

Global PV update in 2020 & module supplier/technology trends/bankability

PV-Tech & Solar Media Market Research

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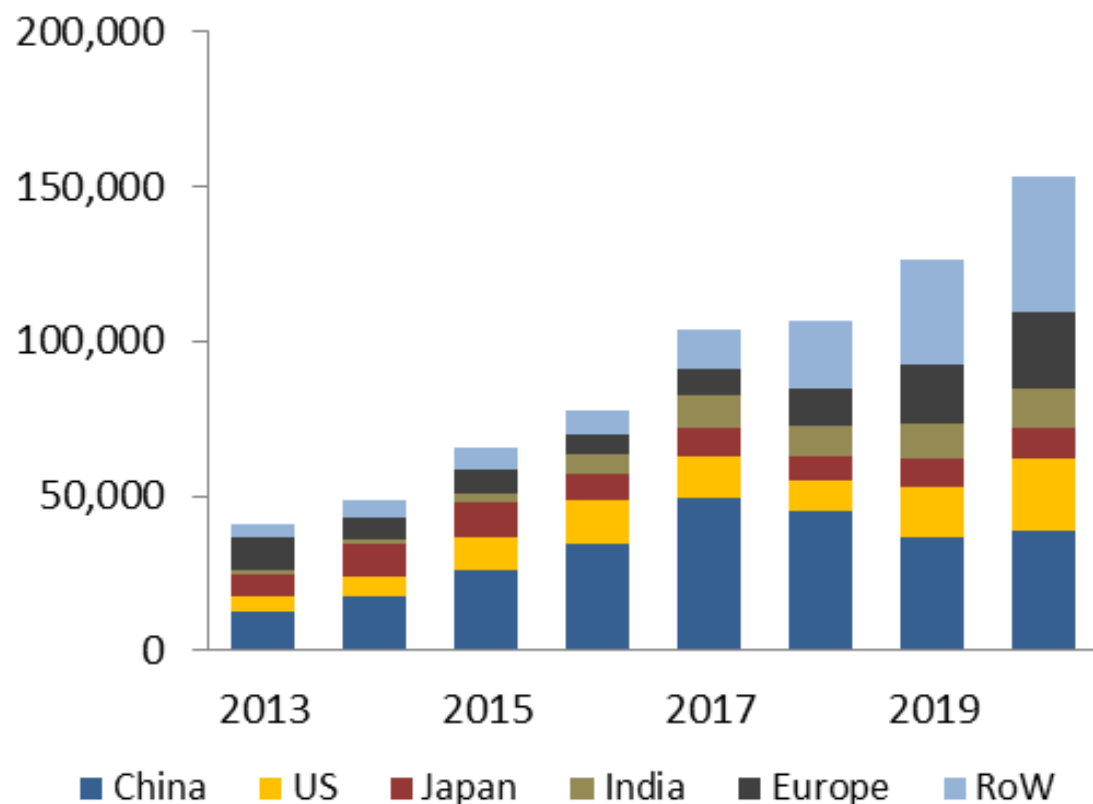
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1. Update on PV industry in 2019/2020

