITC staff, August and September 2013.

[10] Industry representative, telephone interview by USITC staff, September 19, 2013.

[11] Transparency Market Research, "Electricity Meters (Smart Meters) Market," May 20, 2013.

[12] Navigant Research, "Smart Electric Meters, Advanced Metering Infrastructure," 2013.

Global market drivers

Governments typically have been the principal drivers of growth in the global market for smart meters through mandated use and incentives. In fact, according to one industry assessment of global smart grid projects, government investment propelled nearly all of the initiatives identified across Europe and in seven individual countries.[13] Once installed, smart meter technology usually results in savings for both utilities and consumers, but most utilities are reluctant to invest in the new technology without a government mandate or incentive to do so. Utilities tend to have limited budgets for capital expenditures, and smart meters are among many competing demands for those resources.[14] Further, utilities may not realize the benefits from smart meter installation for several years, making the investment less attractive in the absence of government incentives.

Several countries have enacted legislation mandating adoption of smart meters as part of broader clean energy initiatives. In 2008, for example, the United Kingdom mandated that 53 million smart electric and gas meters be deployed in homes and businesses by 2019, though that deadline was recently extended to 2020 in order to accommodate technological challenges. The program is valued at £12.1 billion ($19.5 billion) and has attracted the interest of a wide range of multinational smart meter manufacturers.[15] Further, the European Union (EU) has enacted a mandate that requires utilities in all of its member states to provide smart meters to 80 percent of their electricity consumers by 2020. This will create substantial new markets for both domestic and foreign suppliers. It is estimated that the market for smart meters in Central and Eastern Europe alone will reach $10.3 billion by 2023.[16] In China, the government released its smart grid plan (Special Planning of 12th Five-Year Plan (2011–15) on Smart Grid Major Science and Technology Industrialization Projects) in May 2012, calling for massive investment in smart grid technology. As part of the plan, the State Grid Corporation of China announced that it would deploy 300 million smart meters by 2015 and up to 380 million meters by 2020.[17]

Direct government funding of smart meter adoption has been more common than legislative mandates. In the United States, for example, the 2009 American Recovery and Reinvestment Act (ARRA) funds specifically earmarked for smart grid development played a significant role in the growth of the domestic market.[18] France has announced a program that would channel $15 billion into digital infrastructure with an allocation for smart meters. The plan calls for the installation of 3 million smart meters by 2016 through the national utility, Électricité de France (EDF), scaling up to 35 million meters by 2020. Up to 80 percent of each meter will be manufactured in France, and smart meters will eventually be exported by EDF, the world's largest producer of electricity.[19] More detailed discussion of markets and drivers in particular countries can be found in the Country Profiles section of this report.

Key industry suppliers

The global smart meter market is supplied by a combination of large multinational firms and smaller local manufacturers. The leading global firms include Landis+Gyr (based in Switzerland but owned by Toshiba Corp. of Japan), GE Digital Energy (United States), Itron (United States), Aclara

[13] The seven countries include Great Britain and Ireland, analyzed separately from Europe more broadly. Global Smart Grid Federation, *Global Smart Grid Federation Report 2012*, 12.

[14] Industry representative, telephone interview by USITC staff, August 30, 2013.

[15] Overall program costs likely include the cost of marketing, metering infrastructure, and other costs, in addition to the cost of the meters. Bakewell, "BT, BAE Poised for U.K.," April 23, 2013; industry representatives, telephone interviews by USITC staff, September 10 and 11, 2013.

[16] SmartGridNews.com, "Regulation and Benefits Push Smart Meter Growth," April 10, 2013.

[17] *Sustainable Business.com,* "Over 300 Million Smart Meters in China by 2015," April 2, 2012; *Business Wire,* "Installed Base of Smart Meters in China," January 15, 2013.

[18] Industry representative, interview by USITC staff, September 10, 2013.

[19] Metering.com, "France's Smart Meter Rollout Gets Go-ahead," July 11, 2013.

(United States), Elster Group (Germany), Sensus (United States) and Holley Metering (China), among others. These companies tend to compete against each other globally to supply most of the largest smart meter markets. In many markets, these leading global firms also face competition from local manufacturers. In China, for example, local manufacturers supply the bulk of the market.

Multinational smart meter suppliers have reportedly encountered a mix of challenges when trying to penetrate certain foreign markets, including requirements to produce a certain share of a meter locally and the imposition of local manufacturing standards that may require significant product modifications, effectively eliminating advantages of scale. Consequently, most suppliers invest directly in major markets and produce smart meters locally, rather than export from their home countries, as a way to meet local-market specifications.[20] Additionally, the location of a smart meter's final assembly often differs from the origin of its components and subassemblies. Toward the end of this paper, country profiles highlight some specific issues encountered in certain important smart meter markets.

U.S. Smart Meter Market

Demand

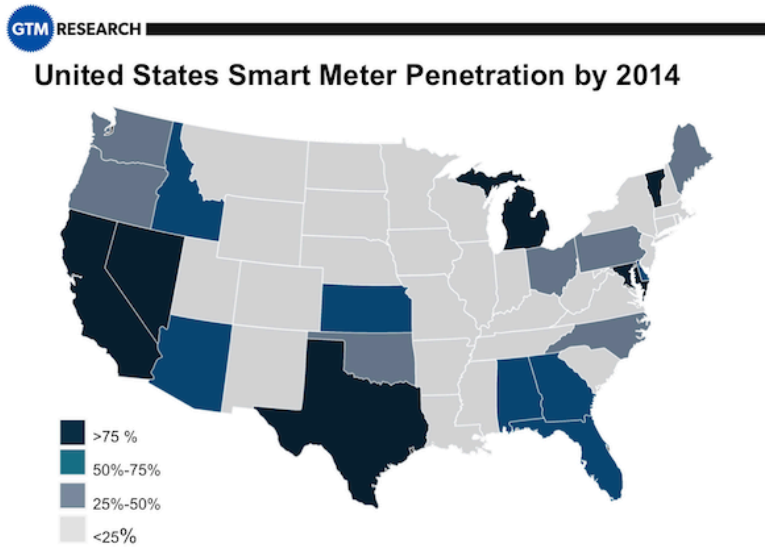
U.S. demand for smart electricity meters comes from a broad range of commercial and personal home users. According to the Federal Energy Regulatory Commission (FERC), as of December 2012, U.S. smart electricity meter penetration was estimated at 22.9 percent, or 38.1 million installed smart meters deployed throughout the United States, up from 8.7 percent in 2010.[21] More recent data suggest that the number of advanced meters in the United States may have reached 45.8 million (or 30.2 percent penetration) in 2013. [22]

Nationally, the largest driver of the rollout of smart electricity meter infrastructure has been ARRA, which included funding for the Smart Grid Investment Grant (SGIG) program. More than 50 percent of the $7.9 billion in the SGIG ($3.4 billion from ARRA and $4.5 billion in matched funds from private sector ARRA funding recipients) was designated for advanced metering infrastructure.[23] Five large smart meter manufacturers (Elster, GE Energy, Itron, Landis+Gyr, and Sensus) each received at least $30 million in ARRA funds or matching funds.[24] This funding encouraged utilities and municipalities to start implementing smart metering infrastructure in their communities, and many utilities have started or completed installations of some smart meters. Other utilities are still installing or considering smart meters, but with the end of ARRA funding, this process is moving much more slowly than it did in 2009–10.[25] The Department of Energy reports that although equipment installations continued through 2013, most SGIG-funded meter deployments have already started or even been completed.[26]

[20] Industry representative, telephone interview by USITC staff, August 30, 2013.
[21] FERC, *Assessment of Demand Response,* October 2013, 3.
[22] FERC, *Assessment of Demand Response,* October 2013, 3.
[23] U.S. Department of Energy. Smart Grid Investment Grant Program Progress Report II, October 2013. SGIG funding was a combination of ARRA funding and matched funds from recipients. As of March 31, 2014, SGIG had funded $2.6 billion in AMI smart meters, $0.6 billion in communications infrastructure for metering, $0.6 billion in hardware and IT to support advanced metering functions, and $0.3 billion in other metering costs. The program also included funding for other smart grid improvements: customer assets including communicating thermostats and load control devices, distribution assets like substation monitoring systems and automated distribution management systems, and transmission assets such as phasor measurement units and physical reliability improvements to transmission systems. U.S. Department of Energy, "Advanced Metering Infrastructure and Customer Systems", updated May 6, 2014.
[24] U.S. Department of Energy, *Economic Impact of Recovery Act Investments*, April 2013, 6.
[25] Industry representative, telephone interview by USITC staff, September 10, 2013.
[26] U.S. Department of Energy. Smart Grid Investment Grant Program Progress Report II, October 2013.

State-level policies and incentives and local utilities' willingness to adopt the new technology are also important drivers of U.S. smart meter penetration rates.[27] Both California and Texas have implemented smart grid policies, in part due to rising energy consumption.[28] Many states with high penetration rates for smart electricity meters in 2012 experienced a large increase in total smart meter adoption between 2008 and 2012. The timing of this jump varies by state and may be attributed in part to electric utilities engaging in large smart meter rollouts, some of which came in response to the ARRA funding. California and the District of Columbia topped the list of smart meter penetration rates, at 87.1 percent and 70.5 percent respectively, in 2012. At the opposite end of the spectrum, six states still had advanced smart meter penetration rates of under 1 percent as of December 2012: New York, New Jersey, Hawaii, Rhode Island, Vermont, and West Virginia.[29] Overall, 28 U.S. states are estimated to have smart meter penetration rates of less than 25 percent by 2014 (figure 1).

FIGURE 1 Expected Smart Meter Penetration by U.S. State



Source: GTM Research, cited in Lacey, "The U.S. Smart Meter Market," March 6, 2013.

Currently, most demand for smart meters in the United States is for residential meters, since many U.S. commercial customers have long had smart meters to monitor facility electricity usage more accurately.[30] The bulk of residential smart meters are procured and installed en masse by utilities.

Utilities have a number of strong incentives to implement smart meter infrastructure, including improved data reporting. AMI meters transmit data more frequently than can be done with traditional AMR meters, which allows utility companies to more accurately forecast demand and set rates based on usage. Other, less direct benefits exist as well. Smart metering saves money for electricity providers by allowing them to provide a variety of services remotely, including meter reading, disconnecting and connecting consumers, and identifying issues at the point of service.[31] Utilities are also able to better

[27] In general, smart meter penetration rates refer to the share of AMI smart meters in the total of all installed meters (for individual consumers, businesses, and other entities). FERC, *Assessment of Demand Response,* October 2013, 3.
[28] Industry representative, telephone interview by USITC staff, September 19, 2013.
[29] FERC, Assessment of Demand Response, December 2012, 12.
[30] Industry representative, telephone interview by USITC staff, September 10, 2013.
[31] SMMAA, "What Are Some of the Benefits of Smart Meters?" (accessed March 19, 2013).

monitor consumers, including outage and failure monitoring. Along with alerting utilities to coverage gaps, smart meters can actually transmit "last gasp" messages back to the utility before failure so that utilities can respond rapidly to outages.[32] Customer service can become more efficient, because issues can be automatically flagged by the system rather than requiring a customer report.

Smart meters can also benefit electricity users, as the meters give them ready access to their electricity usage data. With frequent updates, consumers can easily use these data to control usage or costs. Of the 38 million installed advanced electricity meters in the United States as of 2012, 17.5 million smart meter consumers were reported to have online access to their personal electricity usage data through their utility provider. This represents a more than 300 percent increase in smart meter users with Internet access to their personal electricity usage data since 2010.[33]

Another factor that may affect advanced meter adoption is domestic housing starts, which increased in 2013.[34] With smart meters becoming more common, new homes are more likely to have smart meters installed by utilities, increasing both smart electricity meter penetration rates and the absolute number of installed smart meters.[35]

Due to concerns about data privacy and radiation from radio frequency (RF) emissions, some U.S. utilities installing smart meter infrastructure have allowed opt-out programs for customers who prefer not to have smart meters installed at their residence.[36] To allay these concerns, many utilities include a section on their websites explaining why the meters they use are secure. Both utility-sponsored and state government studies into the negative effects of radiation from smart meters have concluded that the level of RF emissions from correctly installed smart meters, even at close range, falls well below Federal Communications Commission (FCC) limits.[37]

Supply

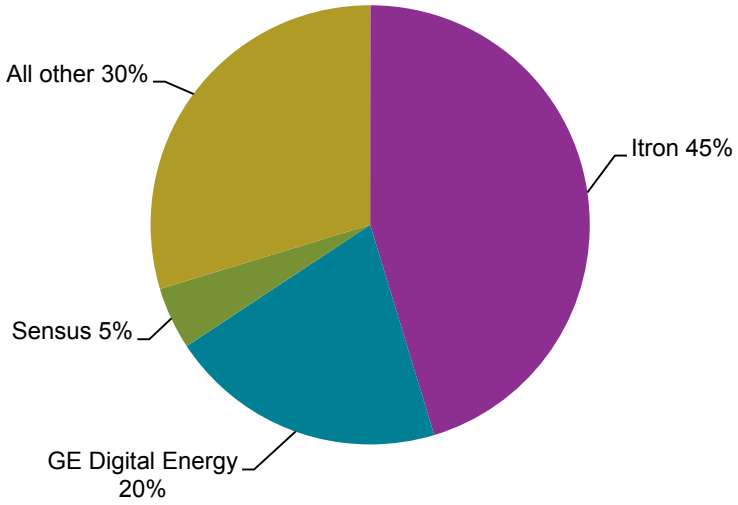
There are roughly 40 U.S. manufacturers of smart meters, though the market is dominated by a few large producers and includes smart meters for electricity, gas, and water. Smart meters for electricity make up almost three quarters of U.S. production, followed by smart meters for gas and then water. According to an industry research analysis, three manufacturing companies in the United States account for more than 70 percent of all domestic revenue in the smart meter market, led by Itron with almost one-half the market (figure 2). In 2012, U.S. employment for production of all types of smart meters was at just over 2,000 individuals.[38]

The members of the Smart Meter Manufacturers Association of America (SMMAA)[39] reportedly account for almost all U.S. smart meter production, and they also supply a large share of the international market.[40] Most SMMA members (with the exception of GE Energy) entered the electricity meter industry between 2002 and 2004 by acquiring smaller, privately owned electricity meter producers. In fact, in

[32] FERC, Assessment of Demand Response & Advanced Metering Staff Report, December 2012, pg 16.
[33] Ibid., pg 13.
[34] Samadi, *Smart Meter Manufacturing in the US*, December 2012, 4; U.S. Census Bureau, "New Residential Construction in March 2014," April 16, 2014 (accessed May 9, 2014).
[35] Samadi, Smart Meter Manufacturing in the US, December 2012, 5.
[36] Samadi, Smart Meter Manufacturing in the US, December 2012, 6.
[37] Edison Electric Institute, "A Discussion of Smart Meters and RF Exposure Issues" (accessed November 21, 2013); California Council on Science and Technology, "Health Impacts of Radio Frequency Exposure," April 2011; Vermont Department of Health, "Radio Frequency Radiation and Health: Smart Meters," February 10, 2012.
[38] Samadi, Smart Meter Manufacturing in the US, December 2012.
[39] As of December 2013, SMMAA members included Elster Solutions LLC, GE Energy, Itron Electricity Metering Inc., Landis+Gyr Inc., and Sensus USA Inc. Echelon Corp. was a member of SMMAA earlier in 2013, but was not included in the membership list in December 2013. See the SMMAA website at http://smmaa.org/about/ (accessed December 13, 2013).
[40] Industry representative, telephone interviews by USITC staff, August 30, 2013.

recent years there has been considerable merger and acquisition (M&A) and consolidation activity in the companies supplying the U.S. market, both those with and those without U.S. production facilities (table 1). Examples include Toshiba Corporation's acquisition of Landis+Gyr in 2011 and London-based investment company Melrose PLC's acquisition of Elster in 2012. Additionally, in August 2013, ESCO Technologies, a utility technology company based in St. Louis, Missouri, announced its intention to sell its U.S. subsidiary and mid-tier smart meter producer, Aclara, due to Aclara's inability to compete with larger international smart meter producers.[41]

FIGURE 2 U.S. smart meter market share, 2012



Source: Samadi, *Smart Meter Manufacturing in the US*, December 2012

[41] No sale had been announced when this report was published. St. John, "ESCO to Sell Its Aclara Smart Meter Unit," August 9, 2013.

