Current PV Status in China and Future Forecast

Wang Sicheng  PV Committee of China
Dec. 5-7, 2017  Weihai, China
PV Industry in China
China is the Leading Country in PV Industry (2016)

1. World Poly-Si Production is 400,000 Tons, China produced 194,000 Tons, shared 48.50%;

2. World silicon wafers produced 74.8GW, China produced 64.8GW, shared 86.63%;

3. PV cell production in the world is 75GW, China produced 51GW, shared 68.00%;

4. PV module production in the world is 72GW, China produced 53GW, shared 74.7%.

Source: China PV Industry Association (CPIA)
Poly-Silicon Production in the World (2015, 2016)

<table>
<thead>
<tr>
<th>Country</th>
<th>USA (Ton)</th>
<th>Germany (Ton)</th>
<th>Japan (Ton)</th>
<th>Korea (Ton)</th>
<th>China (Ton)</th>
<th>Others (Ton)</th>
<th>Total (Ton)</th>
</tr>
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<tbody>
<tr>
<td>2015 Capacity</td>
<td>75000</td>
<td>58000</td>
<td>33000</td>
<td>92000</td>
<td>190000</td>
<td>22000</td>
<td>470000</td>
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<tr>
<td>2015 Production</td>
<td>43000</td>
<td>56000</td>
<td>8800</td>
<td>63000</td>
<td>165000</td>
<td>9200</td>
<td>345000</td>
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<tr>
<td>2016 Capacity</td>
<td>80000</td>
<td>60000</td>
<td>35000</td>
<td>100000</td>
<td>210000</td>
<td>5000</td>
<td>490000</td>
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<td>2016 Production</td>
<td>45700</td>
<td>56000</td>
<td>10000</td>
<td>85000</td>
<td>194000</td>
<td>9300</td>
<td>400000</td>
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China shared 48.5% of poly-silicon production in the world.

Imported Poly-Silicon from Abroad (2006-2016)

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<td>15715</td>
<td>9170</td>
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<td>77000</td>
<td>79000</td>
<td>85000</td>
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<td>Share of Import(%)</td>
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<td>89.69</td>
<td>77.03</td>
<td>31.35</td>
<td>52.67</td>
<td>47.83</td>
<td>58.09</td>
<td>51.52</td>
<td>41.21</td>
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Source: China PV Industry Association (CPIA)
## Poly-Silicon Production in the World and China (2016)

<table>
<thead>
<tr>
<th>No.</th>
<th>World Manufacturer</th>
<th>Location</th>
<th>2015 Production (Ton/y)</th>
<th>2016 Production (Ton/y)</th>
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<tbody>
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<td>1</td>
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<td>China</td>
<td>74300</td>
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</tr>
<tr>
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<td>Korea</td>
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<td>China</td>
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</tr>
<tr>
<td>6</td>
<td>China Silicon, Luoyang</td>
<td>China</td>
<td>12000</td>
<td>15700</td>
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<tr>
<td>7</td>
<td>HK Silicon</td>
<td>Korea</td>
<td>9000</td>
<td>15000</td>
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<tr>
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<td>China</td>
<td>7900</td>
<td>13300</td>
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<td>9</td>
<td>Da Quan New Energy</td>
<td>China</td>
<td>9500</td>
<td>13000</td>
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<tr>
<td>10</td>
<td>Yongxiang, Sichuan</td>
<td>China</td>
<td>7500</td>
<td>12300</td>
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<tr>
<td></td>
<td>Total</td>
<td></td>
<td>267200</td>
<td>313100</td>
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<td></td>
<td>World Total</td>
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<td>400000</td>
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<table>
<thead>
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<th>No.</th>
<th>China Manufacturer</th>
<th>2015 Production (Ton/y)</th>
<th>2016 Production (Ton/y)</th>
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<td>Asia Silicon Co.</td>
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<td>Jingyang CGC</td>
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<td>Ruineng Sichuan</td>
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<td>5100</td>
</tr>
<tr>
<td>11</td>
<td>China South Glass</td>
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<td>Kangbo Jiangsu</td>
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<tr>
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<td>Others</td>
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<tr>
<td></td>
<td>China Total</td>
<td>165000</td>
<td>194000</td>
</tr>
</tbody>
</table>

GCL is the largest poly-silicon producer in the world; 48.5% of poly-silicon world production shared by China.

