Chinese bauxite and alumina market overview in the light of new policy

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Miami, USA
Sandy Kong, BGRIMM
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Chinese alumina demand
Aluminium production reached 24.8 Mt in 2013

During 2009~2013 Chinese aluminium production grew rapidly with a CAGR of 16%.

The growth rate hit a record high of 27% in 2010 before declining to 10% in 2013.

Aluminium capacity increased to 30.4 Mt in 2013.

Capacity utilization rate fell to 81.5% in 2013, compared to 85% before.
11.8 Mt aluminium capacity is expected to come on line by 2018.

<table>
<thead>
<tr>
<th>Province</th>
<th>Probable</th>
<th>Possible</th>
<th>Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chongqing</td>
<td>300</td>
<td>-</td>
<td>300</td>
</tr>
<tr>
<td>Guangxi</td>
<td>-</td>
<td>630</td>
<td>630</td>
</tr>
<tr>
<td>Guizhou</td>
<td>-</td>
<td>620</td>
<td>620</td>
</tr>
<tr>
<td>Gansu</td>
<td>600</td>
<td>1610</td>
<td>2,210</td>
</tr>
<tr>
<td>Inner Mongolia</td>
<td>565</td>
<td>260</td>
<td>825</td>
</tr>
<tr>
<td>Ningxia</td>
<td>-</td>
<td>380</td>
<td>380</td>
</tr>
<tr>
<td>Qinghai</td>
<td>1,110</td>
<td>500</td>
<td>1,610</td>
</tr>
<tr>
<td>Yunnan</td>
<td>150</td>
<td>-</td>
<td>150</td>
</tr>
<tr>
<td>Xinjiang</td>
<td>3,320</td>
<td>1,750</td>
<td>5,070</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6,045</strong></td>
<td><strong>5,750</strong></td>
<td><strong>11,795</strong></td>
</tr>
</tbody>
</table>

Source: BGRIMM

- 6 Mt are under construction
- 5.8 Mt are without time table
- All of them are located in west
- Xinjiang accounts for 43% of total.
The government has been taking serious measures to curb the rapid growth in Al industry...

**MIIT: Norms of Al Industry, July 24, 2013.**

- Integrated AC power consumption per ton molten Al should be less than 13,200 kwh for existing Al capacity and 13,350 kwh for new Al capacity.

  Notes: All new capacity and 80% existing capacity have already met NORMs by the end of 2013.

**State Council: Guideline for Resolving Serious Overcapacity of Specific Industries, Oct 10, 2013.**

- Eliminate all cells below 160KA
- Impose extra 10% power tariff on those capacities that can’t meet the NORMs by the end of 2013.

  Notes: Only 2 Mt capacity with cells below 160KA of which 70% have been eliminated.

**MIIT: New aluminium capacity is not permitted to be built before 2017, Feb 18, 2014.**

  Notes: excluding those capacity under construction.

**Promote direct purchase power policy**

  Notes: 60% capacity owns captive power plants.
...And bearded some fruits

1.5 Mt/a capacity were eliminated or idled in 2013

<table>
<thead>
<tr>
<th>Item</th>
<th>Province</th>
<th>Number</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chongqing</td>
<td>1</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>Guizhou</td>
<td>2</td>
<td>270</td>
</tr>
<tr>
<td>3</td>
<td>Henan</td>
<td>6</td>
<td>346</td>
</tr>
<tr>
<td>4</td>
<td>Hubei</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>Jiangsu</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>Shaanxi</td>
<td>2</td>
<td>240</td>
</tr>
<tr>
<td>7</td>
<td>Shandong</td>
<td>1</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>Sichuan</td>
<td>1</td>
<td>60</td>
</tr>
<tr>
<td>9</td>
<td>Yunnan</td>
<td>1</td>
<td>150</td>
</tr>
<tr>
<td>10</td>
<td>Zhejiang</td>
<td>1</td>
<td>150</td>
</tr>
<tr>
<td>11</td>
<td>Guangxi</td>
<td>1</td>
<td>125</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>18</td>
<td>1,521</td>
</tr>
</tbody>
</table>

Source: BGRIMM

...of which 1/3 occurred in Aug-Dec 2013.
Aluminium production will continue to grow but with slower growth rate

- In 2014, there might be a new round of capacity commissioning before tighter policies coming
- The production is forecast to edge up to 35 Mt by 2018 with a slower growth rate during 2015-2018

Source: BGRIMM

Some possible projects might be delayed

Capacity utilization rate will grow from 82% in 2013 to 88% in 2018
Total alumina demand: SGA usage + NMA usage

Chinese alumina demand

- Total alumina demand in 2013 was 51 Mt
- Alumina demand in 2018 is expected to reach 72 Mt

Unit Alumina consumption: 1.92-1.94 t per ton Al

NMA production was around 3 Mt in 2013, accounting for 6% of total demand

Source: BGRIMM
Chinese alumina supply
During 2009~2013 Chinese alumina production grew rapidly with a CAGR of 19%.