TABLE 1 Mergers and acquisitions involving major suppliers to the U.S. market, 2003-13

Company	Date	Merger/acquisition
Sensus	2003	Sensus was originally a subsidiary of a UK-based company, but was spun off as a wholly owned subsidiary in December 2003 through an acquisition of Invensys Plc, a metering systems company.
Itron	2004	Itron entered the electricity meter manufacturing business with the acquisition of Schlumberger Electricity Metering.
	2007	Itron expanded its presence in smart meters with the acquisition of Actaris Metering Systems S.A.
Elster	2002	Elster Electricity LLC, formerly known as ABB Electricity Metering, acquired Ruhrgas Industries, an electricity and water meter producer.
	2010	Elster Integrated Solutions, LLC, merged with its sister company Elster Electricity, LLC; Elster Electricity, LLC was the surviving entity.
	2012	Elster Group was acquired by Mintford AG (Germany), a wholly owned subsidiary of Melrose PLC (United Kingdom), for $2.3 billion and became a privately held company.
Landis + Gyr	2004	Landis+Gyr was acquired by Australia-based Bayard Capital, owner of the British metering company Ampy Automation-Digilog. Bayard Capital continued to acquire metering firms, extending the Landis+Gyr name to all metering products by 2008.
	2006	Landis+Gyr acquired Enermet Group (Finland), Hunt Technologies (United States) and Cellnet Technologies (United States).
	2011	Toshiba Corporation (Japan) acquired Landis+Gyr for $2.3 billion.
Echelon	2010	Echelon acquired Xtensible Solutions, Inc. (US), and its subsidiary, Aclara (US), a smart meter producer.
	2013	Echelon announced its intention to sell Aclara due to lackluster meter sales.
GE Energy	2011	GE acquired UK-based start-up Remote Energy Monitoring, Ltd., with operations in the United Kingdom and Australia.
	2011	GE acquired France-based electricity and automation equipment company Converteam for $3.2 billion, changing the company name to GE Power Conversion in 2012.

Sources: Company websites, news releases, and annual reports of Sensus, Itron, Elster, Landis+Gyr, Echelon, and General Electric.

Moreover, Sensus, Itron, and Elster have only a limited number of manufacturing facilities that produce or assemble smart meters in the United States (table 2). GE Energy appears to be the only SMMA member ramping up smart meter manufacturing in the United States. In July 2013, the company announced plans to start manufacturing smart electricity meters in its Chicago plant in order to fulfill a $200 million contract with the Illinois electricity provider, ComEd.[42] GE previously set up a manufacturing facility in 2009 to assemble and test smart electricity meters as part of a contract with Florida Power and Light to install 4.5 million smart meters across 35 counties in Florida.[43]

[42] Bomkamp, "GE to Make Smart Meters in Chicago," July 9, 2013.
[43] *GE Reports,* "Smart Move: Big Data Leads," July 11, 2013.

TABLE 2 Key smart electricity meter suppliers to U.S. market

Smart meter producer (HQ location)	U.S. manufacturing locations for electricity meters	Worldwide manufacturing locations for electricity meters	Other U.S. presence related to smart electricity meters
Sensus (Raleigh, North Carolina)	DuBois, PA Texarkana, AR Uniontown, PA	Ciudad Juarez, Mexico Santiago, Chile El Eulma, Algeria Laatzen, Germany Ludwigshafen, Germany Stara Tura, Slovakia Temara, Morocco Beijing, China Fuzhou, China	Offices in Alpharetta, GA; Boise, Idaho; Covington, LA; Morrisville, NC; Pittsburgh, PA; Santa Barbara, CA
Landis + Gyr (Zug, Switzerland)	None	Reynosa, Mexico Baddi, India Joka, India Zhuhai, China Corinth, Greece Fehraltorf, Switzerland Isando, South Africa Jyska, Finland Nuremberg, Germany Northfields, Great Britian Prague, Czech Stockport, Great Britian Zug, Switzerland	R&D facilities in Alpharetta, GA Lafayette, IN and Pequot Lakes, MN. Sales offices and service centers in Austin, TX; Colorado Springs, CO; Dallas, TX; Decatur, IL; Hamden, CT; Huntington Beach, CA; Indianapolis, IN; Jacksonville, FL; Kansas City, MO; Kirkland, WA; Lenexa, KS; Morton, IL; New Haven, CT; New York, NY; Pittsburgh, PA; Roseville, MN; Waukesha, WI
Itron (Liberty Lake, Washington)	Oconee, SC Jackson, MS	Barcelona, Spain Godollo, Hungary Al-Khobar, Saudi Arabia Kuala Lumpur, Malaysia Cikarang, Indonesia Sumaré, Brazil Atlantis, South Africa	R&D facilities and sales offices in San Diego, CA; Raleigh, NC; Excelsior, MN; Boston, MA; Owenton, KY; San Mateo, CA; Oakland, CA; Davis, CA; Vancouver, WA
Elster (Essen, Germany)	Tempe, AZ	San Luís Potosí, Mexico Johannesburg, South Africa Beijing, China Nanjing, China Guangzhou, China Kwai Chug, Hong Kong Kwai Fong, Hong Kong Damam, India Mumbai, India Almaty, Kazakhstan Broadmeadows, Australia Burlington, Canada Vienna, Austria Bucharest, Romania Ghiroda, Romania Istanbul, Turkey Mainz-Kastel, Germany Budapest, Hungary Kyiv, Ukraine Moscow, Russia Chesterfield, United Kingdom Stafford, United Kingdom Dubai, United Arab Emirates	Raleigh, NC (currently software support for smart electricity meters; discontinued smart meter production at this location)

Sources: Company websites of Itron, Elster, Sensus and Landis + Gyr.
Note: GE Energy is another significant supplier to the U.S. market. However, there was insufficient publically available information on GE's global operations to include a thorough presentation of the firm in this table.

Other smart meter companies have decreased their U.S. manufacturing in recent years, but continue to have a U.S. presence through their sales offices or research and development (R&D) facilities. For example, Elster's location in Raleigh, North Carolina, continues to be a R&D and solutions support system for smart meters, despite Elster recently moving its manufacturing from North Carolina to its facility in San Luís Potosí, Mexico.[44] Landis+Gyr is the only SMMA member that does not appear to have any manufacturing or assembly production plants in the United States. Landis+Gyr's main production facility for the North American smart meter market produces over 4.8 million smart meters per year in Reynosa, Mexico.[45] Landis+Gyr does have three R&D facilities and numerous sales offices and service centers throughout the United States.[46]

Smart meter manufacturers are struggling with slowing smart meter sales after the end of the rollout of the ARRA, which helped boost smart meter installations in the U.S. from 2009 to 2011. From 2007 to 2012, smart meter revenues grew at an average rate of 17.7 percent per year to $884.9 million, but fell 8.6 percent in 2012 as stimulus funds dried up and infrastructure upgrades slowed.[47] In response to the decline in U.S. smart meter sales, some smart meter producers have laid off U.S. employees and closed manufacturing facilities. For example, in September 2013, Itron announced plans to lay off 9 percent of its workforce, including U.S. employees and production workers outside of North America. In May 2012, Echelon announced that it planned to lay off up to 10 percent of its workforce, including some U.S. employees. Echelon stated that the layoffs were due to the company's focus on production of cheaper smart meters for emerging markets in Asia, India, Latin America, and the Middle East.[48] Stating that the smart meter industry is "nearing a saturation point in the United States," Elster moved its smart meter manufacturing operations from the United States to Mexico in January 2013.[49]

New entrants to the U.S. smart meter market face several relatively high barriers. First, existing firms have deep technical expertise and are constantly improving product functionality. Second, many U.S. smart meter manufacturers are vertically integrated, and able to provide both the smart meters and the communication infrastructure and technology associated with the meter. Potential new entrants also face challenging product testing and qualification requirements. Further, the leading suppliers tend to have deep and long-standing relationships with their major utility customers.[50]

In addition to the manufactured physical meters, supplies of services and peripheral goods generate revenue for this industry. Both manufacturers and independent consulting firms market software systems and services for smart meter data monitoring and demand response management. Multiple manufacturers can provide smart meter hardware, smart meter data extraction solutions like software and communication infrastructure, or both, according to customer demand.[51]

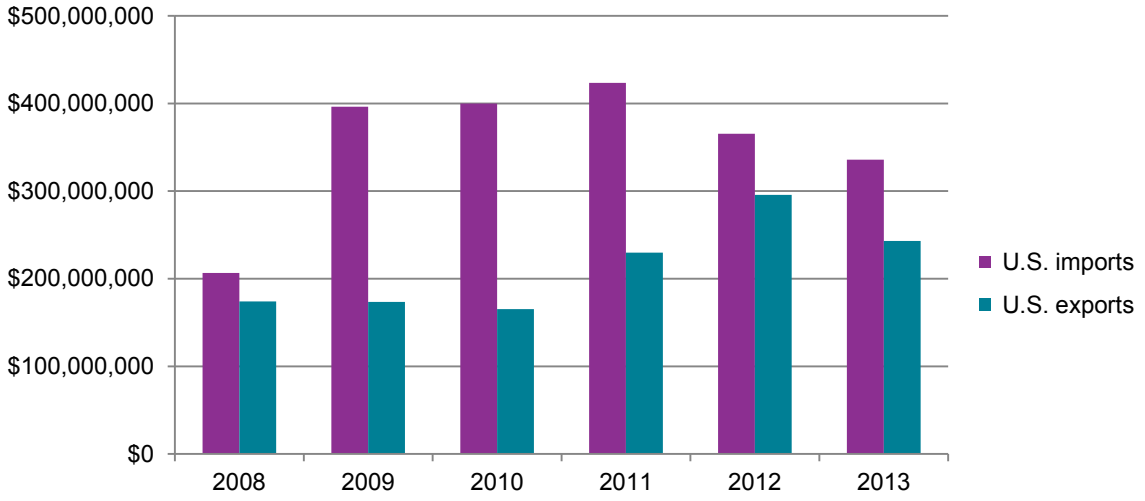
[44] Bagley, "Elster Work Done in Raleigh Moving to Mexico," January 31, 2013.
[45] Landis+Gyr, "Landis+Gyr's Mexico Smart Meter Facility Recognized," September 16, 2009.
[46] Landis+Gyr website, "Global Organization," http://www.landisgyr.com/about/worldwide-locations/ (accessed March 27, 2014).
[47] Samadi, *Smart Meter Manufacturing in the US,* December 2012.
[48] St. John, "Echelon Launches Cheaper Meter," May 10, 2012.
[49] Bagley, "Elster Work Done in Raleigh Moving to Mexico," January 31, 2013.
[50] Industry representatives, telephone interviews by USITC staff, August 30, 2013 and September 19, 2013.
[51] Industry representatives, telephone interviews by USITC staff, August and September 2013.

U.S. Trade in Smart Meters

U.S. trade flows

U.S. bilateral trade flows reflect firms' production strategies for smart electricity meters. Some manufacturers have U.S. production facilities to supply domestic demand, while others solely import meters assembled abroad.[52] U.S. import and export statistics for all types of electricity meters, classifiable under HTS 9028.30.0000, are presented in figure 3.[53] Although the annual values include a broader set of products, smart electricity meters are estimated to account for 90-95 percent of all electricity meters imported by the United States. The United States is a net importer of electricity supply and production meters, though the trade deficit has narrowed since its 2010 peak. In 2013, the United States exported 2.1 million electricity meters; while these were distributed worldwide, they went primarily to the United States' partners in the North American Free Trade Agreement (NAFTA)—Canada (which took more than half) and Mexico (figure 4). The United States imported 6.9 million electricity meters in 2013; again, while these came from a variety of countries, they were predominantly sourced from neighboring Mexico (figure 5).[54] According to company websites, Sensus, Elster, and Landis+Gyr have manufacturing plants in Mexico that produce smart meters.

FIGURE 3 U.S. imports and exports of electricity meters, by value, 2008–13



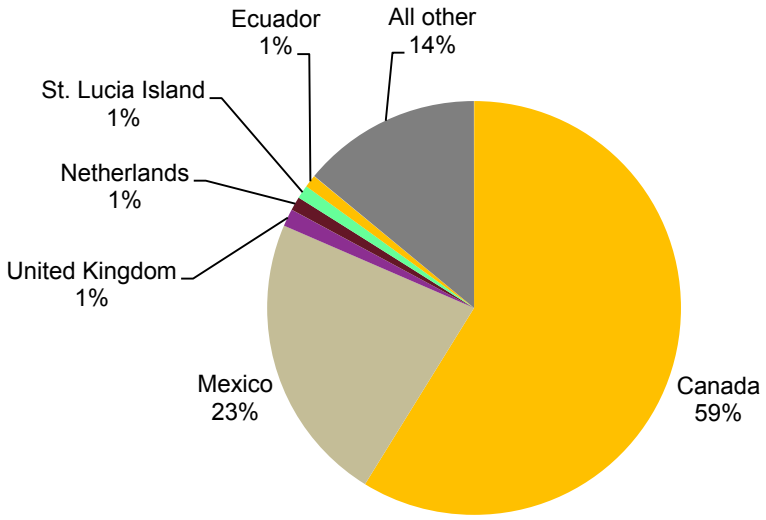
Source: USITC, Dataweb (accessed February 26, 2014).

[52] Industry representative, telephone interview by USITC staff, September 11, 2013.

[53] U.S. trade in smart electricity meters is not distinguished separately in U.S. trade statistics from that for conventional electricity meters. Likewise, worldwide trade statistics are also not readily available specifically for smart electricity meters.

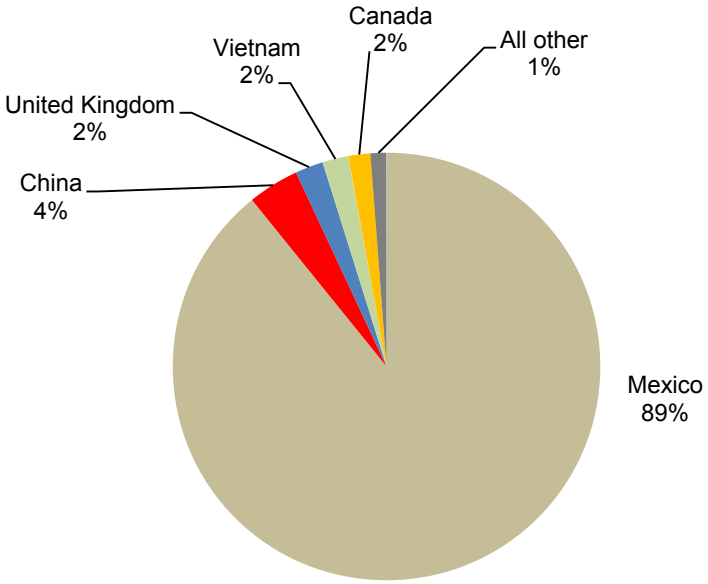
[54] Includes smart meters used for electricity, natural gas, and water. Electricity meters reportedly account for 72 percent of the industry total, by value. Industry representatives, telephones interviews by USITC staff, September 11 and 19, 2013; Samadi, *Smart Meter Manufacturing in the US,* December 2012, 15.

FIGURE 4 Share of U.S. exports of electricity meters, by value, 2013



Source: USITC, Dataweb (accessed February 14, 2014).

