The global market has consistently overproduced...

WORLD PRIMARY ALUMINUM MARKET BALANCE VS LME CASH PRICES
(million mton vs $/mton; annual vs monthly data)

Source: HARBOR Aluminum.
...which has increased global aluminum stocks to a record high of 16 million mton

Source: HARBOR Aluminum, CME, IAI, LME, Marubeni, SHFE, and SMM data
At the same time, China’s smelters have become much more competitive

### PRIMARY ALUMINUM CASH COST OF PRODUCTION*
(monthly average data: $/mton)

![Graph showing the primary aluminum cash cost of production from Jan-09 to Jan-16. The cost decreases over time for all regions.]

Source: HARBOR Aluminum

*Before casting (molten metal). Does not include depreciation, interest payments or working capital; Excludes applicable VAT of 17% that Chinese aluminum smelters pay on raw materials, energy and services.
In fact, China has moved down to the 60th percentile of the cost curve.

CHINA'S PRIMARY ALUMINUM SMELTING INDUSTRY CASH COST CURVE POSITION*
(Q1 of every year; percentile)

* Cash cost before casting (molten metal). Does not include depreciation, interest payments, sustained capital expenses or working capital; excludes applicable VAT of 17% that Chinese aluminum smelters pay on raw materials, energy and services.
Source: HARBOR Aluminum
...and building low-cost, state-of-the-art mega smelters...

<table>
<thead>
<tr>
<th>Year</th>
<th>Projects Announced</th>
<th>Average Cash Cost (left scale)</th>
<th>Average Capacity (right scale)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td></td>
<td>1,500</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td></td>
<td>1,450</td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td>1,410</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td>1,340</td>
<td>1,392</td>
</tr>
<tr>
<td>2016</td>
<td></td>
<td>1,270</td>
<td>200</td>
</tr>
</tbody>
</table>

* On cash cost basis before casting (molten metal). Does not include depreciation, interest payments, sustained capital expenses or working capital; excludes applicable VAT of 17% that Chinese aluminum smelters pay on raw materials, energy and services.

Source: HARBOR Aluminum
...with captive coal mines, power plants and in some cases downstream assets

CHINESE PRIMARY ALUMINUM PROJECTS' STRUCTURE
(New primary aluminum projects announced in 2011-2015)

<table>
<thead>
<tr>
<th># OF PROJECTS</th>
<th>UPSTREAM</th>
<th>ENERGY</th>
<th>DOWNSTREAM</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bauxite</td>
<td>Coal</td>
<td>Semis Production</td>
</tr>
<tr>
<td></td>
<td>Alumina</td>
<td>Power</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aluminum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>✓</td>
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</tr>
<tr>
<td>4</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>✓</td>
<td>✓</td>
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<tr>
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<td>✓</td>
<td>✓</td>
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<tr>
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<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Source: HARBOR Aluminum
Moreover, declining coal prices have reduced China’s electricity price by 20%...

CHINA COAL PRICE AND PRIMARY ALUMINUM INDUSTRY ELECTRICITY PRICE
(weekly data;)

<table>
<thead>
<tr>
<th></th>
<th>$/mton</th>
<th>$/MWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep-14</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>Jan-15</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>May-15</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Sep-15</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Jan-16</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Sep-15</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Jan-16</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

AVG ELECTRICITY PRICE*
(right scale)

AVG COAL PRICE*
(left scale)

$35.6 -27% y/y
$29.7 -20% y/y

* Domestic price excluding 17% VAT.
Source: HARBOR Aluminum
...and have pushed China's electricity cost down to ROW's levels