Alumina fed by imported bauxite accounted for 31% in 2013 after recording 38% in 2011.

Production in Shanxi province comprised 23% of total production in 2013, up from 12% in 2009,
15.4 Mt alumina capacity is forecast to come on stream in the near future

### New alumina capacity

<table>
<thead>
<tr>
<th></th>
<th>Probable</th>
<th>Possible</th>
<th>Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chongqing</td>
<td>600</td>
<td>-</td>
<td>600</td>
</tr>
<tr>
<td>Guangxi</td>
<td>1000</td>
<td>1200</td>
<td>2200</td>
</tr>
<tr>
<td>Guizhou</td>
<td>2100</td>
<td>1600</td>
<td>3700</td>
</tr>
<tr>
<td>Henan</td>
<td>1400</td>
<td>500</td>
<td>1900</td>
</tr>
<tr>
<td>Inner Mongolia</td>
<td>1000</td>
<td>500</td>
<td>1500</td>
</tr>
<tr>
<td>Shanxi</td>
<td>3500</td>
<td>2000</td>
<td>5500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9,600</strong></td>
<td><strong>5,800</strong></td>
<td><strong>15,400</strong></td>
</tr>
</tbody>
</table>

*Source: BGRIMM*

- 9.6 Mt are under construction
- 5.8 Mt are without time table
- Shanxi accounted for 39% of total new capacity
Norms for alumina industry mainly focus on raw material supply

**Raw material self sufficiency rate for new alumina capacity**
- Over 85% (30 years) for those fed by domestic bauxite
- Over 60% (5 years) for those fed by imported bauxite

**Admittance capacity**
- 800kt/a for those fed by bauxite
- 500kt/a for those fed by coal ash

**Integrated energy consumption for new capacity**
- Bayer process: 480kg standard coal per ton
- Coal ash: 1900kg standard coal per ton
- Series Bayer-sintering process: 750kg standard coal per ton
Chinese alumina production will continue to rise in line with smelter production

- Alumina production is forecast to reach 65 Mt in 2018
- Alumina production fed by imported bauxite is expected to fall by 7% in 2018 compared to 2013 with its share declining to 22% in 2018 from 31% in 2013
- Alumina production fed by domestic bauxite will grow by a CAGR of 6% during 2014-2018, taking 75% share in 2018 (69% in 2013).
- Coal ash will be an important resource for alumina.

Source: BGR IMM
Imported alumina will meet the increasing domestic deficit

Oversea projects owned by Chinese companies are predicted to supply domestic market...

<table>
<thead>
<tr>
<th></th>
<th>Company</th>
<th>Country</th>
<th>Capacity kt/a</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Weiqiao</td>
<td>Indonesia</td>
<td>2,000</td>
<td>Under construction</td>
</tr>
<tr>
<td>2</td>
<td>Hainan Joint Enterprise</td>
<td>Indonesia</td>
<td>1,000</td>
<td>Under construction</td>
</tr>
<tr>
<td>3</td>
<td>Chinalco</td>
<td>Indonesia</td>
<td>2,000</td>
<td>Plan</td>
</tr>
<tr>
<td>4</td>
<td>Jinjiang</td>
<td>Indonesia</td>
<td>1,200</td>
<td>Plan</td>
</tr>
<tr>
<td>5</td>
<td>Nanshan</td>
<td>Indonesia</td>
<td>2,100</td>
<td>Plan</td>
</tr>
<tr>
<td>6</td>
<td>CPI</td>
<td>Guinea</td>
<td>4,000</td>
<td>Plan</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>12,300</td>
<td></td>
</tr>
</tbody>
</table>

Source: BGRIMM

600kt/a alumina capacity in Vietnam was commissioned mid 2013, which mainly focused on China market.

In this case, alumina imports are expected to increase during 2014-2018, reaching 6.5 Mt in 2018.