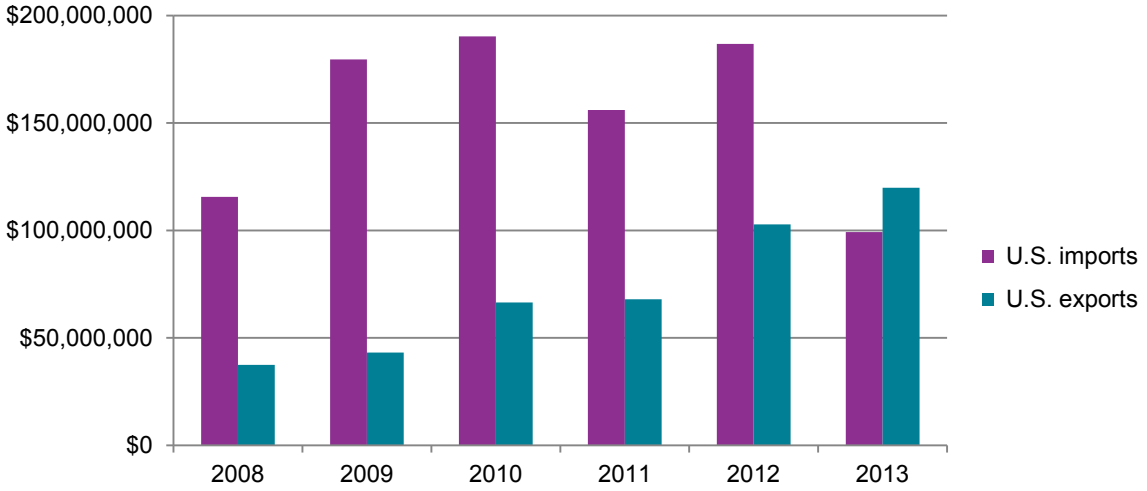
FIGURE 5 Share of U.S. imports of electricity meters, by value, 2013



Source: USITC, DataWeb (accessed February 14, 2014).

Smart electricity meter manufacturers source the parts and components for their U.S. production facilities from both the United States and abroad.[55] U.S. import and export statistics for parts and components for all types of electricity supply or production meters, classifiable under HTS 9028900040, are shown in figure 6.[56] The values also are likely overstated for export and import flows of such parts and components specifically for smart electricity meters. However, U.S. import and export values for parts and components were significantly smaller than the corresponding values for complete electricity meters. Asia was reported as the predominant source for parts and components assembled into smart electricity meters for the U.S. market.[57]

FIGURE 6 U.S. imports and exports of parts and components for electricity meters, by value, 2008–13



Source: USITC, Dataweb (accessed February 26, 2013).

The level of U.S. exports of smart meters is considered relatively low by industry representatives, as U.S.-based firms tend to manufacture locally or regionally to meet foreign specifications[58] and to demonstrate a commitment to large or growing markets.[59] An industry analysis reported Canada and Mexico as the predominant foreign destinations for U.S.-origin smart meters that are shipped abroad; together, they accounted for 79 percent of all U.S. exports by value in 2012.[60] The United States' output of smart electricity meters is not shipped in significant volumes to South America, Europe, or Asia, because these regions each host their own local manufacturing facilities for smart electricity meters. However, some U.S.-made parts and components are reportedly exported to assembly facilities located abroad.[61]

[55] Industry representatives, telephone interviews by USITC staff, September 11 and 19, 2013.

[56] U.S. trade in parts and components for smart electricity meters is not distinguished separately in U.S. trade statistics from that for conventional electricity meters. Likewise, worldwide trade statistics are also not readily available specifically for parts and components specifically for smart electricity meters.

[57] Industry representative, telephone interview by USITC staff, September 19, 2013.

[58] Industry representative, telephone interview by USITC staff, September 10, 2013.

[59] Industry representative, telephone interview by USITC staff, August 30, 2013.

[60] Includes smart meters used for electricity, natural gas, and water. Electricity meters reportedly account for 72 percent of the industry total, by value. Samadi, *Smart Meter Manufacturing in the US*, December 2012, 14.

[61] Industry representatives, telephone interviews by USITC staff, August 30 and September 10, 2013.

Barriers to trade

In the global market for smart electricity meters, vendors contend with tariffs as well as nontariff measures which often tend to take the form of regional or local technical standards. However, many manufacturers do not consider these differing technical standards and requirements to be barriers, per se,[62] due to their capabilities and willingness to tailor their metering products to meet the customer's specific grid requirements.[63]

Tariffs

Smart electricity meters are not broken out separately from conventional electricity meters in import tariff classifications. However, most-favored-nation (MFN) applied rates are available for the broader product categories of electricity meters and for parts and accessories thereof entering the major worldwide markets (table 3). As of 2010, these rates were zero for Japan and 5 percent or less, ad valorem, for the United States, the EU, Australia, Canada, and Mexico. MFN applied tariff rates for these products were 10 percent or less, ad valorem, for the Republic of Korea (Korea), India, and China; for Brazil, they were 14–18 percent ad valorem.

MFN applied tariff rates for imports of these products entering the Mexican, Indian, and Brazilian markets are notably below their World Trade Organization (WTO) member bound rates. Nevertheless, Brazil's rates of 14–18 percent reportedly are high enough for smart electricity meter firms to consider it necessary to manufacture within the country to access the Brazilian market.[64]

Nontariff measures

Smart electricity meter manufacturing is considered a global industry with local market differences that may make trade more difficult. Specifically, a vendor's metering products must meet the local standards and regulations that govern the utilities operating in each market.[65] Among the more prominent obstacles to exporting cited by industry representatives are (1) metering product standards, (2) telecommunications policies and standards, (3) local-provider preferences, and (4) local-content requirements.[66]

Electricity meters must reliably perform over the long term on the electric power grid, while being continuously exposed to varying environmental conditions and periodically subject to lightning strikes.[67] For product quality and performance assurance, the North American metering market is governed by American National Standards Institute (ANSI) standards.[68] By contrast, most markets outside of North America are governed by International Electrotechnical Commission (IEC) standards.[69] However, IEC member states can have custom metering standards within the IEC framework—standards that pose economies-of-scale issues for metering product vendors.[70] For example, in Australia, the states and territories have a mix of IEC and ANSI standards, which drives up costs for metering products which must meet different sets of standards.[71] Other markets are governed by neither ANSI nor IEC standards:

[62] Industry representative, telephone interview by USITC staff, September 19, 2013.
[63] Industry representatives, telephone interviews by USITC staff, September 11 and 19, 2013.
[64] Industry representative, telephone interview by USITC staff, August 30, 2013.
[65] Industry representative, telephone interview by USITC staff, September 19, 2013.
[66] Industry representatives, telephone interviews by USITC staff, August 30 and September 10, 2013.
[67] Industry representative, telephone interview by USITC staff, September 19, 2013.
[68] Industry representatives, telephone interviews by USITC staff, September 10 and 19, 2013.
[69] Industry representative, telephone interview by USITC staff, September 10, 2013.
[70] Industry representative, telephone interview by USITC staff, August 30, 2013.
[71] Ibid.

TABLE 3 World Trade Organization (WTO) members' bound and most-favored-nation (MFN) applied import duty rates (percent ad valorem, unless noted otherwise) for electricity meters and parts and accessories thereof

WTO member	Harmonized System code	Description	Bound duty rate	Implementation year	MFN applied duty rate	Year
Australia	902830	Electricity meters	5	1995	5	2010
	902890	Parts and accessories	5	1995	0	2010
Brazil	902830	Electricity meters:				
	90283011	Numerical (digital)	35	1995	14	2010
	90283019	Others	35	1995	18	2010
	90283021	Numerical (digital)	35	1995	14	2010
	90283029	Others	35	1995	18	2010
	90283031	Numerical (digital)	35	1995	14	2010
	90283039	Others	35	1995	18	2010
	90283090	Others	35	1995	18	2010
	902890	Parts and accessories:				
	90289010	Of electricity meters	35	1995	16	2010
Canada	90283000	Electricity meters	5.1	1995	5	2008
	902890	Parts and accessories:				
	90289010	Transducers	5.1	1995	([a])	([a])
	90289094	Of the goods of tariff item No. 9028.20.20 or 9028.30.00	0	1995	0	2010
China	902830	Electricity meters:				
	90283010	Watt-hour meters	10	2001	10	2010
	90283090	Other	10	2001	10	2010
	902890	Parts and accessories:				
	90289010	For technical use	8.4	2001	8.4	2010
	90289090	Other	8.4	2001	8.4	2010
EU	90283000	Electricity meters:				
	90283011	For single-phase	2.1	1999	2.1	2010
	90283019	For multi-phase	2.1	1999	2.1	2010
	90283090	Others	2.1	1999	2.1	2010
	902890	Parts and accessories:				
	90289010	For electricity meters	2.1	1999	2.1	2010
	90289090	Others	2.1	1999	2.1	2010
India	902830	Electricity meters	40	1995	10	2009
	902890	Parts and accessories	40	1995	8	2009
Japan	902830	Electricity meters	0	1995	0	2010
	902890	Parts and accessories	0	1995	0	2010
Korea	902830	Electricity meters:				
	9028301010	Not less than 50 amps	9	1995	8	2010
	9028301020	Less than 50 amps	9	1995	8	2010
	9028302000	Calibrating meters	9	1995	8	2010
	9028900000	Parts and accessories	9	1995	8	2010
Mexico	902830	Electricity meters:				
	90283001	Watt-hour meters	35	1995	5	2010
	90283099	Others	35	1995	0	2010
	902890	Parts and accessories:				
	90289001	For watt-hour meters	35	1995	0	2010
	90289099	Others	35	1995	0	2010
United States	90283000	Electricity meters	16¢ each + 1.5%	1995	16¢ each + 1.5%	2010
	90289000	Parts and accessories	3.2	1995	3.2	2010

Source: World Integrated Trade Solution, WTO Consolidated Tariff Schedule (CTS) database (accessed July 19, 2012).

[a] Not available.

the Brazilian market, for instance, is governed by the Associação Brasileira de Normas Técnicas (ABNT) standards.[72]

In major markets, regulatory authorities have adopted differing technologies for smart electricity meters' two-way communications. In the EU, strict regulation of public, unlicensed radio bands initially encouraged adoption of power-line carrier (PLC) technology. However, reliability concerns about PLC technology have prompted more recent EU consideration of wireless mesh technology (WMT). In comparison, the widespread adoption of WMT in the United States is attributed to the FCC's greater regulatory flexibility with regard to such radio communications bands. Other major markets that have adopted WMT include Australia, Canada, and Japan. China's power grid systems rely on either the more conventional PLC or broadband power line (BPL) technologies for their smart electric meters.[73]

Localization trends may pose problems for vendors to varying degrees. Reportedly, several prominent foreign markets exhibit preferences for local providers, particularly in China, Eastern Europe, India, Japan, and Korea. The Japanese and Korean markets are said to be dominated by parastatal utilities that have singled out domestic partner firms (e.g., Toshiba in Japan) for launching smart meter installations.[74] By contrast, while local-content requirements do exist in a few countries (e.g., in Brazil, Mexico, and Taiwan), industry representatives did not consider them to be a pervasive global problem.[75] In Korea, some local policies require inputs that are only available locally for manufacturing smart electricity meters.[76]

Country Profiles

European Union

Despite the EU's relatively low starting point, policy at the EU and national levels is pushing smart meter initiatives ahead quickly so as to meet the EU's 2020 energy efficiency targets. The Energy Services Directive (2006/32/EC) identified smart meters as one of the main ways to achieve an improvement in energy efficiency.[77] According to the Electricity Directive (2009/72/EC), at least 80 percent of consumers have to be equipped with smart meters by 2020 subject to positive economic assessment of the long-term costs and benefits, to be carried out by each member state.[78]

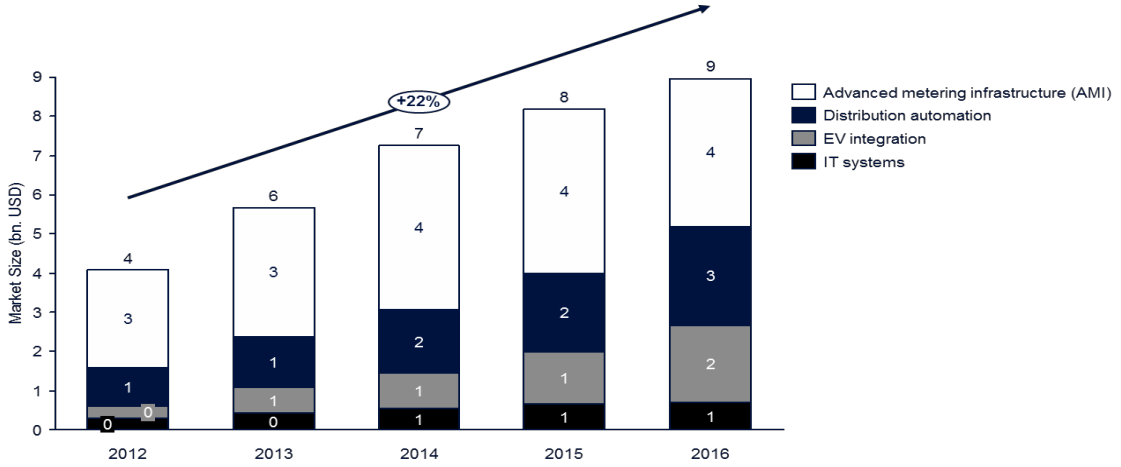
The EU's smart-meter rollout is getting underway. By mid-2011, an estimated 42.3 million smart meters had been installed in the EU, mainly as the result of large rollouts in Italy, Sweden, Finland, and Denmark,[79] and this total is estimated to have risen to 61 million by the end of 2013.[80] Industry observers expect the rollout to gather considerable steam in coming years, with compound annual growth in installed smart meters of nearly 20 percent over the next six years.[81] By mid-2012, the EU Commission

[72] Industry representative, telephone interview by USITC staff, September 10, 2013.
[73] EIA-SAIC, "Selected Country Overviews," October 3, 2011, 1–4.
[74] Industry representative, telephone interview by USITC staff, September 10 and 11, 2013.
[75] Industry representative, telephone interview by USITC staff, August 30, September 10 and 19, 2013.
[76] Industry representative, telephone interview by USITC staff, August 30, 2013.
[77] Article 13(1) of the Energy Services Directive (ESD) demands that member states ensure, if reasonably possible, that end customers are provided with competitively priced individual meters that accurately reflect consumption and provide information on the actual time of use. These do not necessarily have to be smart meters. However, the ESD encouraged member states to begin pilot smart metering projects that were already being promoted by the dominant energy utilities seeking cost savings and compliance with local legal requirements. Hierzinger et al., *European Smart Metering Landscape Report 2012,* October 2012, 12.
[78] The requirement for a "positive economic assessment of long-term costs and benefits" is an important caveat, as a negative assessment allows national governments to halt their EU-required smart-metering programs. European Commission, "Q&A on the Deployment of Smart Electricity Grids," April 2011; Hierzinger et al., *European Smart Metering Landscape Report 2012,* October 2012, 13.
[79] Van der Zanden, "The Smart Grid in Europe 2012–2016," August 16, 2011.
[80] Berg Insight, "Executive Summary," December 2013, 1.
[81] Berg Insight, "Executive Summary," December 2013, 1.

had catalogued about 90 smart metering pilot projects and national roll-outs, as well as 281 other smart grid projects.[82]

However, meeting the EU's smart-metering goals will take some time. By the end of 2013, smart meter penetration for all metered electricity customers was only 22 percent.[83] Navigant Research estimates that total smart meter shipments in Europe in the quarter ending June 30, 2013, represented just 2 percent of the 25.5 million meters shipped globally.[84] It is estimated by industry sources that the installed base of smart meters in Europe will be just under 230 million by 2020,[85] and that the penetration rate for smart meters will approach but perhaps not reach the mandated 80 percent by 2022.[86] The value of smart meter sales in Europe is forecast to grow from around $318 million in 2010 to as much as $1.93 billion in 2017.[87] By 2016, advanced metering infrastructure (AMI) is expected to account for the majority of the EU's total smart grid market with 44 percent, and distributed automation (mainly in the form of automation of secondary substations) is expected to account for 33 percent (figure 7).[88]

FIGURE 7 Growth in European Smart Grid Spending: Average annual growth forecast for 2012–16 is 22 percent



Source: GTM Research, 2011, as cited in Copenhagen Cleantech Cluster, *The Global Cleantech Report 2012*, 141.