Moving from 50 to 100 to 150 GW pa

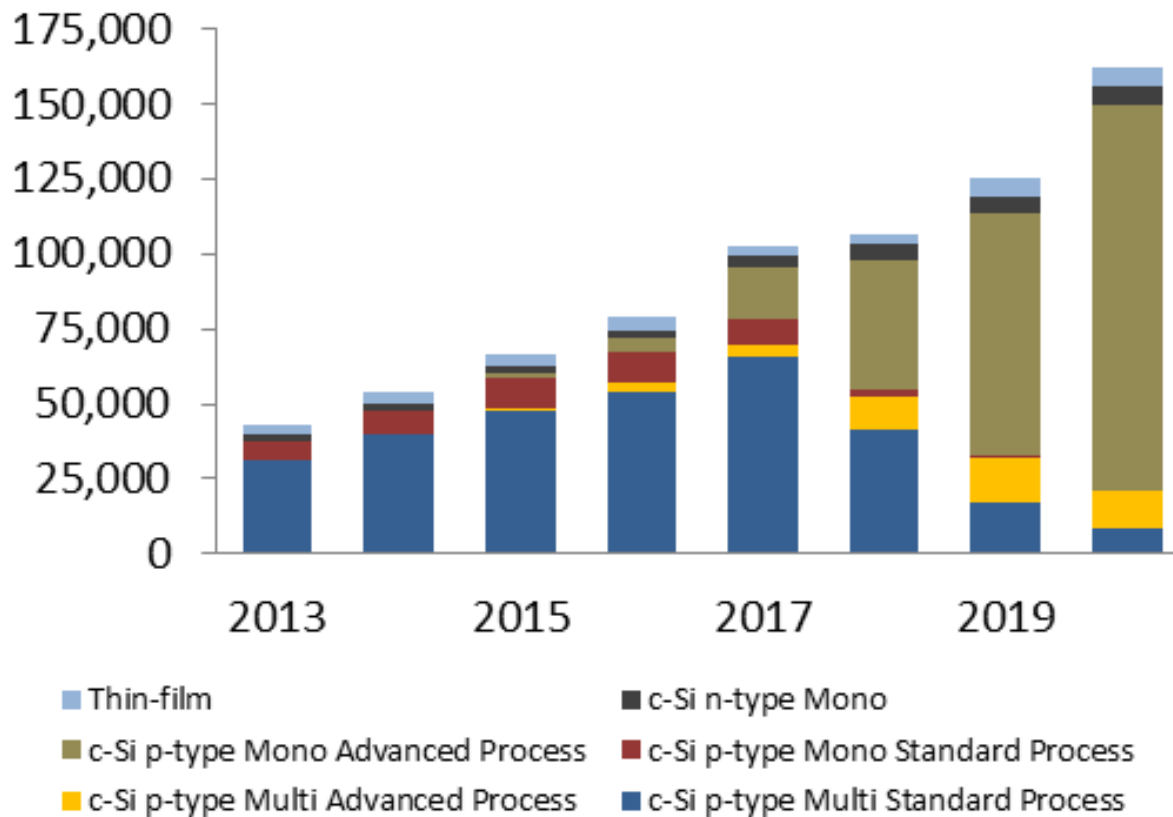
Global PV Module Supply (MW)



- The PV industry doubles in size about every 4 years.
- End-market demand was strongly influenced by China during the 50-100 GW growth phase.
- Europe, India, US & RoW countries/regions now have many annual-GW drivers.
- The industry generally grows during each calendar-year, but is impacted by fiscal-year deadlines, mid-year policy-changes, trade tariffs & ad-hoc stockpiling.