**PRIMARY ALUMINUM ELECTRICITY PRICE BY SELECTED COUNTRIES/REGIONS***
($/MWh)

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2014</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>China Average</td>
<td>66</td>
<td>51</td>
<td>30</td>
</tr>
<tr>
<td>China New Capacity</td>
<td>17</td>
<td>17</td>
<td>15</td>
</tr>
<tr>
<td>ROW</td>
<td>30</td>
<td>28</td>
<td>24</td>
</tr>
<tr>
<td>USA</td>
<td>33</td>
<td>35</td>
<td>25</td>
</tr>
<tr>
<td>Middle East</td>
<td>24</td>
<td>26</td>
<td>23</td>
</tr>
<tr>
<td>Canada</td>
<td>22</td>
<td>21</td>
<td>20</td>
</tr>
</tbody>
</table>

* Excludes 17% VAT for China.
Source: HARBOR Aluminum
New Chinese smelters pay about half the electricity price of new smelters in ROW

CHINA AND ROW PRIMARY ALUMINUM ELECTRICITY PRICE*
(average $/MWh)

- China New Capacity: $15
- Canada: $21
- Quebec Smelters: $23
- ROW New Capacity: $27

* Excludes 17% VAT for China.
Source: HARBOR Aluminum
New Chinese smelting projects are more competitive than ROW's if capex is considered

2016-2020 PRIMARY ALUMINUM COMMITED PROJECTS' CAPACITY AND TOTAL COST* OF PRODUCTION (thousand mtpy and $/mton of aluminum)

- **CHINESE SMELTERS**
  - Baotou (Chalco) 1,392
  - Xinjiang Qiya II (Sichuan Qiya) 1,489
  - Karmoy Norway (Hydro) 1,379
  - BEMO II Russia (UC Rusal) 1,396
  - Xinjiang Tianshan (Xinren Aluminum) 1,484
  - Xinjiang Jarun (Xinjiang Jarun Resource) 1,576
  - Chongqing Jinghangyuan II (Chongqing Jinghangyuan) 1,625
  - Ningxia Qinya (State Power Investment) 1,635
  - Baoji Nong I Vietnam (Tran Hong Quan) 1,635

- **ROW SMELTERS**
  - Ras Zurrayed (Line 6) Bahrain (Alba) 1,775
  - Jharkhand India (Hindalco) 1,804
  - Kitimat Canada (RTA) 1,760
  - Jharkhand India (Hindalco) 1,804
  - Ras Zurrayed (Line 6) Bahrain (Alba) 1,775
  - Kitimat Canada (RTA) 1,760
  - Xinjiang Jiaren Ningxia Qin (Xinjiang Jiarun Resource) (State Power investment) 1,598
  - Taishet I Russia (UC Rusal) 1,598

*Includes interest payments, depreciation and working capital. Excludes applicable VAT of 17% that Chinese aluminum smelters pay on raw materials, energy and services. Bubble size = production capacity.

Source: HARBOR Aluminum
...and World’s production cash costs are down to year 2000 levels with a flatter curve

GLOBAL ALUMINUM PRODUCTION CASH COST CURVE BEFORE CASTING BY SMELTER*

*Does not include depreciation, sustained capital expenses, working capital or amortization. Excludes applicable VAT of 17% that Chinese aluminum smelters pay on raw materials, energy and services. Source: HARBOR Aluminum

*GLOBAL ALUMINUM PRODUCTION CASH COST CURVE BEFORE CASTING BY SMELTER*
(in $/mton)

0 25 50 75 100
% of cumulative global capacity

1ST QUARTILE  2ND QUARTILE  3RD QUARTILE  4TH QUARTILE

2010  2000  2016
US primary aluminum production has been declining since 1980

**USA PRIMARY ALUMINUM PRODUCTION**

(million mton; annual data)

- 1980: 4.6 million mton (32 Smelters)
- 2015: 1.6 million mton
- 2017: 0.6 million mton (5 Smelters)

Source: HARBOR Aluminum with Aluminum Association data
China's economic and industry's transformation drove prices and margins up... and now down.

CHINA GDP ANNUAL GROWTH VS LME 3M ALUMINUM PRICES
(annual % change vs $/mton)

Source: HARBOR Aluminum with LME and NBS data