The major suppliers of smart meters for the pilot projects, as well as for the national roll-out programs currently underway, include the top five or six global producers, as well as smaller local and Asian producers. Echelon (United States), Elster (Germany), eMeter (founded in the United States, acquired by Germany-based Siemens in January 2012), Itron (United States), and Landis+Gyr (based in Switzerland, acquired by Toshiba of Japan in May 2011), in particular, have participated in a large number of pilot projects and have made an effort to be well placed for supplying the EU's large national

[82] Hierzinger et al., European Smart Metering Landscape Report 2012, October 2012, 3.
[83] Berg Insight, "Executive Summary," December 2013, 1.
[84] Navigant Research, "Smart Grid Deployment Tracker 3Q13," July 2013.
[85] Zpryme Smart Grid Insights, "Abstract: European Advanced Metering Infrastructure," January 25, 2013.
[86] Navigant Research, "Global Smart Meter Unit Shipments Will Peak," July 11, 2013; Berg Insight, "Executive Summary," December 2013, 1.
[87] Frost & Sullivan, "Europe to Experience Five-Fold Growth," October 20, 2011.
[88] Copenhagen Cleantech Cluster, *The Global Cleantech Report 2012*, May 2012, 141–42.

roll-outs.[89] In addition, EDMI, a Singapore-based meter manufacturer, is developing a growing customer base in Europe.[90]

Notwithstanding some regulatory delays, government mandates in the United Kingdom, Spain, and France, in particular, are expected to drive growth in smart meter shipments in Europe through 2020, while Sweden and Italy are already mature markets with 100 percent rollouts completed by 2010.[91] In addition, some Eastern European nations are pursuing smart metering as a means of energy theft reduction.[92] EU member states that have taken the decision to roll out electricity smart meters include the UK, Ireland, Sweden, Finland, Norway, Denmark, the Netherlands, France, Spain, Italy, Austria, Slovenia and Estonia. Following a cost-benefit analysis (CBA) with negative results, Belgium, Lithuania and the Czech Republic decided not to carry out a smart meter rollout. Germany's cost benefit analysis was also negative, and a full-scale rollout is therefore unlikely. Some other countries have not yet finalized their decisions.[93] Further details of the smart meter deployment in major European markets are provided in box 1.

Trade data gathered from *Global Trade Atlas* indicate that the EU is a net importer of the electricity supply or production meters classified under Harmonized System (HS) number 902830, which includes a broad group of meters including smart meters. In 2012, the EU imported more than $300 million of electricity supply and production meters from suppliers outside the EU, and exported less than $200 million of such equipment to customers outside the EU (figure 8). While comparable figures are not available for intra-EU trade (because meters may be re-exported), available 2012 data suggest that intra-EU trade in smart meters is around 2.8 million units, compared with imports of 8.2 million units from non-EU countries. In 2012, the EU exported over 500,000 meters to Saudi Arabia, and more than 150,000 meters each to Switzerland, Colombia, Israel, and Hong Kong. Switzerland, Saudi Arabia and the United States were the leading export market in terms of value (figure 9). Imports of electricity meters from China (over 4.5 million meters) accounted for over half of the EU's total imports in 2012 by volume and value (figure 10). The EU also imported over 1.7 million meters from Tunisia and more than 200,000 meters from Indonesia, Switzerland, and Moldova.[94]

[89] Landis+Gyr has several R&D, production, and assembly facilities across Europe, where it lists E.ON, British Gas, ERDF and ACEA as major customers. Google Maps, Smart Metering Projects; Borska, "Executive Summary," 2nd quarter 2012, 2–3; Toshiba, *Annual Report 2012*, 2012, 20.

[90] EDMI News Release, "EDMI Releases 2010 Financials," March 9, 2011.

[91] Mass rollouts were already completed by the end of 2009 in Italy (36 million meters) and Sweden (5.2 million meters), achieving close to 100 percent smart meter penetration, with investments totaling €2.1 billion and €1.5 billion respectively. EU Commission, Joint Research Center Scientific and Policy Reports, *Smart Grid Projects in Europe*, April 15, 2013, 7, 64.

[92] Navigant Research, "Executive Summary," *Smart Grid Technologies*, 1Q 2013.

[93] Poland, Portugal, Greece, Hungary, and Russia have started initial deployments of smart meters in the pilot phase. GEODE Working Group Smart Grids, "Bringing Intelligence to the Grids," May 2013; EU Commission, *Smart Grid Projects in Europe*, April 15, 2013, 65; Navigant Research, "Executive Summary," *Smart Grid Deployment Tracker 3Q13,* July 2013; Pike Research, "Executive Summary," 3Q 2012; Berg Insight, "Executive Summary," December 2013, 1.

[94] This information as well as the information presented for other foreign markets was gathered using HS subheading 902830 (Electricity Supply or Production Meters) for both imports and imports from the Global Trade Atlas database. Smart meters may also fall under HS subheading 902890 (Parts and Accessories of Gas, Liquid, or Electricity Supply or Production Meters, Including Calibrating Meters). However, since this HS category is too broad and the unit of measure is kilograms, we present data only for HS 902830. GTIS, Global Trade Atlas, "HS number 902830, Electricity Supply and Production Meters" (accessed November 22, 2013).

BOX 1 Smart Meter Deployments in Major European Markets

United Kingdom: The UK government has mandated a full rollout of smart meters and other smart grid improvements to deregulated utilities. Its strategy was to have an initial preparation phase, including consultation with industry, consumer groups, and other stakeholders, in 2011–2013. This was to be followed by an implementation phase starting in 2014 and running through 2019 to install 53 million smart meters in 30 million homes and businesses. The total cost of the project was estimated to be about £11 billion ($17 billion).[a]

In December 2012, the UK government published its decisions on rules for consumer engagement, privacy, and security, establishing the following requirements: (1) consumers will be able to choose the frequency with which their energy suppliers can access their consumption data; (2) energy suppliers will not be able to use energy consumption data for marketing purposes without explicit consent from consumers; and (3) suppliers must remind their customers of their previous privacy choices and give them opportunities to change their minds. In May 2013, the government announced that the rollout phase would be delayed by one year to 2015–20, in order to allow industry suppliers more time to prepare. In particular, the communications infrastructure needs further trial and testing, which is a complex exercise. Shipments of smart meters have not been very significant to date, but manufacturers are confident that the expected large deployment will materialize in the next few years in line with the government timetable. For example, Centrica (parent company of British Gas) deployed 1 million smart meters in the first half of 2013, and in September 2013, British Gas announced that it had awarded a £600 million contract to Landis+Gyr to supply a large portion of the 16 million smart meters British Gas expects to install in UK homes. Most British smart meters are joint gas and electricity meters.[b]

France: France is just beginning its large nationwide rollout. Per a July 2013 decision, the government plans to initiate a pilot smart meter program for a widespread deployment of 35 million new smart meters from 2014 to 2020. The government is expected to begin procurement for its national rollout in 2013.[c]

Spain: The Spanish smart meter rollout is underway and is expected to gather pace in coming years, with the upgrading of around 29 million meters. In mid-2012, smart meter shipments in Spain were running at an annual rate of more than 1 million units. A year later, it was reported that Spain continues to deploy smart meters in sizable volumes. For example, Endesa completed a program installing 3.5 million smart meters by the end-April 2013, equivalent to about 30 percent of the existing residential meters in Spain.[d]

Germany: Of the five largest countries in the EU, representing around 60 percent of the EU's potential smart meter market, only Germany has yet to make an explicit commitment to a nationwide rollout, which is expected to cost as much as €33 billion. Although smart meters have been required after major renovations and on new buildings since 2010, the rollout to existing homes has remained in the pilot phase, awaiting the outcome of the required cost-benefit analysis. (By mid-2012, about 500,000 meters had been deployed as part of large-scale pilot projects.) In August 2013, the Federal Ministry of Economics issued a report concluding that a full rollout of smart meters would not deliver economic benefits for German consumers. As a result of the report, Germany has delayed its full rollout until at least 2020. Concerns about privacy and retention of personal data and patterns of energy use figured strongly in the survey responses from some energy users, indicating the depth of public concern about the potential for breaches of privacy.[e]

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[a] Greenbang, "UK 53 Million Smart Meter Rollout," March 30, 2011; Flood, "Britain's 'Smart Meter' Project Delayed," May 13, 2013.

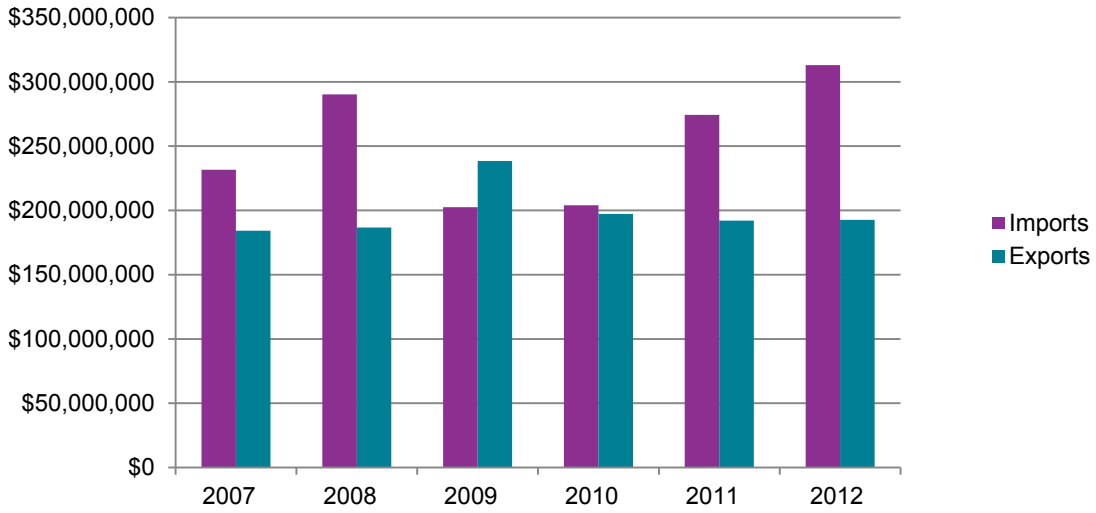
[b] UK, DECC, "Key Milestones for Smart Meters Rollout," December 12, 2012; UK DECC, "Smart Meters Programme Delivery Plan," May 10, 2013; Flood, "Britain's 'Smart Meter' Project Delayed," May 13, 2013; PennEnergy, "Key Milestone Hit for UK Smart Meter Rollout," December 12, 2012; Centrica, "Milestone Moment," July 23, 2013; Navigant Research, "Global Smart Meter Unit Shipments Will Peak," July 11, 2013; Toshiba/Landis+Gyr, "British Gas and Landis+Gyr Announce," September 16, 2013.

[c] Navigant Research, "Global Smart Meter Unit Shipments Will Peak," July 11, 2013; Pike Research, "Executive Summary," 3Q 2012.

[d] Berg Insight, "Executive Summary," December 2013, 1; Pike Research, "Executive Summary," 3Q 2012; Navigant Research, *Smart Grid Deployment Tracker 3Q13,* July 2013; Endesa, "Endesa Leads Remote Management in Spain," May 20, 2013.

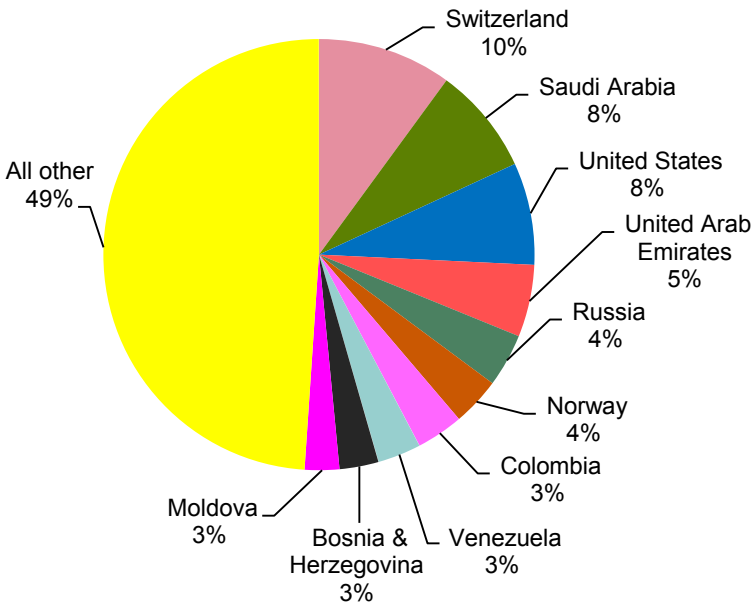
[e] Pike Research, "Executive Summary," 3Q 2012; Lang, "Smart Meters Mandatory in New Buildings," January 1, 2010; Copenhagen Cleantech Cluster, *The Global Cleantech Report 2012*, May 2012, 141; Bayar, "Will Germany Reject Smart Meters?" September 17, 2013; Berg Insight, "Executive Summary," December 2013, 1.

FIGURE 8 EU-28's imports and exports of electricity meters, by value, 2007–12



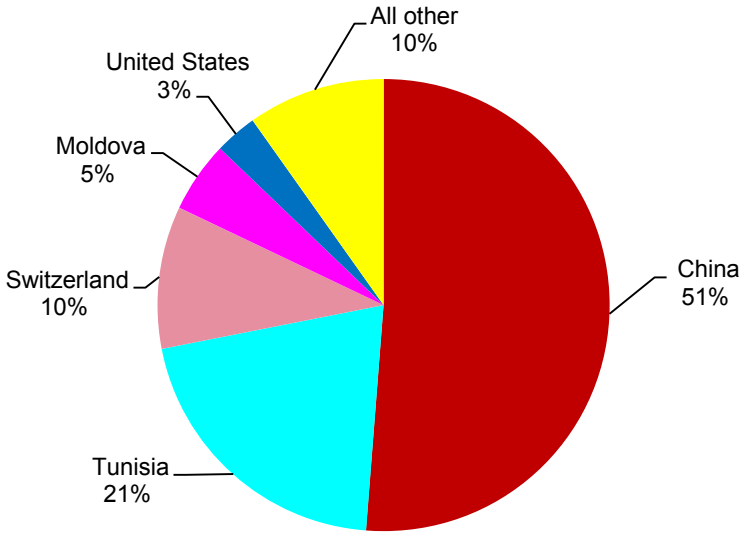
Source: Global Trade Atlas (accessed January 6, 2014).