Source: China PV Industry Association (CPIA)
# Top 16 Wafer Manufacturers in the World and China (2016)

## World Top 16 Manufacturers

<table>
<thead>
<tr>
<th>Year</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
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</thead>
<tbody>
<tr>
<td>World Capacity (GW)</td>
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<td>10</td>
<td>16</td>
<td>33</td>
<td>56</td>
<td>60</td>
<td>50</td>
<td>68</td>
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<td>100</td>
<td>100</td>
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<tr>
<td>World Production (GW)</td>
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<td>10</td>
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<tr>
<td>China Capacity (GW)</td>
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<td>6.8</td>
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<td>40</td>
<td>50</td>
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<td>50</td>
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<td>81.9</td>
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<td>26</td>
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<td>38</td>
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<td>64.8</td>
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## Yearly Capacity and Production

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<tbody>
<tr>
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<td>6</td>
<td>10</td>
<td>16</td>
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<td>56</td>
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<td>36</td>
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<td>38</td>
<td>48</td>
<td>64.8</td>
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## Manufacturers

<table>
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<th>Year</th>
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<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>%</th>
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</thead>
<tbody>
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<td>World Top 16</td>
<td>Manufacturers</td>
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<td>2016 Pro. (MW)</td>
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In 2016, 86.63% of wafer production in the world was shared by China.

Source: China PV Industry Association (CPIA)
### Top 20 PV Cell Manufacturers in the World and China (2016)

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<th>No.</th>
<th>Cell Manuf.</th>
<th>2016 Capacity (MW)</th>
<th>2016 Production (MW)</th>
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<td>4700</td>
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<tr>
<td>2</td>
<td>JA Solar</td>
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</tr>
<tr>
<td>3</td>
<td>Hanwha (KR)</td>
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<td>4000</td>
</tr>
<tr>
<td>4</td>
<td>JinKo</td>
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<tr>
<td>5</td>
<td>Motech (Taiwan)</td>
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<tr>
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<table>
<thead>
<tr>
<th>No.</th>
<th>Cell Manuf.</th>
<th>2016 Capacity (MW)</th>
<th>2016 Production (MW)</th>
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<td>1</td>
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<td>4200</td>
<td>3200</td>
</tr>
<tr>
<td>5</td>
<td>Shun Feng Int. (SunTech)</td>
<td>3400</td>
<td>3000</td>
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<tr>
<td>6</td>
<td>Tongwei Solar</td>
<td>3400</td>
<td>2200</td>
</tr>
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<td>7</td>
<td>Hanwha China</td>
<td>2300</td>
<td>2100</td>
</tr>
<tr>
<td>8</td>
<td>Canadian Solar</td>
<td>2500</td>
<td>2100</td>
</tr>
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<td>9</td>
<td>Harein Solar</td>
<td>1800</td>
<td>1750</td>
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<tr>
<td>10</td>
<td>Zhongli Talesun</td>
<td>2000</td>
<td>1600</td>
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<tr>
<td>11</td>
<td>Zhanyu, Jiangxi</td>
<td>1600</td>
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<td>12</td>
<td>Risen Energy</td>
<td>1500</td>
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</tr>
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<td>13</td>
<td>AKCom</td>
<td>1400</td>
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<tr>
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<td>Fortune Energy</td>
<td>1300</td>
<td>1100</td>
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<td>15</td>
<td>Yijing</td>
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<td>1050</td>
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<td></td>
<td>Sub-Total</td>
<td>41100</td>
<td>35140</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>21900</td>
<td>15860</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>63000</td>
<td>51000</td>
</tr>
</tbody>
</table>

68% global PV cell production shared by China Mainland.

