PV Industry Trends: with some update and COVID impact on Japanese PV market

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RTS Corporation – founded in 1983, 36 year experience

Comprehensive Consulting company on Photovoltaics (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, Norway, etc.

Consulting for PV projects

Go to Japanese Market

Japan

World

R & D
PV system
PV projects

Deployment
Business models

Silicon feedstock for solar cell
Contents

• Trends of PV industry from Trends Report with some update
  • 1H PV module shipment ranking
  • Trends of >500 W PV modules
  • Polysilicon supply impact

• Impacts of COVID-19 on global PV market and Japan
PVPS

Trends in the PV Industry
Yearly PV Installation, PV Module Production & Production capacity
Share of manufacturing countries along the value chain (2019)

Source: IEA PVPS and Trends Report 2020, to be published
PV module top 10 suppliers in 1H 2020 and major manufacturing sites

<table>
<thead>
<tr>
<th>Rank</th>
<th>1H 2020 Shipment preliminary (GW)</th>
<th>2019 Shipment preliminary (GW)</th>
<th>2018 Shipment (GW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>JinkoSolar (China/ Malaysia/ USA)</td>
<td>8</td>
<td>JinkoSolar (China/ Malaysia/ USA)</td>
</tr>
<tr>
<td>2</td>
<td>LONGi Green Energy Technology (China/ Malaysia)</td>
<td>6.8</td>
<td>JA Solar Technology (China/ Malaysia/ Vietnam)</td>
</tr>
<tr>
<td>3</td>
<td>Trina Solar (China/ Thailand)</td>
<td>5.84</td>
<td>Trina Solar (China/ Thailand)</td>
</tr>
<tr>
<td>4</td>
<td>JA Solar Technology (China/ Malaysia/ Vietnam)</td>
<td>5.46</td>
<td>Canadian Solar (Canada/ China/ Brazil/ Vietnam/ Taiwan)</td>
</tr>
<tr>
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<td>Canadian Solar (Canada/ China/ Brazil/ Vietnam/ Taiwan)</td>
<td>5.12</td>
<td>LONGi Green Energy Technology (China/ Malaysia)</td>
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<tr>
<td>6</td>
<td>Hanwha Solutions (S. Korea/ China/ Malaysia/ USA)</td>
<td>4</td>
<td>Hanwha Solutions (S. Korea/ China/ Malaysia/ USA)</td>
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<tr>
<td>6</td>
<td>Risen Energy (China/ Mexico)</td>
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<td>Risen Energy (China/ Mexico)</td>
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<tr>
<td>8</td>
<td>First Solar (USA/ Malaysia/ Vietnam)</td>
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<td>First Solar (USA/ Malaysia/ Vietnam)</td>
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<tr>
<td>8</td>
<td>Zhejiang Chint Electrics (Astronergy) (China)</td>
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<td>Zhejiang Chint Electrics (Astronergy) (China)</td>
</tr>
<tr>
<td>10</td>
<td>GCL System Integration Technology (GCLSI) (China/ Vietnam)</td>
<td>2</td>
<td>GCL System Integration Technology (GCLSI) (China/ Vietnam)</td>
</tr>
</tbody>
</table>

Source: RTS Corporation based on annual report, etc., including estimates, as of August 2020.
PV module production capacity by major companies

Source: RTS Corporation as of 8th May 2020
PV Module production by technology

- sc-Si share increased to 62%, mc-Si share decreased from 50.4% to 34%
- Thinfilm share: 4.1%, majority from First Solar, then, Solar Frontier, etc.
Technology trends along the value chain: upstream

- Debottlenecks
- FBR
- Metallurgical process

- G7 → G8
- HP mc-Si
- Continuous pulling sc-Si
- Cast mono
- Larger wafer

- DW for sc-Si & mc-Si
- Texture
- Thinner sc-Si
- Using IoT for optimizing cell process

- PERC, PERT, SHJ, IBC
- Bifacial
- Multi-busbars
- Halfcut → Multicut → Shingles
- Lower Ag consumption

- Glass-Glass/ Glass-transparent backsheets
- Non-EVA encapsulants
- 1.500V
- Bifacial
- AR coating
- Anti-Soiling
- Reliability

Lower cost equipment/ process / higher throughput/ location

- Higher efficiency
- Larger size
- Material/ electrodes
- Process
- Flexible substrates
Recently announced high efficiency PV modules

*If not noted, cell type is p-mono silicon PERC
*Cell number based on fullsize wafer
Impact of polysilicon price

Source: PV Insight
Polysilicon manufacturing capacity by companies as of the end of 2019

- Explosion (Small fire) occurred on July 2, 2020 at a polysilicon plant in Xinjiang. Full operation is expected by the end of September.

- Multiple explosions were reported at a polysilicon plant in Xinjiang on 19th of July. Reported full recovery in 2021

- Other polySi plants in Xinjiang are under inspection
- Lockdown of the region due to second wave of COVID-19

Source: RTS Corporation
PolySilicon capacity and consumption for PV

Source: RTS Corporation
Downstream trends

- Lower Capex and Opex for lower LCOE
  - Efforts on all the stage of development: design, procurement, construction and O&M
- More power with bifacial PV and trackers
- BOS Cost reduction
  - Inverter: String vs Centralized, 1500V or more???
  - Tracker: Centralized or distributed control?
  - Support structures: Prefabricated, automation
- Mitigating risks of component failures
- More cost efficient O&M
  - AI analysis for failure detection and prescheduled maintenance, using drones, etc.
Downstream Trends: business opportunities

- New applications: FPV (on-shore & off-shore), AgroPV, BIPV and VIPV
- Repowering and revamping
- Requirement for grid code and regulation
  - Smart inverters → Grid forming/ grid supporting inverters
- Requirement for building energy efficiency code and regulation
  - BIPV
  - PV and ESS
- Recycling
Impacts of COVID-19 on global PV market and Japan

https://coronavirus.jhu.edu/map.html
Impacts of COVID-19 in Japan, surveyed by RTS in beg. April 2020
Impacts became visible in March 2020

Major impacts
1) Delay of projects due to cancelation of meetings and negotiations
2) Delivery delay of components (PV modules, support structures, etc.)
3) Cancellation of projects
4) Shortage of workers at installation sites
5) Delay of financing

Source: RTS Corporation
Good news from Japan, July and August 2020

• METI will start discussions towards establishing a “renewable energy-based economic society” in response to the instruction by Mr. Hiroshi Kajiyama, Minister of Economy, Trade and Industry.

• METI also started discussions on the revision of the rules on the use of power transmission lines aiming to fade out inefficient coal thermal power plant and to make renewable energy a mainstream power source.

• Under the Acts for Establishing Resilient and Sustainable Electricity Supply Systems, it was agreed to remove the risk of approval revocation in case construction starts by April 2022 for ≥ 2 MW PV projects.
Conclusion: COVID-19 affects the PV market but PV will lead energy transition

Trends of renewable energy (2010〜2019年)

Source: IEA PVPS [Snapshot of Global PV Markets 2020]
Acknowledgement for the support of PVPS activities

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