FIGURE 9 Share of EU-28's exports of electricity meters, by value, 2012



Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

FIGURE 10 Share of EU-28's imports of electricity meters, by value, 2012

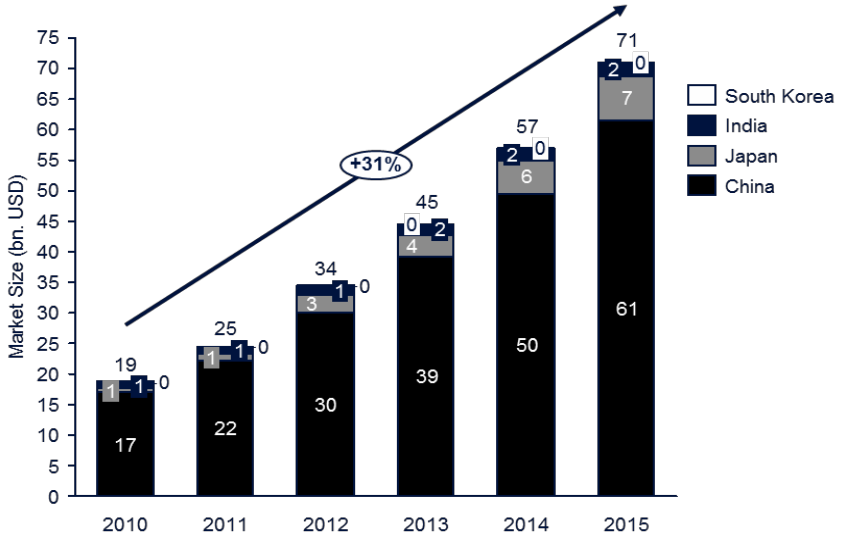


Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

Asia

According to one recent estimate, the combined smart grid technology market for China, Japan, and South Korea (including smart meters but also including transmission and distribution automation equipment and services) totaled nearly $8.5 billion in 2012 and will grow to $19 billion by 2016. China represents about 70 percent of the total, while Japan and Korea represent 20 percent and 10 percent, respectively (figure 11).[95]

FIGURE 11. Asia Smart Grid Market Size



Source: Zpryme, 2011, cited in Copenhagen Cleantech Cluster, *The Global Cleantech Report 2012*, 133.

[95] Bojanczyk and Leeds, "The Smart Grid in Asia, 2012–2016," May 7, 2012.

China

China has become the world's largest market for smart electricity meters as a result of several initiatives by the Chinese national government. The installed base of smart meters in China is expected to grow from 139 million units in 2012 to 377 million units by 2020, reaching 74 percent market penetration.[96] The Smart Grid Corporation of China (SGCC) is China's sole state-owned electric utility company and the largest utility company in the world, affecting 1 billion people. In the past five years, the SGCC has sought ways to upgrade the power industry (including energy-equipment manufacturing), reduce the deployment of new coal-fired power plants, ensure reliable power supply, and maintain national power security.[97]

China hopes to phase out traditional electric meters by 2016.[98] Smart meter bids for future projects across China added up to 76 million units in 2012, with single-phase meters that serve homes and small to medium-sized businesses accounting for 92 percent of that total.[99] Reportedly, China's customer base demands smart meters at price points of less than $50 per unit for residences, less than half of the typical price in North American and European smart meter markets.[100]

China's smart meter industry is served by both domestic and foreign companies, although the market remains highly fragmented. For example, three of China's top smart meter producers, Wasion Group, Linyang Electronics, and Ningbo Sanxing, each held less than 6 percent market share in single-phase meters in 2012.[101] Many Chinese smart meter producers are forming partnerships with foreign companies, allowing the foreign firms to penetrate the Chinese market and giving the Chinese firms access to foreign technology.[102] Foreign companies selling smart meters in China through joint ventures include General Electric, Siemens, Schneider Electric, Alstom, Toshiba, and Mitsubishi. [103]

Smart electric meters in China are mainly sold to utilities through centralized bidding.[104] Both foreign and domestic firms have been successful in winning bids. In January 2011, Landis+Gyr was selected by SGCC to supply over 10,000 smart meters for deployment in six provinces.[105] Chinese-based Holley Metering won a SGCC bid worth $53.73 million in 2010.[106] In March 2012, Echelon Corporation, a California-based company, and Holley Metering formed a joint venture company, Zhejiang Echelon-Holley Technology Co., Ltd. (Echelon-Holley), to focus on the development and sales of advanced smart metering products for China.[107] In October 2012, Echelon-Holley received orders from SGCC for 30,000 smart meters for a pilot installation project in the Inner Mongolia autonomous region, and 1,000 smart meters for another pilot project in Shanxi province.[108]

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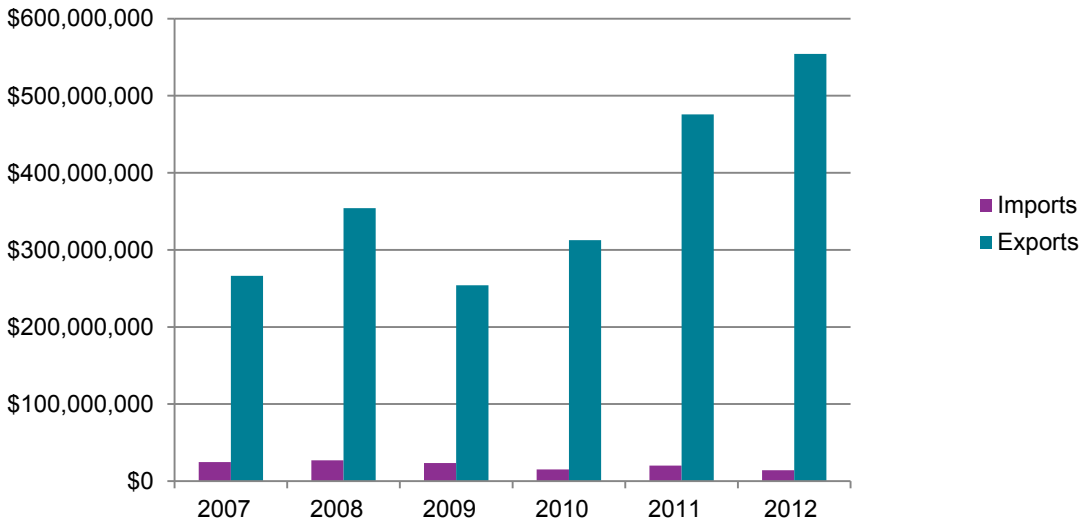
[96] *PV Magazine,* "Smart Meter Market Is Hotting Up in China," May 13, 2013.
[97] State Grid Corporation of China, "Welcome to State Grid Corporation of China Message from President," February 1, 2012.
[98] Ibid.
[99] Greentech Grid, "Some Snapshots of China's Smart Grid," June 25, 2013.
[100] Greentech Grid, "Some Snapshots of China's Smart Grid," June 25, 2013.
[101] Ibid.
[102] St. John, "The China-US-UK Smart Grid Connection," March 27, 2012.
[103] Greentech Grid, "Some Snapshots of China's Smart Grid," June 25, 2013.
[104] "Research and Markets: China Smart Meter Industry Report 2013–2016," September 2, 2013.
[105] Landis+Gyr website, "Landis+Gyr Company Profile." http://www.landisgyr.com/resources/landisgyr-company-profile/ (accessed March 27, 2014).
[106] Fehrenbacher, "A Smart Meter Giant You Never Heard Of," August 10, 2013.
[107] Echelon, "Echelon and Holley Metering to Create Joint Venture," May 27, 2012.
[108] Ng, "China Electricity Meter Market Ranks High," January 7, 2013.

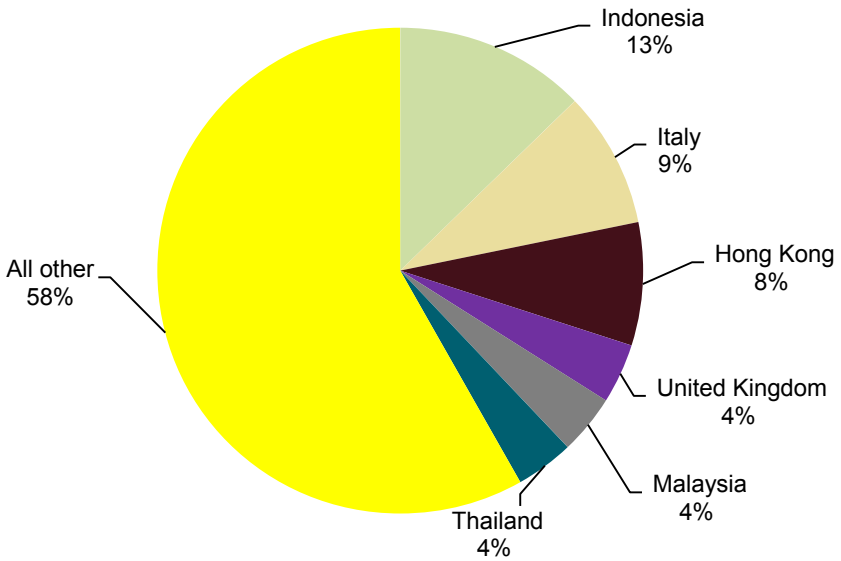
Trade data gathered from the Global Trade Atlas indicates that China is a large net exporter of the electricity supply or production meters classified under HS number 902830, which includes a broad group of meters including smart meters. In 2012, China imported over $14 million of electricity supply and production meters (figure 12), and exported close to $550 million. In 2012, China exported over 3.2 million meters to Indonesia and more than 1.2 million meters each to Thailand, Italy, and the United Kingdom. By value, China's largest export markets for smart meters were Indonesia, Italy, and Hong Kong (figure 13). China imported less than 30,000 electricity meters in 2012, from Japan,

FIGURE 12 China's imports and exports of electricity meters, by value, 2007–12



Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

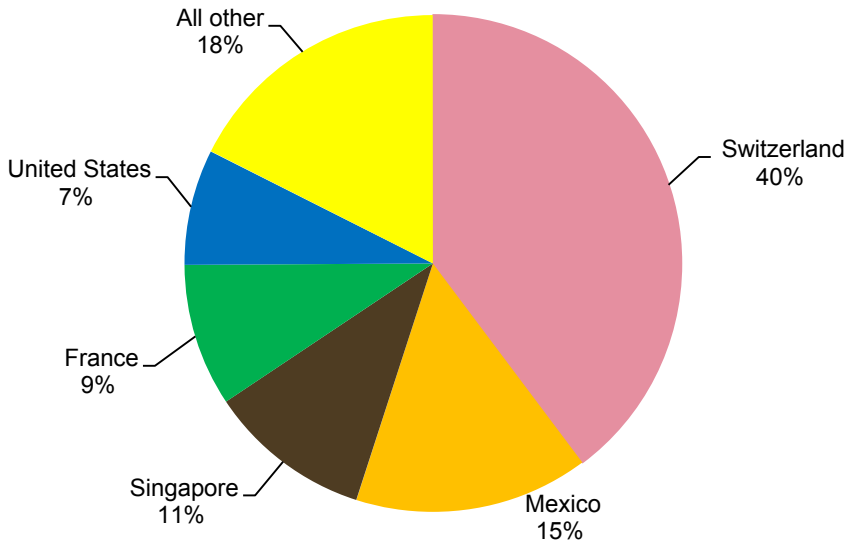
FIGURE 13 Share of China's exports of electricity meters, by value, 2012



Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

Singapore, Thailand, and Mexico, though Switzerland was the leading import source in terms of value (figure 14).

FIGURE 14 Share of China's imports of electricity meters, by value, 2012



Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

India

Although India is one of the fastest-growing economies in the world, its industrial growth has been limited by inadequate energy availability.[109] India ranks sixth in terms of worldwide electricity consumption, yet reportedly suffers from electricity transmission and distribution losses of around 30 percent and a mismatch of supply and demand in electricity of approximately 12 percent. Large companies operating in India often build their own power plants to ensure a reliable supply of electricity, due to frequent blackouts and an inefficient electric supply. Further, a large segment of India's rural population has no access to electrical services.[110]

India's Ministry of Power has been advocating for smart grid investment in recent years in order to cut electricity losses. Industry reports estimate that India will install 130 million smart meters by 2021.[111] India ranks third in the world for smart grid investment, after the United States and China. The India Smart Grid Task Force (ISGTF), an interministerial group that serves as a government focal point for all activities related to smart grid technology, formed a Smart Meter Task Force in March 2011 to advocate for the development of cost-effective smart meters in India. The task force advised the government that India needs 100 million low-cost smart meters, priced between ₹1,000 and ₹1,500 ($16–$25) per meter,[112] in order to feed critical data into the smart grids. This price is considerably lower than

[109] *Metering.com,* "India's Smart Grid to Reach 1.9 Billion by 2015," October 3, 2011.
[110] Tongia, India Country Profile, *IEEE Smart Grid.*
[111] Ghorai, "Reality Check: Are Indian Utilities Prepared?" February 26, 2013; Goswami, "Smart Metering: Energizing India," September 17, 2012.
[112] The Smart Meter Task Force recommended this price point because Indian consumers are price sensitive and consume a low volume of electricity, translating into a low electricity bill per person. Sharada, "Smart Grid on-Ground Report from India," January 25, 2013; Kumar, "Smart Grid in Indian Power System," January 18, 2013; Kumar, "Smart Grid Initiatives in India," September 25, 2012.

the average price of a smart meter in the United States.[113] The Ministry of Power also developed draft specifications for single-phase smart meters in 2012. In the same year, the India Smart Grid Forum—a public-private partnership consisting of utility companies, industry, academics, and other interested parties—released plans calling for smart meters to be the norm for all new connections by 2017.[114]

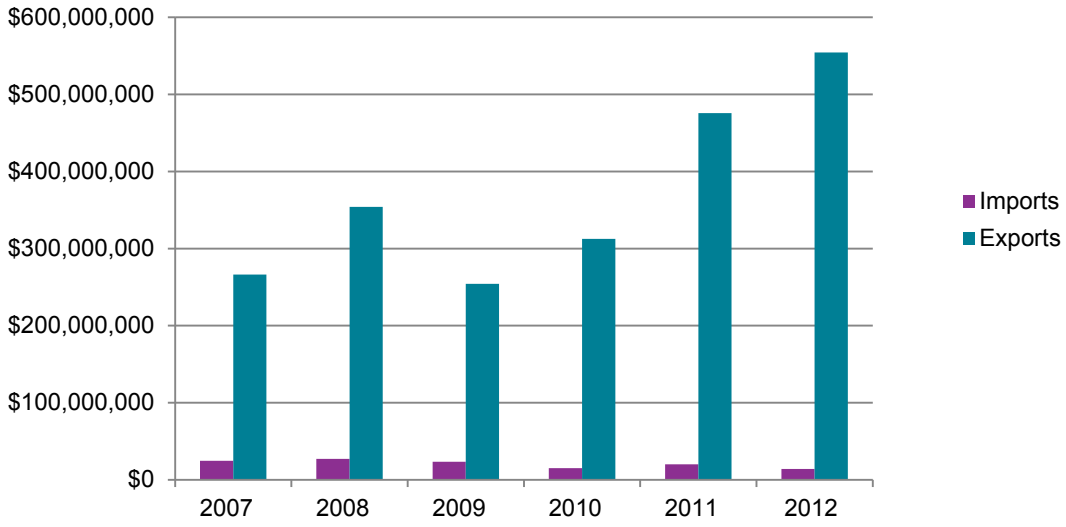
Though the central government's advocacy has helped to promote the technology, regional governments reportedly have been the most proactive in actually implementing smart meters programs.[115] The city of Bangalore launched a program that aims to install one million smart meters in 2012.[116] In 2011, North Delhi Power Limited, a joint venture between Tata Power and the regional Delhi government, installed smart meters on the premises of the largest electricity consumers in Delhi, which represent about 60 percent of the company's revenue.[117]

Indian's regional governments rely on both domestic and foreign manufacturers to supply the smart meters for these initiatives. For example, in India's largest smart meter order to date, Landis+Gyr was chosen by the West Bengal State Electricity Distribution Company to supply 1.5 million smart meters to the city of Kolkata by November 2013.[118] Landis+Gyr produces electricity meters from two factories in India, located in Kolkata and Baddi.[119] Cyan, a UK-based smart meter provider, was chosen as a supplier for Puducherry's pilot project to install smart meters on 87,000 homes over four months in 2013. Smart meters will enable the Puducherry Electricity Board to detect electricity theft much more easily.[120] The smart meters will be evaluated by the Power Grid Corporation of India Limited (PGCIL), a state-owned India enterprise, as part of the test pilot program.[121] Infosys and Wipro are major Indian-based manufacturers of smart meters.[122]