Source: BGRIMM, China Customs
Alumina market will be in deficit over the next few years

- Chinese alumina market will be in a deficit of 1.6 Mt in 2015.
- And then move back to balance in 2018.
Raw material of alumina
Raw materials of alumina

**Bauxite:**
- Al₂O₃ > 40%, A/S > 2.1

**Coal ash:**
- Al₂O₃ > 40%

**Nepheline:**
- [(Na,K)₂Al₂O₃·2SiO₂] (bayerite)

**Alumina:**

**Alunite:**
- [K₂SO₄·Al₂(SO₄)₃·4Al(OH)₃]

**Kaolinite:**
- (Al₂O₃·2SiO₂·2H₂O)

**two type of bauxite breakdown**

<table>
<thead>
<tr>
<th>Item</th>
<th>Ore type</th>
<th>A:S ratio</th>
<th>Al₂O₃ content</th>
<th>Main process</th>
<th>Ave. unit cons.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic bauxite</td>
<td>Diaspore</td>
<td>Low</td>
<td>High</td>
<td>High temperature Bayer process</td>
<td>2.5-2.8</td>
</tr>
<tr>
<td>Imported bauxite</td>
<td>Thrihydrate</td>
<td>High</td>
<td>Low</td>
<td>Low temperature Bayer process</td>
<td>1.9-2.2</td>
</tr>
</tbody>
</table>
Domestic bauxite: rich resource but poor quality

- **Relative rich resource:**
  - 3.8 billion ton-ore by 2012

- **Disordered mining in some places**
  - Henan and Shanxi provinces

- **Deteriorating A:S ratio**

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**Average A:S ratio in China**

<table>
<thead>
<tr>
<th>Location</th>
<th>Mine Number</th>
<th>Resource + reserve base</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>410</td>
<td>3031.4</td>
<td>100%</td>
</tr>
<tr>
<td>Shanxi</td>
<td>82</td>
<td>995.1</td>
<td>33%</td>
</tr>
<tr>
<td>Henan</td>
<td>82</td>
<td>696.4</td>
<td>23%</td>
</tr>
<tr>
<td>Guangxi</td>
<td>27</td>
<td>509.9</td>
<td>17%</td>
</tr>
<tr>
<td>Guizhou</td>
<td>102</td>
<td>509.8</td>
<td>17%</td>
</tr>
<tr>
<td>Yunnan</td>
<td>29</td>
<td>97.4</td>
<td>3%</td>
</tr>
<tr>
<td>Shandong</td>
<td>17</td>
<td>59.0</td>
<td>2%</td>
</tr>
<tr>
<td>Chongqing</td>
<td>13</td>
<td>57.9</td>
<td>2%</td>
</tr>
<tr>
<td>Other</td>
<td>58.0</td>
<td>105.9</td>
<td>3%</td>
</tr>
</tbody>
</table>

*Source: MLR*

Over 90% bauxite distributes in Shanxi, Henan, Guangxi and Guizhou.
Are Chinese refineries anxious about the bauxite imports?

Chinese bauxite imports by country

Imports forecasts:
- Indonesia: 5.5 Mt annually till 2017
- Australia: 3% up annually
- India: 5% up annually
- Other source: 10% up annually
  - Bosai, Xinfra, CPI, Chalco

Bauxite imports will fall by 56% YoY in 2014 before declining to 28.6Mt in 2018

Source: China Customs, BGRIMM
New added bauxite stocks are estimated to arrive at 32 Mt in 2013

Assumption:

✧ Alumina production fed by imported bauxite will fall slightly from 15 Mt in 2013 to 14 Mt by 2018.

✧ Accumulated imported bauxite stocks can be consumed for 14 months by the end 2013

✧ Accumulated stocks will support the destocking over the forecast period.
China is developing coal ash to produce alumina

By-product of coal combustion from coal-fired power plants

Only high-Al content coal ash can be used to produce alumina

1t → 0.25t coal ash

Average $\text{Al}_2\text{O}_3$ content in coal ash: 28-30%

Average $\text{Al}_2\text{O}_3$ content in high-Al coal ash: 40-55%
Support from government

In February 2011, NDRC issued *Guideline for comprehensive recovery of high-Al Coal ash*

- Speed up the construction of Datang and Mengxi projects
- Objectives: Coal ash projects with a total capacity of 1.8 Mt/a by 2013, further increasing to 3.6 Mt/a by 2015

In March 2011, coal ash projects are listed in the encouragement category of *Industrial Restructuring Guidance Catalogue (2011)*

- Strong signal from government level
Coal ash is forecast to take 4% share of total raw materials in 2018

- Imported bauxite is forecast to fall over the forecast period with its share decreasing to around 21% in 2018
- Coal ash is expected to take 4% share in 2018
Conclusion

☑ The new policies imposed on aluminium industry having little influence on bauxite and alumina market.

☑ Alumina market will be in deficit over the forecast period.

☑ Accumulated stocks will support the destocking over the forecast period.

☑ Coal ash might change Chinese alumina raw material structure from 2016.
Thanks for your attention!

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