Source: China PV Industry Association (CPIA)
Top 20 PV Module Manufacturers in the World and China (2016)

<table>
<thead>
<tr>
<th>No.</th>
<th>Manufacturer</th>
<th>2016 Capacity (MW)</th>
<th>2016 Production (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>JinKo</td>
<td>6500</td>
<td>6570</td>
</tr>
<tr>
<td>2</td>
<td>Trina Solar</td>
<td>6000</td>
<td>6000</td>
</tr>
<tr>
<td>3</td>
<td>Canadian Solar</td>
<td>5800</td>
<td>5200</td>
</tr>
<tr>
<td>4</td>
<td>Hanwha (KR)</td>
<td>5000</td>
<td>4800</td>
</tr>
<tr>
<td>5</td>
<td>JA Solar</td>
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</tr>
<tr>
<td>6</td>
<td>GCL</td>
<td>5000</td>
<td>4000</td>
</tr>
<tr>
<td>7</td>
<td>First Solar (US)</td>
<td>3200</td>
<td>3100</td>
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<tr>
<td>8</td>
<td>Yingli Green Energy</td>
<td>4200</td>
<td>2800</td>
</tr>
<tr>
<td>9</td>
<td>Leye (Longgi)</td>
<td>4000</td>
<td>2400</td>
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<tr>
<td>10</td>
<td>Talesun Solar</td>
<td>2200</td>
<td>1600</td>
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<td>11</td>
<td>Risen Energy Co.</td>
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</tr>
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<td>12</td>
<td>Changzhou Yijing</td>
<td>2000</td>
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<td>13</td>
<td>SunTech</td>
<td>2200</td>
<td>1500</td>
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<tr>
<td>14</td>
<td>Solar World (DE)</td>
<td>1500</td>
<td>1400</td>
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<td>15</td>
<td>Sunpower (US)</td>
<td>1500</td>
<td>1360</td>
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<tr>
<td>16</td>
<td>Kyocera (JP)</td>
<td>1400</td>
<td>1200</td>
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<tr>
<td>17</td>
<td>ReneSolar</td>
<td>1500</td>
<td>1200</td>
</tr>
<tr>
<td>18</td>
<td>REC (US)</td>
<td>1200</td>
<td>1100</td>
</tr>
<tr>
<td>19</td>
<td>Harein Solar</td>
<td>1500</td>
<td>950</td>
</tr>
<tr>
<td>20</td>
<td>Solar Frontier (JP)</td>
<td>1200</td>
<td>900</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>59400</td>
<td>24020</td>
</tr>
<tr>
<td></td>
<td>World Total</td>
<td>123000</td>
<td>77900</td>
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</table>

<table>
<thead>
<tr>
<th>No.</th>
<th>Manufacturer</th>
<th>2016 Capacity (MW)</th>
<th>2016 Production (MW)</th>
</tr>
</thead>
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<td>6000</td>
</tr>
<tr>
<td>3</td>
<td>Canadian Solar</td>
<td>5800</td>
<td>5200</td>
</tr>
<tr>
<td>4</td>
<td>JA Solar</td>
<td>5500</td>
<td>4800</td>
</tr>
<tr>
<td>5</td>
<td>GCL</td>
<td>5000</td>
<td>4000</td>
</tr>
<tr>
<td>6</td>
<td>Yingli Green Energy</td>
<td>4200</td>
<td>2800</td>
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<tr>
<td>7</td>
<td>Leye (Longgi)</td>
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<td>8</td>
<td>Hanwha Jiangsu</td>
<td>2250</td>
<td>2100</td>
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<td>9</td>
<td>Talesun Solar</td>
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<td>1600</td>
</tr>
<tr>
<td>10</td>
<td>Risen Energy Co.</td>
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<td>1500</td>
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<td>11</td>
<td>Changzhou Yijing</td>
<td>2000</td>
<td>1500</td>
</tr>
<tr>
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<td>SunTech</td>
<td>2200</td>
<td>1500</td>
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<td>13</td>
<td>ReneSolar</td>
<td>1500</td>
<td>1200</td>
</tr>
<tr>
<td>14</td>
<td>Harein Solar</td>
<td>1500</td>
<td>950</td>
</tr>
<tr>
<td>15</td>
<td>ZN Shine Solar</td>
<td>1000</td>
<td>750</td>
</tr>
<tr>
<td>16</td>
<td>Jiangsu Seraphim</td>
<td>1000</td>
<td>710</td>
</tr>
<tr>
<td>17</td>
<td>Jinzhou Solar Power</td>
<td>750</td>
<td>710</td>
</tr>
<tr>
<td>18</td>
<td>JINNENG Clean Energy</td>
<td>750</td>
<td>680</td>
</tr>
<tr>
<td>19</td>
<td>Shenzhen New Energy</td>
<td>700</td>
<td>650</td>
</tr>
<tr>
<td>20</td>
<td>CECEP Solar</td>
<td>650</td>
<td>620</td>
</tr>
<tr>
<td></td>
<td>Others</td>
<td>23300</td>
<td>7460</td>
</tr>
<tr>
<td></td>
<td>China Total</td>
<td>79000</td>
<td>53700</td>
</tr>
</tbody>
</table>