Trade data gathered from the Global Trade Atlas database indicates that India is a large net exporter of the electricity supply or production meters classified under HS number 902830, which includes a broad group of meters including smart meters. India imported close to $3 million of electricity supply and production meters (figure 15), and exported approximately $85 million in 2012. India exported over 400,000 of its electricity supply and production meters to Australia, followed by over 50,000 meters exported to Malaysia, the United Kingdom, and the United Arab Emirates. By value, Australia was again the dominant export destination (figure 16). India's imports of electricity supply and production meters were very limited—less than 5,000 meters each from Hungary, Singapore, Indonesia, and China in 2012; by value, Germany and the United States were the leading foreign suppliers (figure 17).[123] India charges 10 percent for customs basic duty, 12 percent for additional duties, 4 percent for special additional duties, and 3 percent for customs access duties on electricity meters.[124]

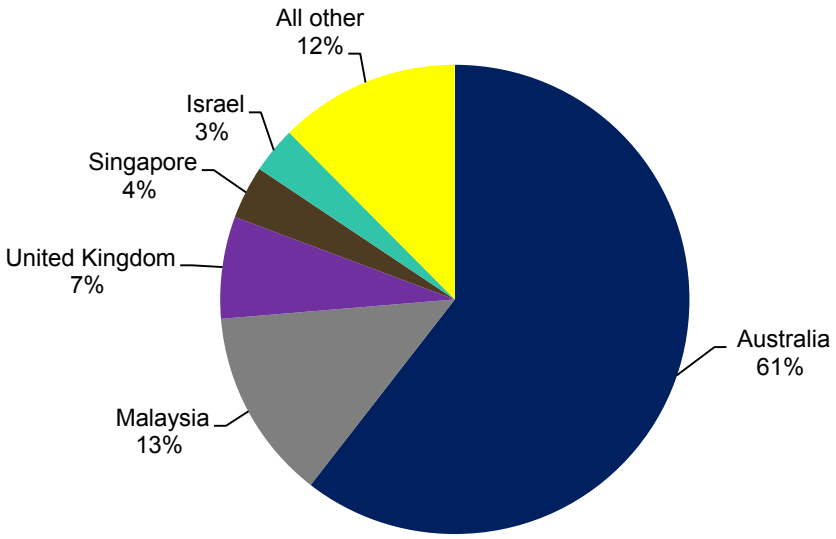
[113] King, "Building a Case for Smart Meters," March 5, 2012.
[114] *Metering.com,* "Draft Smart Grid Map for India Released," March 5, 2012.
[115] St. John, "India's Smart Grid Comes Alive," March 9, 2012.
[116] Rao, "India's Smart Grid May Not Be Secure," March 9, 2012.
[117] Smith, "Smart Meters Take the Bite out of Electricity Theft," September 12, 2011; Antmann, "Reducing Technical and Non-Technical Losses in the Power Sector," July 2009.
[118] Savenije, "The 7 Top Smart Meter Deals of 2013," March 20, 2013.
[119] Landis + Gyr India Website, "Who We Are." http://www.landisgyr.net.in/who-we-are.html (accessed March 27, 2014).
[120] Makhijani, "India Gets Smart with Electricity Grid Investments," March 19, 2012.
[121] *EuroAsia Industry,* "Cyan Looks Ahead to Worldwide Growth in Smart Meters," January 16, 2013.
[122] St. John, "India's Smart Grid Comes Alive," March 9, 2012.
[123] GTIS, "HS Number 902830 (Electricity Supply and Production Meters)" (accessed November 22, 2013).
[124] The tariff rates for HTS numbers for 90283010 (electricity meters for alternating currents) and 90283090 (other electricity meters) are the same. EximGuru website, http://www.eximguru.com/indian-customs-duty/9028-gas-liquid-or-electricity-supply.aspx (accessed August 15, 2013).

FIGURE 15 Share of India's imports and exports of electricity meters, by value, 2012



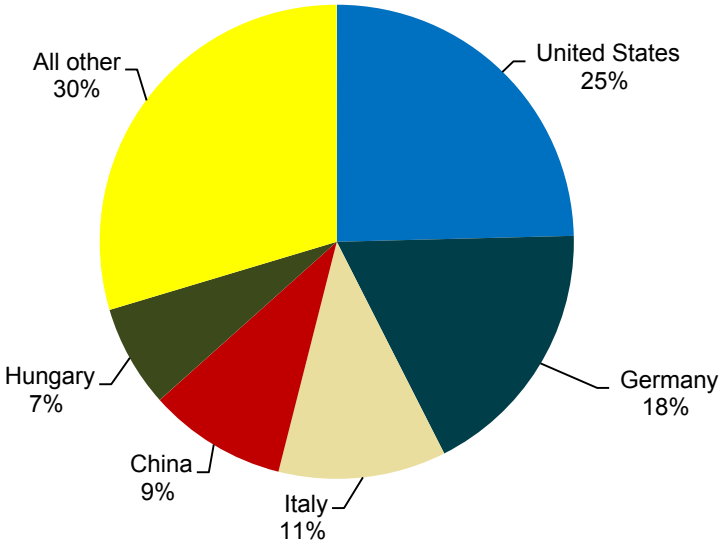
Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

FIGURE 16 Share of India's exports of electricity meters, by value, 2012



Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

FIGURE 17 Share of India's imports of electricity meters, by value, 2012



Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

Japan

In 2011, Japan's smart grid technology market totaled approximately $625 million, but this is expected to increase sharply over the next five years to reach $7.4 billion in 2016. Sales of AMI meters, the largest segment in this market at around 40 percent of the total, are projected to grow from about $250 million in 2011 to $2.5 billion by 2016.[125]

Before the Fukushima earthquake disaster, Japan had adopted a cautious approach to smart grid deployment. Afterwards, however, when continued nuclear-fueled electricity generation became a concern, the government's approach became more proactive, and it established the Energy-Environment Council to develop the policy response to a proposed switch away from nuclear power. The council issued a report in July 2011 which emphasized the need for efficiency and conservation measures as well as supply-side measures, including introducing smart meters and a revised electricity tariff system.[126] The Japanese government set a target for about 80 percent of the nationwide electricity consumption to be monitored using smart meters, to be phased in over the next five years.[127] Also, the government is supporting four Smart Cities projects through its development fund in order to establish Japan as a leader in smart grid design.

The two power utility giants, Kansai and Tokyo Electric Power Company (TEPCO), have essentially redesigned the market landscape for electricity distribution in Japan to respond to government targets. Kansai Electric Power was a first mover; it has been installing smart meters since 2008.[128] During the year after the Fukushima crisis, the government ordered the now mostly state-owned TEPCO to invite bids from both domestic and foreign firms for approximately 17 million smart meters to be installed by 2019.[129] In early 2013, TEPCO began selecting vendors for AMI-related services, and announced that

[125] The Fukushima earthquake and tsunami struck Japan's northeast coast on March 11, 2011. The projections for Japan's smart grid market are from Zpryme Research and Consulting, "Japan: Tsunami Wakens the Smart Grid," March 2012, 3–4.
[126] Institute of Energy Economics, Japan, "Japan Energy Brief," January 2012, 10–12.
[127] Seth, "TEPCO Encourages the Bidding War," August 27, 2012.
[128] Pike Research, "Executive Summary," 1Q 2011.
[129] Ten Hoedt, "Japan Catches Up to Smart Energy," October 2012, 39.

Toshiba would play the role of system integrator and supply the communication system for its residential smart meter rollout.[130] In July 2013, TEPCO announced that it was accelerating its rollout, expanding the program from 17 million new smart meters to 27 million meters (essentially all of its household customers' meters).[131] Installations were to begin in the first half of 2014 and are to be completed by March 2021. Smart metering services for customers—such as providing customers with detailed data on energy use patterns—will be introduced in July 2015.[132] The utility announced in November 2013 which meter manufacturers will supply the first tranche of the program (1.14 million meters): Mitsubishi Electric Corp, GE Fuji Meter Corp., and Toshiba Toko Meter Systems.[133] TEPCO's acceleration of its smart-meter rollout is probably at least partially motivated by the cost cutting and corporate restructuring that followed Fukushima.[134]

With such a large rollout underway, meter manufacturers are working hard to strengthen their ties with the utilities, as they submit bids to supply to the major utility companies.[135] Toshiba, which bought meter giant Landis+Gyr in 2011, appears well positioned to expand on its success in winning the TEPCO AMI contract; the two companies have recently established a joint venture to supply engineering support services to transmission and distribution companies around the world.[136] Also, Toshiba is already working with TEPCO on the Yokohama City smart city project. Fuji Electric and General Electric have also established a joint venture to provide smart meters for the Japanese market, while Hitachi, Panasonic, and Osaki Electric have joined to offer meters and other smart grid products and services. Along with GE, other foreign meter makers, including Enel SpA, Echelon, Elster, and Itron, are also likely to compete in the Japanese market and have established partnership arrangements to this end. For example, Itron has partnered with IBM to gain market share in the meter data management market, and Tepco is also a member of IBM's Global Intelligent Utility Network Coalition.[137]

Trade data gathered from Global Trade Atlas indicate that Japan is a net exporter, in terms of quantity, of the electricity supply or production meters classified under HS number 902830, which includes a broad group of meters including smart meters. However, Japan's surplus has narrowed, and in terms of value, its imports and exports of electricity meters were nearly equal at $1.4 million in 2012 (figure 18).[138] In 2012, Japan exported over 40,000 meters to Taiwan, and less than 3,200 meters to Germany, Singapore and China. In terms of value, Taiwan and Singapore were the leading export markets, indicating higher-value exports to Singapore (figure 19). Japan's imports of electricity meters were very limited (under 20,000 units) in 2012. By value, Japan's imports were predominantly sourced from China (figure 20).

[130] *Metering.com*, "Tokyo Electric Power Selects Toshiba's Smart Meter," May 2, 2013; Navigant Research, "Global Smart Meter Unit Shipments Will Peak," July 11, 2013. Toshiba purchased Swiss-based Landis+Gyr, a multinational manufacturer of smart electricity meters and SMMAA member firm, in July 2011. Toshiba, *Annual Report 2012*, 2012, 20; Landis+Gyr, "Landis+Gyr to Be Acquired by Toshiba," May 19, 2011; industry representatives, telephone interviews by USITC staff, September 10 and 11, 2013.

[131] Navigant Research, "Global Smart Meter Unit Shipments Will Peak" (press release and executive summary), July 11, 2013.

[132] Watanabe, "Tepco Aims to Install Smart Meters," October 28, 2013.

[133] Watanabe, "Tepco Picks Mitsubishi Electric, Others," November 14, 2013.

[134] TEPCO's liabilities for Fukushima are expected to reach as much as $58 billion. Tweed, "Japan's TEPCO to Install 17 Million Smart Meters," February 10, 2012.

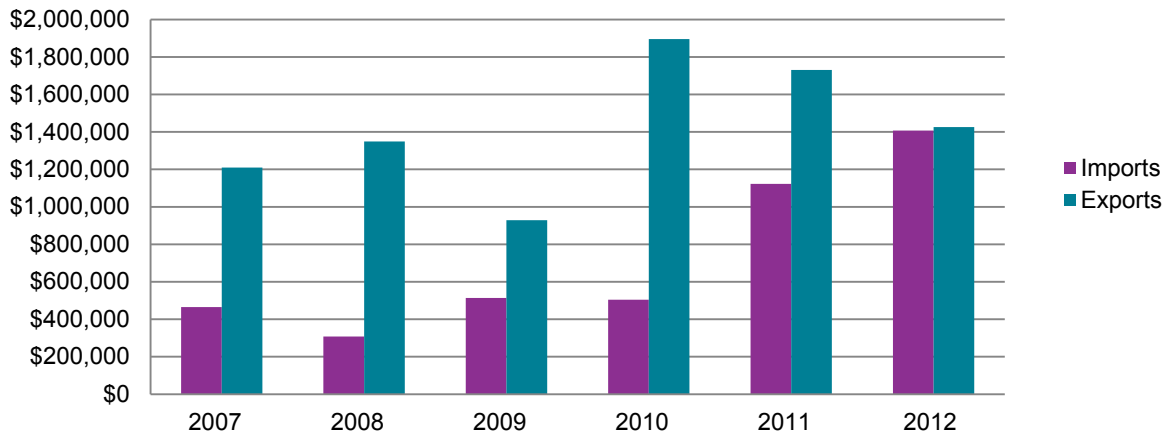
[135] Seth, "TEPCO Encourages the Bidding War," August 27, 2012.

[136] *Metering.com*, "TEPCO and Toshiba Establish Global Power Transmission," September 6, 2013.

[137] Tweed, "Japan's TEPCO to Install 17 Million Smart Meters," February 10, 2012.

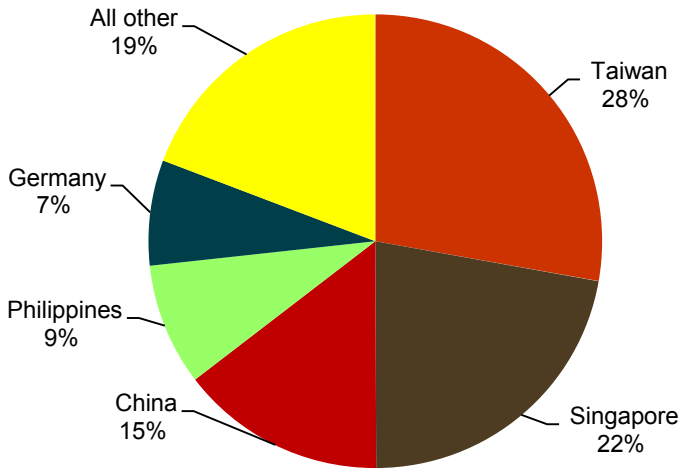
[138] GTIS, "HS number 902830 (Electricity Supply or Production Meters)," accessed November 22, 2013.

FIGURE 18 Japan's imports and exports of electricity meters, by value, 2007–12



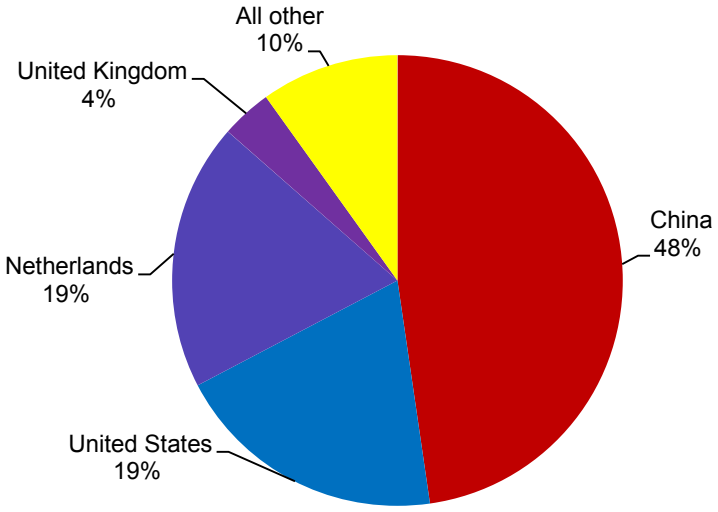
Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

FIGURE 19 Share of Japan's exports of electricity meters, by value, 2012



Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

FIGURE 20 Share of Japan's imports of electricity meters, by value, 2012



Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

Korea

Korea's push for smart meters is part of the Smart Grid Initiative announced by the Korean central government in 2009. Spearheaded by a demonstration project on Jeju Island, the initiative is intended to help reduce overall energy consumption by 3 percent and cut electricity consumption by 10 percent by 2030.[139] The Korea Smart Grid Institute (KSGI), the government body responsible for Korea's smart grid projects, states that the Korean government plans to invest a total of $1.1 billion dollars in smart meters by 2030 (from 2012).[140] According to KSGI, smart meters can help to redress the limited functionality of Korea's current electricity utility communication systems, particularly the labor-intensive process and inaccurate readings of electric meters, along with Korea's escalating power losses due to inefficiencies.[141]

Currently, the Korea Electric Power Company (KEPCO) is focused on installing smart meters for residential customers, which make up about 14 percent of national energy consumption.[142] KEPCO plans to roll out smart meters to about half its households (about 10 million units) by 2016, a 14-fold increase from the 2011 figure.[143] Moreover, Korea's primary government body responsible for energy policy, the Ministry of Knowledge, plans to replace all household analog meters with smart meters by 2020. If Korea meets its 2016 target to install the meters at half its households, reportedly it will be second in Asia only to China in terms of the number of installed smart meters.[144]

Korea's market is supplied mostly by domestic smart meter producers, although these companies sometimes partner with foreign firms to produce meters. In 2012, KEPCO awarded contracts to domestic-based companies, LS Industrial Systems Co., Iljin Electric Co. and Nuri Telecom Co., to manufacture smart meters for a smart grid program that has a commitment of more than $1 billion from the government.[145] Nuri's business partners in smart meter production are leading multinationals General

[139] Han, "South Korea's Smart Meters Program Averts Nuclear Need," March 12, 2012.
[140] Yang, "AMI Development in Korea," August 2011.
[141] Han, "South Korea's Smart Meters Program Averts Nuclear Need," March 12, 2012.
[142] World Energy Council, "Smart Meters," (accessed August 9, 2013).
[143] Han, "South Korea to Install Smart Meters," February 28, 2012.
[144] Han, "South Korea's Smart Meters Program Averts Nuclear Need," March 12, 2012.
[145] Han, "South Korea's Smart Meters Program Averts Nuclear Need," March 12, 2012.