Technology impacts plant design

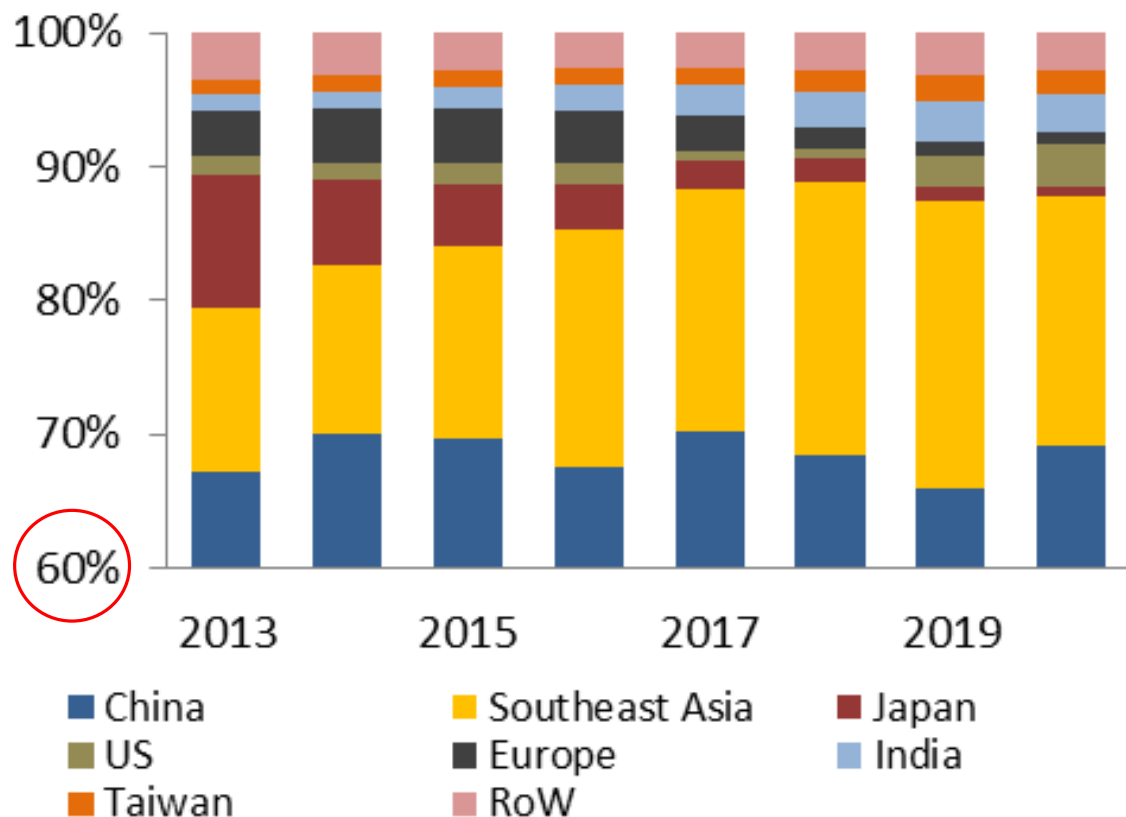
Production (MW)



- Mono is now the standard for module supply, with PERC based offerings dominant in 2019/2020.
- Within p-type mono PERC supply, there are lots of variants:
- Larger wafer formats, half-cut cells, front grid interconnections, larger module arrangements (more cells per panel).
- And of course... bifacial.