China shared 74.7% of PV module production in the world.

Source: China PV Industry Association (CPIA)
7 years before, 96% of PV modules exported to other countries, last year 65% of PV modules installed in China domestically.
PV Market in China
<table>
<thead>
<tr>
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<th></th>
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</tr>
</thead>
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<tr>
<td>1</td>
<td>Rural Electrification</td>
<td>2</td>
<td>182</td>
<td>0.23</td>
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<tr>
<td>2</td>
<td>Communication &amp; Industry</td>
<td>5</td>
<td>90</td>
<td>0.12</td>
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<tr>
<td>3</td>
<td>PV Products</td>
<td>3</td>
<td>88</td>
<td>0.11</td>
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<tr>
<td>4</td>
<td>Distributed and Building PV</td>
<td>4230</td>
<td>10290</td>
<td>13.18</td>
</tr>
<tr>
<td>5</td>
<td>Ground Mounted LS-PV</td>
<td>30310</td>
<td>67430</td>
<td>86.36</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>34550</td>
<td>78080</td>
<td>100</td>
</tr>
</tbody>
</table>
Rural Electrification (0.23%)
Communication & Industry Sector 0.12%
Solar Products  0.11%
PV Buildings
BIPV&BAPV
13.18%
LS-PV in Gobi – Desert (86.36%)
Largest PV Power Plant in the World

850MW PV Power Plant in Golmud, Qinghai, 2015-12-20

(Invested by Yellow River Power Co.)
PV + is a remarkable market in China

PV + Agriculture
PV + vegetables or flowers
PV Greenhouses

Floating PV or Fish-pool
PV at hilly Area
PV Along High-way
### World PV Market Progress 2010-2016

<table>
<thead>
<tr>
<th>Year</th>
<th>China (MW)</th>
<th>Japan (MW)</th>
<th>Germany (MW)</th>
<th>US (MW)</th>
<th>GB (MW)</th>
<th>India (MW)</th>
<th>Others (MW)</th>
<th>Annual Total (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>520</td>
<td>893</td>
<td>7400</td>
<td>961</td>
<td>45</td>
<td>12</td>
<td>16700</td>
<td>16700</td>
</tr>
<tr>
<td>2011</td>
<td>2700</td>
<td>1404</td>
<td>7487</td>
<td>1855</td>
<td>700</td>
<td>172</td>
<td>27650</td>
<td>27650</td>
</tr>
<tr>
<td>2012</td>
<td>3560</td>
<td>2467</td>
<td>7603</td>
<td>3373</td>
<td>925</td>
<td>986</td>
<td>27979</td>
<td>27979</td>
</tr>
<tr>
<td>2013</td>
<td>10680</td>
<td>7042</td>
<td>3304</td>
<td>4840</td>
<td>1546</td>
<td>1004</td>
<td>38350</td>
<td>38350</td>
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<tr>
<td>2014</td>
<td>10640</td>
<td>9740</td>
<td>1900</td>
<td>6200</td>
<td>2200</td>
<td>883</td>
<td>41000</td>
<td>41000</td>
</tr>
<tr>
<td>2015</td>
<td>15150</td>
<td>10800</td>
<td>1463</td>
<td>7300</td>
<td>4100</td>
<td>2133</td>
<td>53000</td>
<td>53000</td>
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<tr>
<td>2016</td>
<td><strong>34550</strong></td>
<td><strong>8600</strong></td>
<td><strong>1400</strong></td>
<td><strong>14762</strong></td>
<td><strong>1940</strong></td>
<td><strong>4500</strong></td>
<td><strong>73000</strong></td>
<td><strong>73000</strong></td>
</tr>
</tbody>
</table>

| Cumulative (MW) | 78080 | 45400 | 40750 | 40362 | 11480 | 10300 | 76628 | 303000 |