Electric Co., Landis+Gyr, and Mitsubishi Electric Corp.[146] In addition, Korea Telecom, a Korean telecommunications service provider, announced its plans to roll out a wireless electricity metering system as part of the initiative's test pilot program on Jeju Island.[147] Fountain Springs, a Korean-based smart meter manufacturer, will provide the smart meters for the test system.[148]

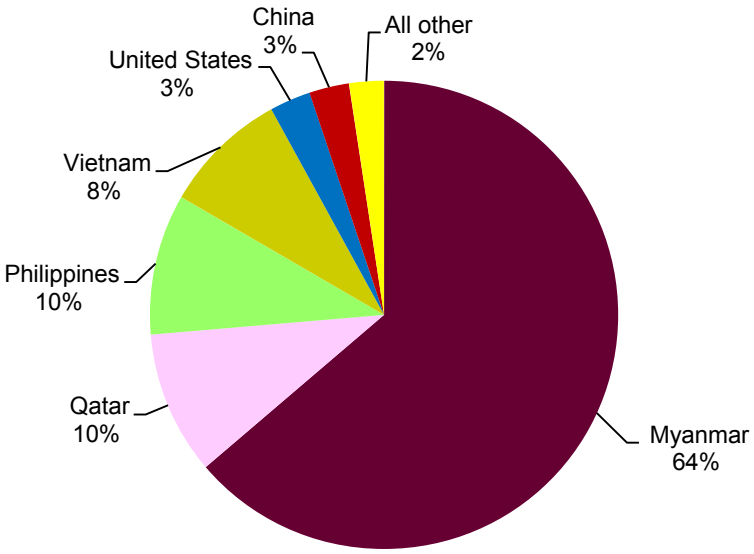
Trade data gathered from the Global Trade Atlas indicates that Korea is a slight net exporter of the electricity supply or production meters classified under HS number 902830, which includes a broad group of meters including smart meters. Korea imported and exported between $4 and $6 million of electricity supply and production meters in 2012 (figure 21). In 2012, Korea exported over 100,000 meters to Vietnam and Burma, with Burma the dominant export market by value (figure 22). Korea imported more than 200,000 electricity supply or production meters from China, which also dominated imports by value (figure 23).[149] Korea charges a tariff of 8 percent on calibrating meters, which are classified under HS number 902830.[150] In Korea, smart meters typically cost between ₩20,000 ($18) and ₩140,000 ($125) per unit, depending on whether they are for small or large electricity users.[151]

FIGURE 21 Korea's imports and exports of electricity meters by quantity, 2012

Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

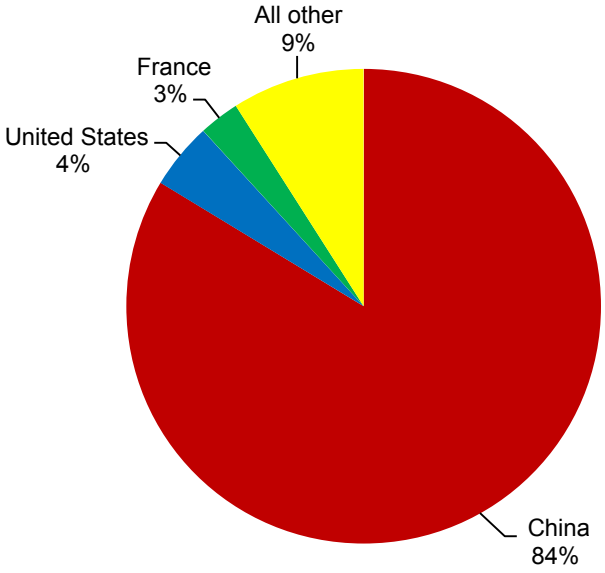
[146] Ibid.
[147] Greenbang, "South Korea Tests Wireless Metering for Energy Efficiency," November 15, 2011.
[148] "Ibid.
[149] GTIS, "HS number 902830 (Electricity Supply and Production Meters)" (accessed November 22, 2013).
[150] The tariff rates for HS numbers 9028301010 (calibrating meters not less than 50A), 9028301020 (calibrating meters less than 50A) and 902830200 (calibrating meters) all have a tariff of 8 percent, according to the Annex Korea Tariff Schedule, found at http://www.atoseoul.com/fta/Annex%20Korea%20Tariff%20Schedule.pdf (accessed August 15, 2013).
[151] Han, "South Korea's Smart Meters Program Averts Nuclear Need," March 12, 2012.

FIGURE 22 Share of Korea's exports of electricity meters, by value, 2012



Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

FIGURE 23 Share of Korea's imports of electricity meters, by value, 2012



Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

The Americas

Brazil and Mexico are the top two emerging markets in the Americas for smart meters due to their rapidly growing economies, while Canada has been a pioneer in smart meter installations in the North American market since 2004. Smart meter pilot programs and full-scale deployments are mostly driven by the central governments of Brazil and Mexico and by Canada's provincial governments.

Brazil

Brazil's smart grid development and smart meter market are driven by demand fundamentals and government initiatives. Like other emerging markets, Brazil suffers from fraud, electricity theft, and inefficiency, which cost the country close to $4 billion per year; as a result, Brazil could reap immediate benefits from smart meter deployment.[152]

Brazil's energy regulator, Agência Nacional de Energia Elétrica (ANEEL), had initially had an ambitious goal to replace all electricity meters with smart meters in 2009, but its plans have since stagnated.[153] In April 2012, ANEEL set a revised target of replacing nearly 63 million existing electromechanical meters with smart meters by 2021.[154] However, in August 2012, ANEEL scaled down its smart meter deployment plan, making smart meters mandatory only for new customers starting in 2014 and optional for existing customers. The change resulted from concerns that high deployment costs would raise energy prices for consumers.[155] As of 2012, Brazilian utility companies were expected to spend about $670 million per year from 2014 to 2017 to install 4.5 million meters, a much smaller sum than the $17 billion that Brazil had originally planned to spend by 2022.[156]

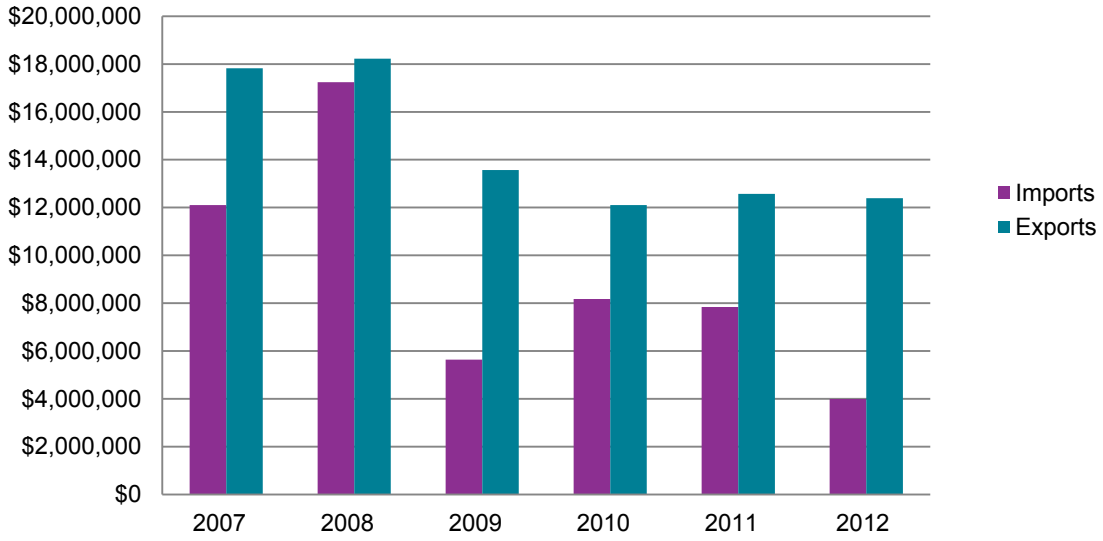
Despite the rollout delays, the potential scope of Brazil's smart meter deployment over the next decade has resulted in many of the major players fighting to make inroads into the market, including industry giants Landis+Gyr, Elster, Itron, Sensus, Trilliant, GE, and Siemens.[157] Reportedly, the market has been shaped by Brazil's insistence that smart meter production be based locally, which has led to a variety of partnerships and creative business strategies by foreign smart meter manufacturers.[158] For example, Landis+Gyr, Elster, and Itron operate factories in Brazil, either directly or through subsidiaries, while Echelon has opted for the licensing and partnership approach with domestic utility giant ELO Sistemas Eletrônicos (ELO). In August 2012, Itron announced a contract with CPFL Energia, Brazil's largest non-government utility company, to produce 20,000 smart meters. In January 2013, Echelon announced that it had secured a contract to supply a 1,500-smart-meter pilot project in Cemig's City of the Future, through a partnership with ELO. Cemig is one of the largest power companies in Brazil, and created City of the Future as an experimental smart grid where infrastructure and the smart grid can be tweaked before the universal deployment of smart meters. In August 2012, the Brazilian government approved Landis+Gyr to deploy the first smart meters in the country.[159] Landis+Gyr's smart meters were certified by Brazil's National Institute of Metrology, Standardization, and Industrial Quality, and the company planned to install 200,000 new smart meters by the end of 2012.[160]

Trade data gathered from the Global Trade Atlas indicates that Brazil is a net exporter of the electricity supply or production meters classified under HS number 902830, which includes a broad group of meters including smart meters. Brazil imported $4 million of electricity supply and production meters (figure 24), and exported approximately $12 million in 2012. Brazil exported over 150,000 meters to Bolivia, Argentina, and Colombia; these were also Brazil's leading export markets by value (figure 25).

[152] Northeast Group LLC, "Brazil Selects First Approved Smart Systems Provider," July 20, 2009; Northeast Group, LLC. *Brazil Smart Grid: Market Forecast (2012–2022),* April 2012.
[153] Navigant, "The Installed Base of Smart Meters," November 11, 2013.
[154] Northeast Group, LLC, Brazil Smart Grid: Market Forecast (2012–2022), April 2012.
[155] Morris, "Brazil's New Smart-Meter Plan Lops $5 Billion," January 2, 2013.
[156] St. John, "Brazil's Opt-In Smart Meter Future," August 21, 2012 St. John, "Brazil's Smart Grid Market to Reach $36.6 Billion," April 6, 2012.
[157] St. John, "Elster's Smart Meter Strongbox Takes Off in Brazil," October 13, 2011.
[158] Industry representatives, interview by USITC staff, Washington, DC, August 30, 2013.
[159] *UPI,* "Brazil Speeds Up to Embrace Smart Meters," August 24, 2012.
[160] Ibid.

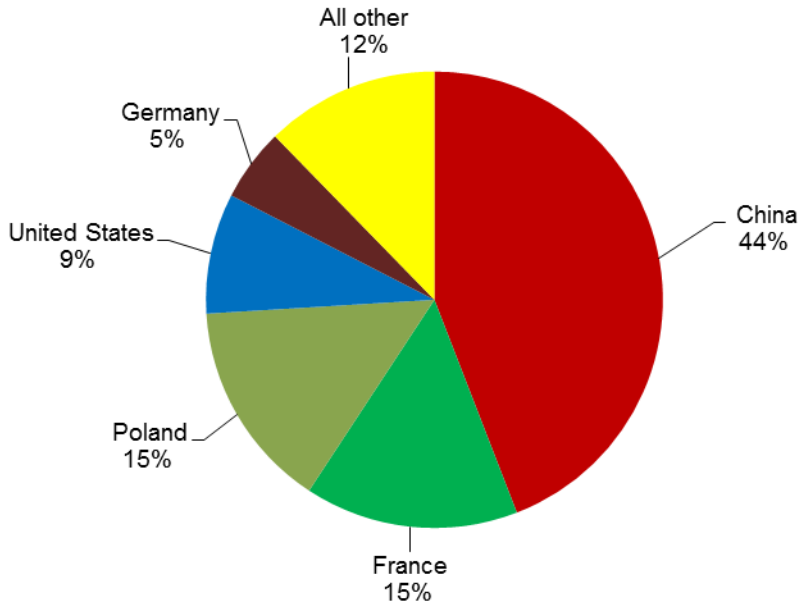
Brazil imported more than 75,000 electricity meters from China in 2012, which was also the largest source of imports by value (figure 26).[161]

FIGURE 24 Brazil's imports and exports of electricity meters, by value, 2012



Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

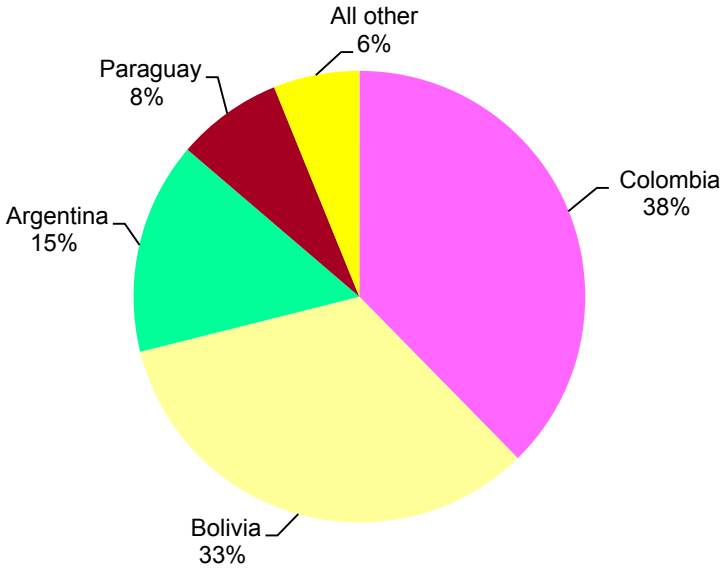
FIGURE 25 Share of Brazil's imports of electricity meters, by value, 2012



Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

[161] GTIS, "HS Number 902830 (Electricity Supply and Production Meters)" (accessed November 22, 2013).