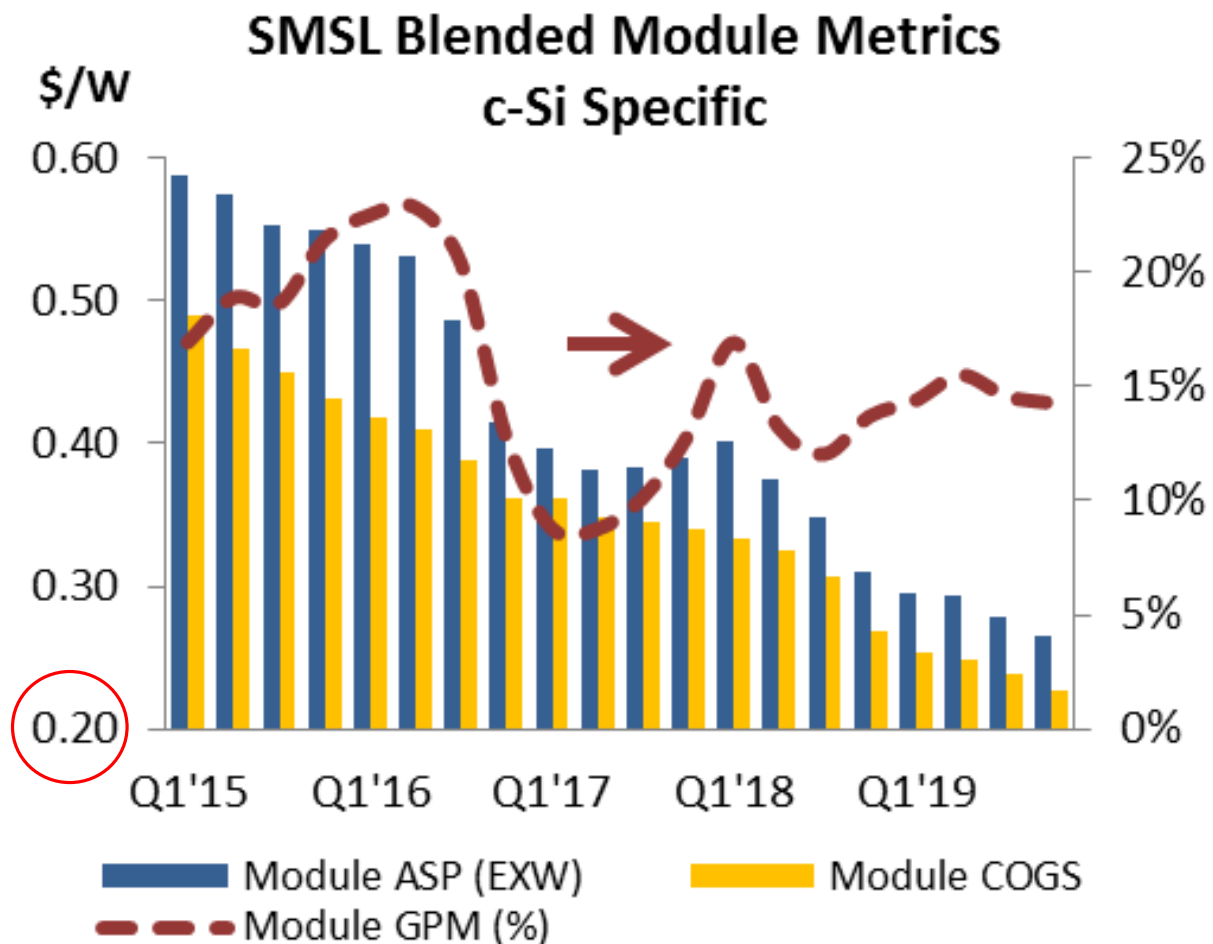
Module manufacturing by region

Module Production (MW)



- Similar to cells, Southeast Asia (including Korea) is the main module production location, outside China.
- There are many module producers in countries across Europe, India and RoW regions – however, many are used on OEM basis or loss-making/underutilized.
- The US is seeing new module capacity coming online (driven by AD/CVD & Section 201 trade barriers) during 2019/2020.

Module cost key to supplier stability



- This graph looks at blended average costs/ASPs of top-9 the SMSL grouping.
- Module costs have come down significantly in the past few years. Key for producers is keeping costs (COGS) trending below average module ASP.
- Module ASPs vary by technology, sales region, application (RT vs GM) & supplier brand-value.