Source: EPIA, IEA, CPIA

PV installation in China shared **47.3%** of world PV market in **2016**, and by the end of 2016, China cumulative PV installation shared **25.8%** of the world total PV installation.
90% cost down in last 10 Years

During Last 10 Years:

- Module price was reduced 91.6%;
- System price was reduced 88.3%;
- Inverter price goes down 92.5%;
- PV FIT goes down 81.3% ;

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Cumul. Ins. (GWp)</td>
<td>0.10</td>
<td>0.14</td>
<td>0.30</td>
<td>0.80</td>
<td>3.50</td>
<td>7.06</td>
<td>17.74</td>
<td>28.38</td>
<td>43.53</td>
<td>78.08</td>
<td>115.00</td>
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<tr>
<td>Module Price (Yuan/Wp)</td>
<td>36.00</td>
<td>30.00</td>
<td>19.00</td>
<td>13.00</td>
<td>9.00</td>
<td>4.50</td>
<td>4.00</td>
<td>3.80</td>
<td>3.60</td>
<td>3.20</td>
<td>3.00</td>
</tr>
<tr>
<td>Sys. Price (Yuan/Wp)</td>
<td>60.00</td>
<td>50.00</td>
<td>35.00</td>
<td>25.00</td>
<td>17.50</td>
<td>10.00</td>
<td>9.00</td>
<td>8.00</td>
<td>7.50</td>
<td>7.20</td>
<td>7.00</td>
</tr>
<tr>
<td>Inverter Price (Yuan/W)</td>
<td>4.00</td>
<td>3.00</td>
<td>2.00</td>
<td>1.00</td>
<td>0.80</td>
<td>0.60</td>
<td>0.50</td>
<td>0.38</td>
<td>0.35</td>
<td>0.30</td>
<td>0.30</td>
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<tr>
<td>Module Lifetime (y)</td>
<td>20.00</td>
<td>20.00</td>
<td>25.00</td>
<td>25.00</td>
<td>30.00</td>
<td>30.00</td>
<td>30.00</td>
<td>30.00</td>
<td>30.00</td>
<td>30.00</td>
<td>30.00</td>
</tr>
<tr>
<td>PV FIT (Yuan/kWh)</td>
<td>4.00</td>
<td>Set by Bidding</td>
<td>1.15</td>
<td>1.00</td>
<td>1.00</td>
<td>0.9-1.0</td>
<td>0.9-1.0</td>
<td>0.8-0.98</td>
<td>0.65-0.85</td>
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</tbody>
</table>
Technology
Innovation
Leading Runner Plan was start in 2015 to Up-grid PV Technology