FIGURE 26 Share of exports of electricity meters, by value, 2012



Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

Canada

Canada's smart grid technology is more advanced than that of most other nations, spurred on by the vast distances and hostile terrain separating significant power resources from electricity consumers.[162] The growth of the Canadian smart meter industry was temporarily boosted by the National Clean Energy Fund in 2009, under which $200 million was allocated towards smaller-scale demonstration projects of renewable and alternative energy technologies, including smart grids and smart meters.[163]

Smart meter deployment in Canada has largely been driven by a combination of provincial and utility-based initiatives and mandates, although an increasing government focus on clean energy may boost further efforts. British Columbia's 2010 Clean Energy Act required BC Hydro, the province's primary electricity provider, to install smart meters for all its nearly 1.8 million customers by the end of 2012.[164] In Ontario, the Smart Meter Energy Initiative was introduced in 2004 with installation targets of 4.3 million homes and small businesses by 2011, which was followed up by a 2010 mandate for time-of-use pricing.[165] With the addition of Hydro-Québec's plan to install nearly four million smart meters in the next several years, Canadian market penetration of households with smart meters should reach two-thirds by 2016. Despite differences in provincial needs for electricity, the smart meter market is projected to be strong in Canada over the next several years, although demand will gradually slow down as near saturation occurs by 2020.[166]

Recently, some Canadian municipalities, particularly in British Columbia (BC), have opposed installing smart meters due to privacy, safety, and health concerns. Approximately 39 municipalities in BC passed motions opposing smart meter installations in 2012; however, BC Hydro is under no

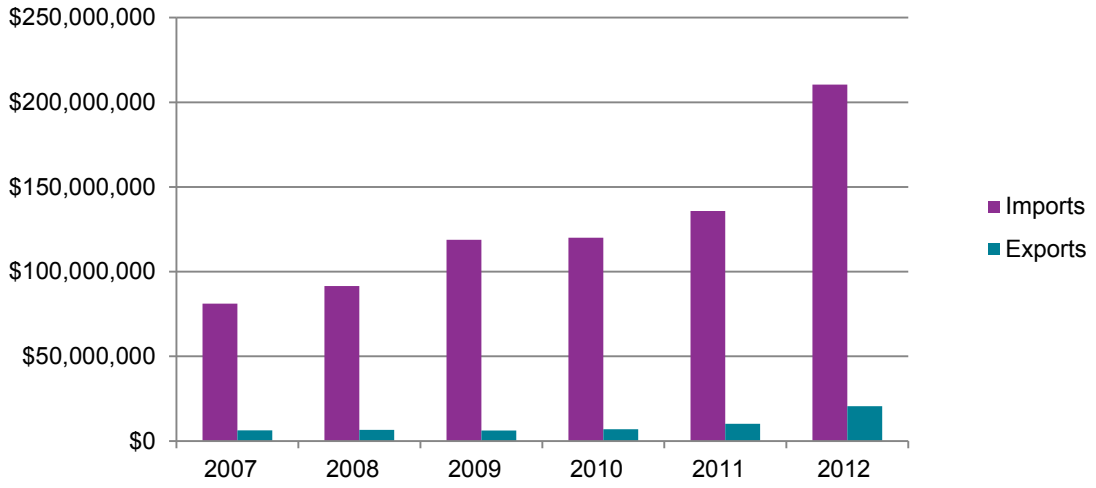
[162] Ernst & Young, "Canada: Tackling Geographical Challenges with Smart."
[163] Natural Resources Canada, "Backgrounder: The Clean Energy Fund," May 2009.
[164] Clean Energy Act, B.C. Reg. 368, S.B.C. 2010, c. 22, section 37.
[165] Ontario Energy Board, "Smart Meter Initiative: Determination to Mandate," June 24, 2010.
[166] *M2M News,* "Smart Meter Penetration in North America," October 19, 2011.

obligation to abide by these motions.[167] In July 2013, Canadian citizens opposed to smart meter installations and a nonprofit group, Citizens for Safe Technology, filed a class action lawsuit against BC Hydro, citing health concerns related to wireless radio transmissions.[168] Moreover, smart meters installed in homes were blamed as the cause of several fires in British Columbia in the last few years.[169] In January 2013, BC Hydro stated that it will no longer install smart meters without the permission of its residents, after it had already installed smart meters for 95 percent of its residential customers.[170] However, BC residents refusing to have smart meters installed may have to pay opt-out fees to keep their traditional electricity meters.[171]

The leading suppliers to the Canadian market for smart meters were mostly foreign companies, including industry giants Landis+Gyr (through its contract with Hydro-Québec) and Itron (through its contract with BC Hydro). Sensus, Elster, and GE Energy also maintain a presence, while Vancouver-based Corix provides metering related services and management. Overall market shares can fluctuate based on current contracts with provincial utility companies.

Trade data gathered from the Global Trade Atlas indicates that Canada is a large net importer of the electricity supply or production meters classified under HS number 902830, which includes a broad group of meters including smart meters. Canada imported over $200 million of electricity supply and production meters (figure 27), and exported approximately $20 million in 2012. In terms of value, most exports went to the United States and France (figure 28). Canada imported over 1.5 million electricity meters from the United States, its largest source of such imports by value (figure 29).[172]

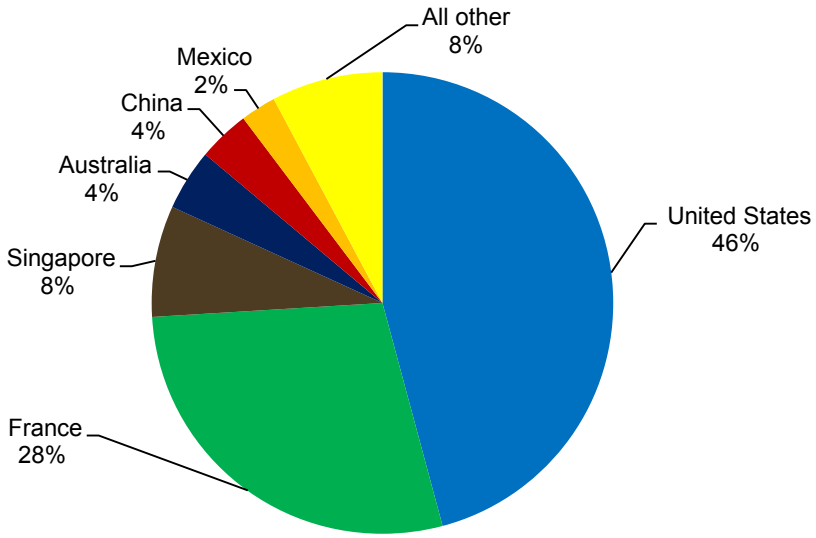
FIGURE 27 Canada's imports and exports of electricity meters, by value, 2012



Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

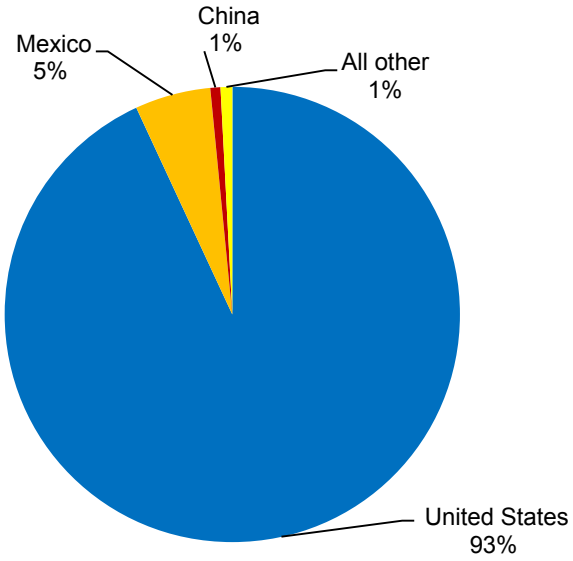
[167] *CBC News,* "Smart Meter Installation Goes to Vancouver Council," May 1, 2012.
[168] *CBC News,* "BC Hydro Outlines Smart Meter Refusal Cost," September 13, 2013.
[169] Elwart, "Smart Meters Turn Incendiary," December 17, 2012.
[170] *CBC News,* "BC Hydro Backs Down on Smart Meter Installation," January 30, 2013.
[171] Messiner, "BC Offers Smart-Meter Alternatives," July 18, 2013.
[172] GTIS, "HS Number 902830 (Electricity Supply and Production Meters)" (accessed November 22, 2013).

FIGURE 28 Share of Canada's exports of electricity meters, by value, 2012



Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

FIGURE 29 Share of Canada's imports of electricity meters, by value, 2012



Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

Mexico

Mexico is the second-largest potential market for smart meters in Latin America, after Brazil, and is expected to have 21 million such meters installed by 2020.[173] Although Mexico primarily relies on mechanical meters and is behind the United States in smart meter installations, Mexico is seen as an emerging market for smart meters for its commercial customers.[174] Mexico's economy is growing more

[173] *PR Newswire,* "Mexico Smart Grid Market to Reach $8.3 Billion," October 11, 2011.
[174] Industry representatives, interview by USITC staff, Washington, DC, September 19, 2013.

rapidly than those of its NAFTA partners, and it is expected that its electricity demand, and the demand for smart meters, will increase as well.[175]

The Secretaría de Energía, Mexico's federal energy ministry, and the Comisión Federal de Electricidad (CFE), Mexico's national electric power company, are implementing smart grid pilot programs throughout Mexico, in an effort to respond to high rates of electricity theft, power outages, and poor energy infrastructure. As of 2013, around 30 percent of Mexico's electricity capacity was sourced from private firms, although the CFE remains the dominant player in the electricity market due to its transmission and distribution monopoly. CFE is seeking to reduce non-technical losses and outages, obtain more reliable readings, and increase operational efficiency, including fewer service calls, for its 34 million customers.[176]

CFE has been testing smart grid infrastructure and implementing a number of pilot projects using various smart meter vendors for several years.[177] In August 2012, CFE announced that it was developing a smart grid plan for the country with the support of a $405,000 grant from the U.S. Trade and Development Agency.[178] In November 2013, CFE announced that it was in the final stages of developing a smart grid roadmap that will spur the smart grid market, which includes smart meters, to reach $12.1 billion in 2023.

International companies including Technolog Ltd., Elster Metering, and Landis+Gyr, as well as some U.S.-based smart meter producers such as Sensus, have manufacturing facilities in Mexico. These factories likely supply the Mexican market and also export smart meters to the United States and elsewhere. For example, the Landis+Gyr facility in Reynosa, Mexico, operates under preferential tariff programs established by the U.S. and Mexican governments to improve economic conditions and cross-border trade. This facility exports its smart meters to North America, the Caribbean, the Philippines, and Honduras.[179] Sensus, based in Raleigh, North Carolina, also has a manufacturing facility in Juárez, Mexico, that produces smart meters for export.

CFE awards contracts to both international and domestic companies to provide smart meters in Mexico. In 2009, CFE awarded a contract to a domestic smart meter manufacturer, Grupo IUSA, to supply 1.74 million smart meters. The contract is valued at approximately $109 million. In 2009, Grupo IUSA also announced in a separate deal that it supplied 160,000 smart meters, valued at $3.9 million, to an electricity supplier in central Mexico.[180]

Trade data gathered from the Global Trade Atlas indicates that Mexico is a large net exporter of the electricity supply or production meters classified under HS number 902830, which includes a broad group of meters including smart meters. Mexico imported over $25 million of electricity supply and production meters (figure 30), and exported over $300 million in 2012. In 2012, Mexico exported over 6.4 million meters, predominantly to the United States; the United States accounted for roughly 99 percent of Mexico's total exports by both volume and value (figure 31).[181] Mexico imported less than 400,000 electricity meters from the United States in 2012; however, they accounted for 99 percent by volume and 91 percent by value of its total imports in 2012 (figure 32). Most of the demand growth for smart meters in Mexico is coming from the residential sector.[182]

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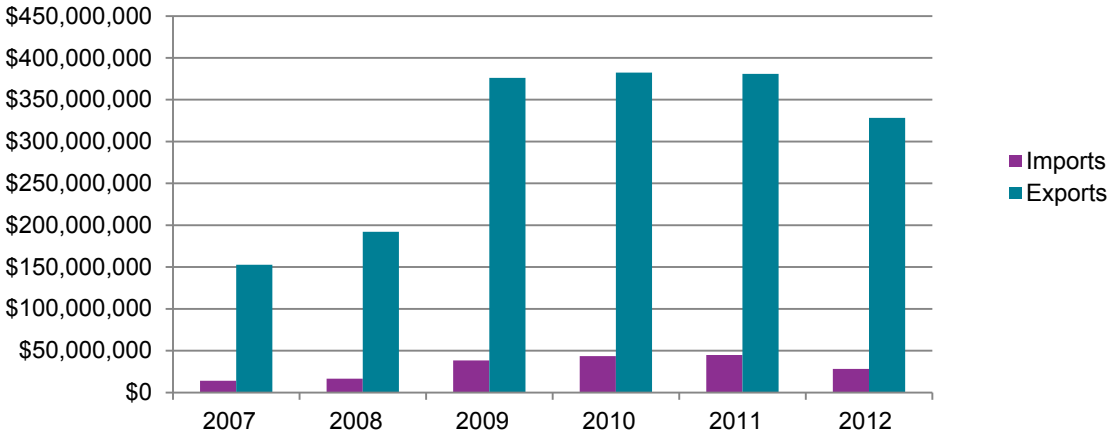
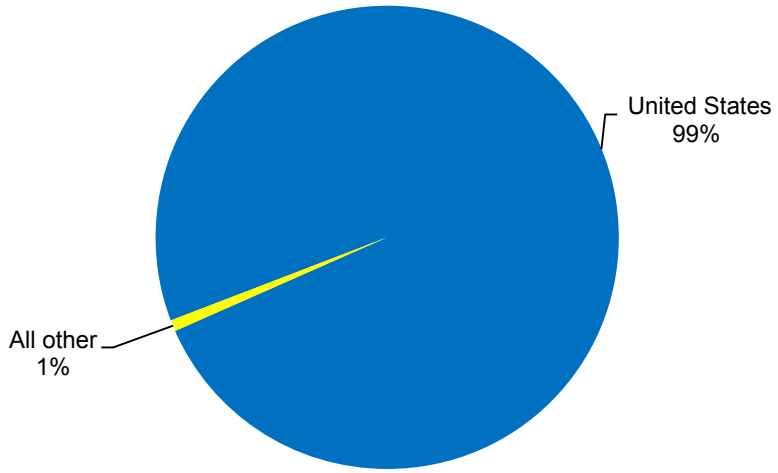
[175] Wood, "Growing Potential for U.S.-Mexico Energy Cooperation," (accessed November 5, 2013).
[176] Ibid.
[177] Northeast Group LLC, "Mexico Smart Grid Market to Grow," November 5, 2013.
[178] Wood, "Growing Potential for U.S.-Mexico Energy Cooperation," (accessed November 5, 2013).
[179] Environmental Expert, "Smart Meters Companies in Mexico" (accessed November 5, 2013); Landis+Gyr, "Landis+Gyr's Mexico Smart Meter Facility," September 16, 2009.
[180] *Metering.com,* "CFE to Purchase 1.74 Million Smart Meters," April 8, 2009.
[181] GTIS, "HS Number 902830 (Electricity Supply and Production Meters)" (accessed November 22, 2013).
[182] Wood, "Growing Potential for U.S.-Mexico Energy Cooperation," (accessed November 5, 2013).

FIGURE 30 Mexico's imports and exports of electricity meters, by value, 2007–12



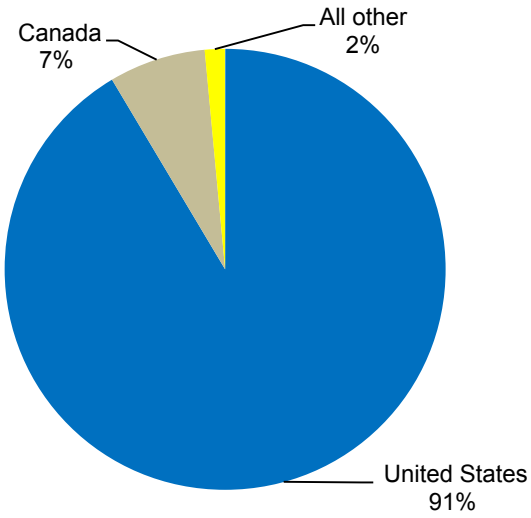
Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

FIGURE 31 Share of Mexico's exports of electricity meters, by value, 2012



Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

FIGURE 32 Share of Mexico's imports of electricity meters, by value, 2012



Source: GTIS, Global Trade Atlas (accessed January 6, 2014).

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