PV Industry Trends
from IEA PVPS Trends Report

14th June 2018, PVPS Workshop@WCPEC-7

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• About RTS Corporation
• How we conduct analysis
• Highlights from IEA PVPS Trends report
• Upstream sector
  – Crystalline Silicon Technology
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RTS Corporation – founded in 1983, 35-year experience

Comprehensive Consultancy on Photovoltaic Power Generation (PV)

Business: Helping establish PV business strategy, “Go to Japanese market”

Clients: Government agencies, utilities, manufacturers (entire value chain of PV) project developers, financial institutes, industry associations, etc. in JP, US, DE, IT, FR, AT, NR, CHE, AUS, CHN, IND, KOR, Taiwan, Thailand, etc.

Consulting for PV projects

30 year experience

R & D

PV system

PV projects

Go to Japanese Market

Japan

World

Silicon feedstock for solar cell

Deployment

Business models
How we conduct analysis

- Information in the National Survey Reports from each member country
- RTS’s primary survey for non-member/member countries
- Available information and figures from industry associations and press releases
Annual installed capacity reached ~98GW
PV module production and capacity

- Production: 2016 ~ 80GW → 2017: ~ 105GW
- Capacity: 2016 106GW → 2017: 133GW
Production share by country

Share of PV Cells Production - 2016

- China: 66%
- Taiwan: 12%
- Malaysia: 8%
- Japan: 5%
- South Korea: 3%
- Other: 2%
- USA: 2%
- Europe: 2%

Share of PV Module Production in 2016

- China: 66%
- Taiwan: 2%
- South Korea: 7%
- Malaysia: 7%
- Japan: 4%
- Singapore: 3%
- Other: 3%
- USA: 2%
- Europe: 4%

No.1: China
No.2: Taiwan
No.3: Malaysia

Source: Trends Report 2017 (before printing)
China continues to dominate production of cell &

Solar cell production

- Chinese domestic production: 68 GW (68% of the world), 33.3% increase
- 21 companies have > 1 GW/year of production capacity

PV module production

- Chinese domestic production: 76 GW (71% of the world), 43.3% increase
- 12 companies have > 2 GW/year of production capacity

Source: China Photovoltaic Industry Association (CPIA), January 2018
### Top 10 PV module suppliers in the world

There will be companies with more than 10GW/year of production capacity by the end of 2018

<table>
<thead>
<tr>
<th>Rank</th>
<th>2017 Shipment (prospects) (GW)</th>
<th>Rank</th>
<th>2016 Shipment (GW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>JinkoSolar (China/Malaysia)</td>
<td>1</td>
<td>JinkoSolar (China/Malaysia)</td>
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<tr>
<td>2</td>
<td>Trina Solar (China/Thailand)</td>
<td>2</td>
<td>Trina Solar (China)</td>
</tr>
<tr>
<td>3</td>
<td>JA Solar (China/Malaysia)</td>
<td>3</td>
<td>Canadian Solar (Canada/China)</td>
</tr>
<tr>
<td>4</td>
<td>Canadian Solar (Canada/China/Vietnam)</td>
<td>4</td>
<td>JA Solar (China)</td>
</tr>
<tr>
<td>5</td>
<td>Hanwha Q CELLS (Korea/China/Malaysia)</td>
<td>5</td>
<td>Hanwha Q CELLS (Korea/China/Malaysia)</td>
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<tr>
<td>6</td>
<td>GCL System Integration Technology (GCLSI) (China/Vietnam)</td>
<td>6</td>
<td>GCL System Integration Technology (GCLSI) (China)</td>
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<tr>
<td>7</td>
<td>LONGi Green Energy Technology (China)</td>
<td>7</td>
<td>First Solar (U.S./Malaysia)</td>
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<td>8</td>
<td>Yingli Green Energy (China)</td>
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<td>Yingli Green Energy (China)</td>
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<td>9</td>
<td>Risen Energy (China)</td>
<td>9</td>
<td>LONGi Green Energy Technology (China)</td>
</tr>
<tr>
<td>10</td>
<td>First Solar (USA/Malaysia)</td>
<td>10</td>
<td>SolarWorld (Germany/U.S.)</td>
</tr>
</tbody>
</table>
PV module manufacturing capacity by major companies

Source: RTS Corporation
Manufacturing capacity of major companies along value chain

Source RTS Corporation
Manufacturing site and capacity of major PV producers

Solar cell production capacity by location (GW)

- Hanwha Q CELLS
- Canadian Solar
- JA Solar
- Jinko Solar
- Trina Solar

PV Module production capacity by location (GW)

- Hanwha Q CELLS
- Canadian Solar
- JA Solar
- Jinko Solar
- Trina Solar
Issues

• Lower margin for manufacturing
  – Lost of interest from investors for manufacturing → Delisting from stock market
  – Difficulty for adding value to price
  – Less investment for R&Ds
    → Consolidation continues

• Trade conflicts
  – Increase of PV module price with tariff will results stagnation of specific PV markets
    (USA and India???)
    → Shift of focus to new markets

China crisis

• Policy change announced in 31st May
• Chinese market may shrink to 30 GW
Spot price of PV modules

Source: PVinsights.com
Revenue & Profit: Jinko Solar

Source: IR presentation, Jinko Solar
China Crisis

- NDRC and NEA and MOF announced “2018 Solar PV Power Generation Notice”
  - DG projects: 10 GW cap in 2018 (22GW in 2017)
  - FIT reduced from June 2018
  - Utility scale target was abolished and provinces are instructed to stop projects seeking 2018 FIT

- Chinese market may shrink to 30 GW
- Announce capacity expansion: +19 GW
- Price erosion will result in a shakeout
Summary

• 2017 production volume is beyond 100GW
• Capacity expansion and current issues may cause shrink of the market in 2018
• Price erosion accelerate shakedown
• PV industry needs to prepare for solar winter
• However, there is no winter that does not end
Acknowledgement for the support of PVPS activities

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