<table>
<thead>
<tr>
<th>Type</th>
<th>PV Cells</th>
<th>PV Modules</th>
<th>Market Entry</th>
<th>Leading Runner</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Size of Cells (mm)</td>
<td>Cell Number in one Module</td>
<td>15.5% Efficiency (Wp)</td>
<td>16% Efficiency (Wp)</td>
</tr>
<tr>
<td>Multi-Si</td>
<td>156*156</td>
<td>60</td>
<td>255</td>
<td>/</td>
</tr>
<tr>
<td></td>
<td>156*156</td>
<td>72</td>
<td>305</td>
<td>/</td>
</tr>
<tr>
<td>Mono-Si</td>
<td>156*156</td>
<td>60</td>
<td>/</td>
<td>260</td>
</tr>
<tr>
<td></td>
<td>156*156</td>
<td>72</td>
<td>/</td>
<td>315</td>
</tr>
<tr>
<td>a-Si</td>
<td>All Thin-Film (TF)</td>
<td>Efficiency ≥ 8%</td>
<td>Efficiency ≥ 12%</td>
<td></td>
</tr>
<tr>
<td>CIGS</td>
<td></td>
<td>Efficiency ≥ 11%</td>
<td>Efficiency ≥ 13%</td>
<td></td>
</tr>
<tr>
<td>CdTe</td>
<td></td>
<td>Efficiency ≥ 11%</td>
<td>Efficiency ≥ 13%</td>
<td></td>
</tr>
<tr>
<td>Other TF</td>
<td></td>
<td>Efficiency ≥ 10%</td>
<td>Efficiency ≥ 12%</td>
<td></td>
</tr>
<tr>
<td>HCPV</td>
<td>500 concentrating times</td>
<td>Efficiency ≥ 28%</td>
<td>Efficiency ≥ 30%</td>
<td></td>
</tr>
<tr>
<td>DC/AC Inverter</td>
<td>Grid-connected Inverters</td>
<td>Efficiency ≥ 96% with transformers; Efficiency ≥ 98% without transformers.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
New Specification Requirements for Market Entry and Leading Runner 2017

Government Announced the **New Specification Requirements** on July 18\(^{th}\), 2017

<table>
<thead>
<tr>
<th>Type</th>
<th>PV Cells Size of Cells (mm)</th>
<th>PV Modules Cell Number in one Module</th>
<th>Market Entry Efficiency (Wp)</th>
<th>Leading Runner Efficiency (Wp)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-Si</td>
<td>156*156</td>
<td>60</td>
<td>16.0%</td>
<td>17.0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16.8%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17.8%</td>
</tr>
<tr>
<td>Mono-Si</td>
<td>156*156</td>
<td>60</td>
<td>16.8%</td>
<td>17.0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>17.0%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17.8%</td>
</tr>
</tbody>
</table>

**For Super-Leading Runner Plan**

Multi-Si PV Module (156x156, 60 cells) must be higher than 295 Wp;
Mono-Si PV Module (156x156, 60 cells) must be higher than 310 Wp;
PERC PV Modules are Manufactured by All First-Tier Chinese Manufacturers

**P-Type Mono-PERC Module.**

**Cell efficiency 21%.**

PERC is an **high-efficiency and low-cost PV technology**

1) The cell efficiency is higher than **21%**;
2) The module cost is now **$0.4 USD/Wp**.
3) **20GW** production capacity has been reached in China.
Longji 60-Cell Mono-Si module: 325.6W, 72-Cell Mono-Si module: 365.0W. P-PERC-Bilateral Module > 300Wp
Nanjing Sunport Power developed high-efficiency MWT PV Modules:

1) 20Wp higher than ordinary multi-Si PV module: for 60-156 PV module, 285Wp;
2) The cost is even lower than ordinary PV modules;
3) The thickness of the MWT cells is only 150 micro-meters.
Trina Solar IBC High-Efficiency PV Modules

Trina Solar N-type IBC PV module: Efficiency 22%

Get championship of Solar Vehicle Racing. Manufacturing capacity is now 30MW.
100MW capacity of HIT High-Efficiency PV Module Line
At GS Solar, Fujian Province

GS Solar N-Type HIT Module-60 Cell-156-320 Wp;

Efficiency > 22%

Production Line Capacity: 100MW;

Cost is = PERC Module
1. Increase PV-Inverter Ratio (10% more income and 10% lower of LCOE);

2. Using Solar Trackers (20% - 30% more generation);

3. Using Information technology to build intelligent monitoring and O & M System. 3%-5% more income by reducing maintenance cost and less trouble losses;

4. Increase the Performance Ratio (PR), form 75% to 80%.

Conclusion: 40% more less of LCOE can be reached by system innovation. The grid-parity can be reached by the year 2020, PV FIT can be around 0.4 Yuan/kWh (6 US cents/kWh).
Various Type of Solar Trackers: 10%–35% More Generation

- E-W Tracking
- Tilted E-W Tracking
- Pole-Axis Tracking
- Dual-Axis Tracking
- Solar-Azimuth Tracking
- Manual Tracking
How can PV in China growing so fast?