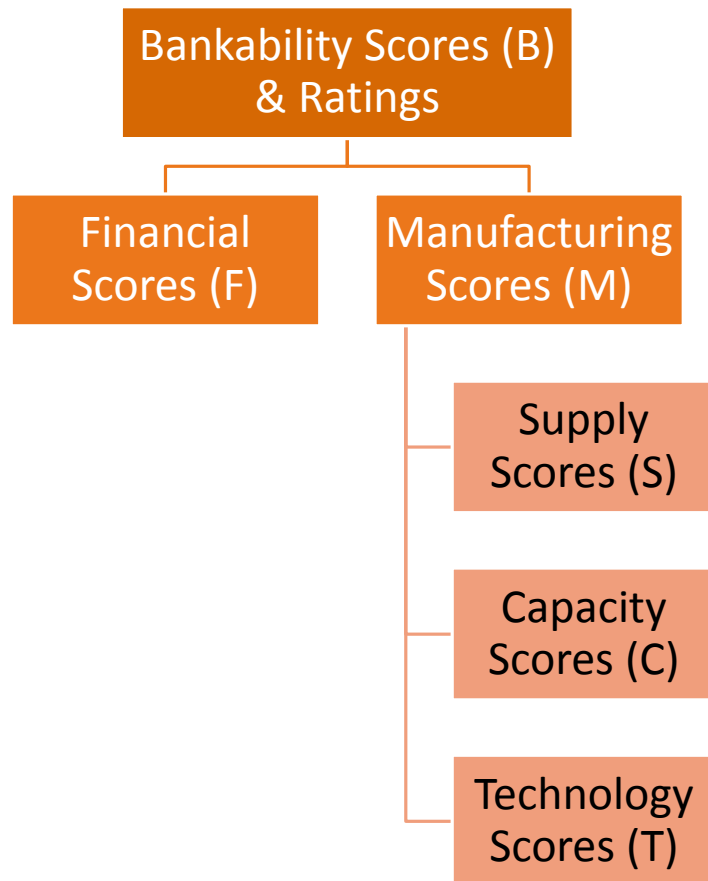
2. Bankability methodology

Motivation: bankability benchmarking



- There are still several hundred PV module suppliers within the industry.
- Well over 50 have been claiming to have Tier-1 type status & use this heavily for marketing & to infer bankability.
- There has been no analysis combining manufacturing & financial metrics to fully assess bankability.
- Within the utility sector, only a small grouping (around 10) of PV module suppliers compete for business outside China.
- Investors, EPCs, developers need a credible, independent mechanism to use in short-listing & due-diligence processes when selecting suppliers.

Methodology overview



- The final bankability score (B) is derived using a range of statistical analyses that involve gathering a wealth of data for each PV module supplier, going back 5-10 years.
- Scores are derived for each company's financial (F) and manufacturing health (M); the two key contributors to overall bankability (B).
- The manufacturing health (M) is a combination of PV module suppliers' supply/shipment (S), capacity (C) and technology (T) scores.

Hyperlinks to analysis on PV-Tech.org



- PV Tech's bankability analysis series links:
 - [Part 1. PV-Tech research set to reveal investment grades for global PV module suppliers](#)
 - [Part 2. PV-Tech research reveals how to assess PV module suppliers' capacity claims](#)
 - [Part 3. PV-Tech research establishes technology-leadership scorecard for top-100 module suppliers](#)
 - [Part 4. PV-Tech research reveals ranking tool for manufacturing strength of global module suppliers](#)
 - [Part 5. PV-Tech research ranks PV module suppliers by financial health](#)
 - [Part 6. First PV module supplier bankability ratings tool created by PV Tech research team](#)
- During July & August 2019, a series of six featured articles on PV-Tech.org outlined the methodology employed.
- This included separate articles for the different factors included in the flow-chart boxes on the previous slides (variables, T, C, S, M, F and B).

Bankability Score (B)