Because the Incentive Policies

(The Most Important Issue)
PV Incentive Policies in China

1. “Renewable Energy Law” was issued in 2006;
2. According to “Renewable Energy Law”, the surcharge was collected since 2008 and the surcharge level from 0.2 cents/kWh, 0.4 cents, 0.8 cents, 1.5 cents to today’s 1.9 cents/kWh. Now, 65 billion Yuan (10 billion USD) can be collected each year to support RE power;
3. Since 2008, China started Feed-in Tariff policy;
4. Government sponsored market expansion and technology promotion demonstration projects: PV Buildings, Golden Sun Project, PV poverty alleviation project, Hybrids and Micro-grid demonstrations, Leading runner plan, etc.;
5. Supporting policies from Ministry of Finance, National Grid Company, Ministry of Land Resources, State Administration of Taxation, etc.;
6. Incentive policies are also issued by more than 20 provincial governments.
### Feed-in Tariff and Fixed Subsidy Policies

**Released by NDRC on Aug. 26, 2013**: NDRC [2013] No.1638

#### Key Points:

1. 3 levels of FIT for LS-PV based on local solar resources;
2. For distributed PV, 0.42 Yuan/kWh will be subsidized to PV electricity;
3. Subsidy duration: 20 Years.

<table>
<thead>
<tr>
<th>Solar Resources</th>
<th>FIT for LS-PV (Yuan/kWh)</th>
<th>Self-Consumption for Distributed PV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FIT</td>
<td>For self-consumed PV (Yuan/kWh)</td>
</tr>
<tr>
<td>I</td>
<td>0.65 ($0.100)</td>
<td>Retail Price of Grid Electricity + 0.42 Yuan (+ $0.068)</td>
</tr>
<tr>
<td>II</td>
<td>0.75 ($0.115)</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>0.85 ($0.131)</td>
<td></td>
</tr>
</tbody>
</table>
Why China doing so Hard to develop Solar PV?

We have to Finish the Energy Transition within next 20-30 years!
China Now is Facing Pressure in Energy Supply and GHG Emission

China is Facing Serious Problems in Energy Supply and Air Pollution

1、The largest country in GHG emission since 2007；
2、The Largest country in energy consumption；
2、The largest producer and consumer of electricity；
3、The largest importer and user of coal；
4、The largest importer of oil and 60% of oil was imported from other countries；
5、Serious shortage in energy supply and serious pollution in environment。
The Reserves of Traditional Energy in China is much less than World Average Level

In another 30 years, there will be no coal, no oil and no gas in China!

China must complete the transforming of energy structure within next 20-30 years, and based on solar and other RE.

<table>
<thead>
<tr>
<th>Reserves</th>
<th>Coal (Year)</th>
<th>Oil (Year)</th>
<th>Gas (Year)</th>
<th>Uranium (Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>114</td>
<td>50.7</td>
<td>52.8</td>
<td>100</td>
</tr>
<tr>
<td>China</td>
<td>31</td>
<td>11.7</td>
<td>27.8</td>
<td>50</td>
</tr>
<tr>
<td>%</td>
<td>27.19</td>
<td>23.08</td>
<td>52.65</td>
<td>50.00</td>
</tr>
</tbody>
</table>

Source: BP Statistical Review of World Energy June 2016
Announced by Chinese Government in 2014

1. Non-fossil Energy will share 15% of total energy consumption by 2020, and 20% by 2030;

2. Coal consumption will reach to the peak by 2020;

3. Primary energy consumption will reach to the peak by 2025 (4.5 billion Tce);

4. CO₂ emission will reach to the peak by 2030.

5. By the year of 2050, Renewable Energy will share 60% of total energy consumption.

<table>
<thead>
<tr>
<th>Year</th>
<th>Cumulative Installation of Solar PV (GW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>200</td>
</tr>
<tr>
<td>2030</td>
<td>400</td>
</tr>
<tr>
<td>2040</td>
<td>1000</td>
</tr>
<tr>
<td>2050</td>
<td>2000</td>
</tr>
</tbody>
</table>
Thank You! Question
?
jikewsch@163.com