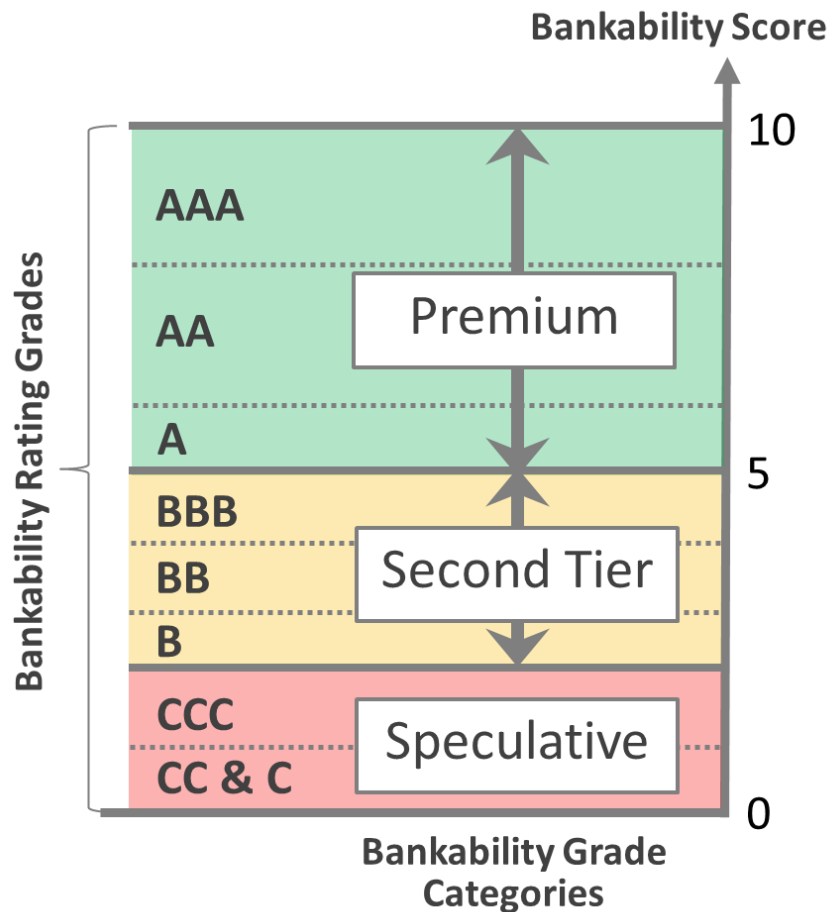
- The final bankability strength score (B) combines the manufacturing (M) and financial (F) scores.
- The bankability scores (from 0 to 10) are therefore an overall indication that PV module suppliers can deliver product, while remaining solvent.
- PV module suppliers with strong bankability scores must have high values for both manufacturing and financial operations. Weakness in one of the factors cannot be compensated by strength in the other factor. This is evident from the product nature of the final statistically-derived relationship below.

$$B_i = k \cdot M_i^m \cdot F_i^n$$

Scaling
constant

The power terms (m and n) are derived from nonlinear regression analysis based on the dependency of the variables (M and F) to observed bankability strengths of a chosen subset of module suppliers.

Scores, categories & rating Grades



- Three bankability grade categories are created, termed premium, second tier and speculative.
- Each category has three rating grades (for example, premium includes AAA, AA and A ratings).
- The ratings are based on the bankability scores (previous slide).
- The highest rated PV module suppliers will have AAA ratings (triple-A rated).
- The categories and rating grades are analogous to those used by credit ratings agencies (such as Standard & Poor's) when they assess the creditworthiness of entities (governments or companies, for example).

3. Module suppliers with 'A' & 'B' grade ratings

Only four suppliers AA-Rated

- Thirteen PV module suppliers are included in the provisional Y/E 2019 rankings, across the premium (AAA, AA, A) and second tier (BBB, BB, B) bands.

Rating	Module Suppliers				
AAA					
AA	LONGi Solar	JinkoSolar	First Solar	Canadian Solar	
A	Hanwha Q CELLS	GCL-SI	JA Solar	Trina Solar	Risen Energy
BBB					
BB					
B	Talesun (Zhongli)	DMEGC Magnetics	Astronergy (Chint)	Seraphim	

* Provisional Y/E 2019 Ratings: subject to changes post 2H'19 reporting & PV-Tech in-house data refreshes during Q1'20.

5. Summary

Key takeaways

- More than 75% of module suppliers claiming to be 'Tier-1' 'bankable' fall into the speculative bands of the PV ModuleTech Bankability Ratings, & are largely 'unbankable' for large-scale solar site selection today (or extremely high risk).
- Only companies with strong Manufacturing (in particular own-brand module shipments) & Financial operations are scored A & B grades.
- Only 4 suppliers are AA-Rated today: Jinko, Canadian, First Solar, LONGi.
- Large utility-scale global PV projects built in 2020/2021 should be considering 10-15 module suppliers (max) to start any due-diligence. Short-list likely to include the four AA-Rated suppliers above.
- Quality as a metric remains extremely challenging to quantify!
- PV ModuleTech Bankability Ratings report released quarterly as subscription service; Q1'20 updates get released next week! Several key changes to be announced!

Thank-you for listening!

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