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## PV module bankability 2014: who to trust?

Although PV modules are generally a commodity, some brands do have more visibility and better perception in the market. Bloomberg New Energy Finance ran a survey of engineering, procurement and construction contractors, debt lenders and independent technical consultants, identifying which brands industry players are most willing to use in their projects.

- Bloomberg New Energy Finance asked respondents which manufacturers out of a list of 49 they considered 'bankable'. The total capacity installed, financed and/or audited by the 17 participants of our survey corresponds to over 5GW.
- According to qualitative interviews, banks are not more stringent than two years ago but do have a clearer idea of what questions they should ask their technical assessors (companies like Sgurr Energy, Black & Veatch, TUV, E3 and OST Energy). Engineering, procurement and construction contractors have less stringent criteria than banks and independent technical consultants when selecting the brands for their projects.
- Some participants shared concerns on thin-film modules, particularly regarding long-term degradation risk – although 100% considered US leader First Solar bankable, and 77% rated Japanese company Solar Frontier bankable. China-based crystalline silicon module makers Yingli, Trina, JA Solar and Korean-owned Hanwha SolarOne were considered bankable by 93% of respondents, just behind First Solar.
- Although the financial standing of most solar firms is better than it was for much of 2013, the Chinese manufacturers in particular carry a lot of debt and therefore have low Altman-Z scores. However, their modules continue to be used in many projects, and many are expanding via agreements with original equipment manufacturers, or OEMs.
- Interviewees had mixed perceptions of module insurance products. Many feel that these are mostly taken on by module manufacturers to help them sell their products rather than to offering customers cover in case of bankruptcy of the manufacturer.
- The survey does not differentiate between regions, and some manufacturers may be well known to local banks. This is particularly true in Japan, where disclosure levels are low.

### 1. ABOUT THIS SURVEY

Seventeen firms, including engineering, procurement and construction contractors, or EPCs, and technical advisors on both modules and manufacturing lines, participated in our survey and in a round of qualitative interviews.

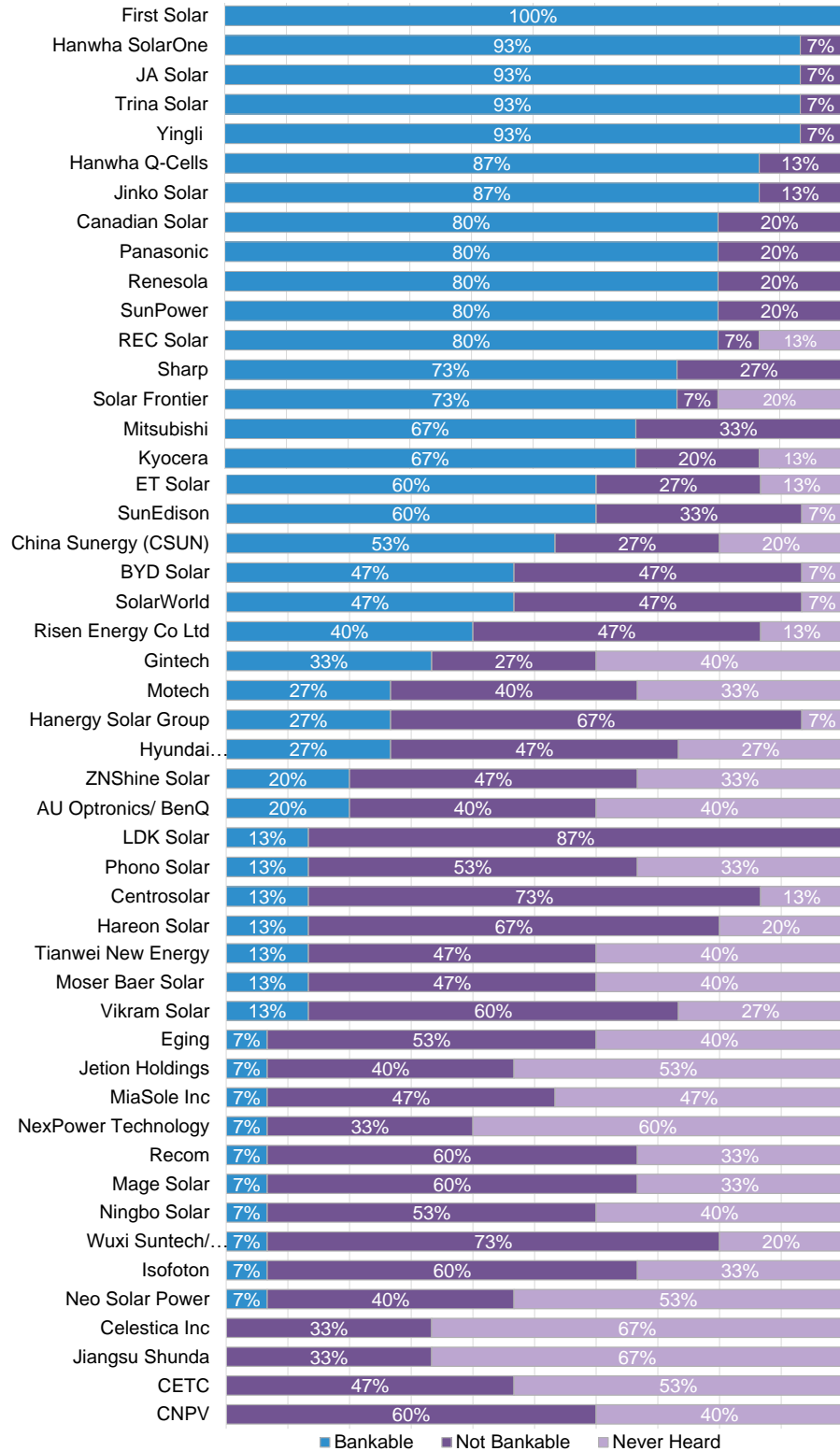
Bloomberg New Energy Finance asked respondents which manufacturers out of a list of 49 they considered 'bankable', with the options "Yes", "No" and "Never heard of the company". The total capacity installed, financed and/or audited by participants of our survey is more than 5GW.

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**1.1. Survey Results**

Figure 1 shows the results of the survey. The brands most widely considered bankable are First Solar and the leading Chinese firms.

**Figure 1: BNEF's bankability survey results**



Source: Bloomberg New Energy Finance

There are some concerns that cash-strapped manufacturers building projects for sale may not always have built to the highest quality standards

## 2. CHANGES IN THE MARKET

### 2.1. Bypassing banks

We define 'bankable modules' as those that are likely to be financed in projects by non-recourse loans from non-development banks.

Although the PV industry is no longer in severe overcapacity in the first half of 2014, there is still pressure on costs, and in the past two years many manufacturers have invested downstream in their own project development pipelines to capture margin and secure sales. Many large systems were commissioned on balance sheet, with no backing from debt lenders, and were then sold on to international investment funds. For example, the 24MW San Floro PV plant in Italy was developed and built by manufacturer Zhongli Talesun, then acquired by ForVei – a joint venture of banks, insurance companies and funds (including Foresight Group). In this case, we are sure that a thorough due diligence process minimised risk to the buyer. There is, however, a perception that some projects built by manufacturers may not have been executed to the highest standards and, if so, any quality issues may manifest years later.

An increasing number of deals in developing countries are taking place without involvement by commercial banks, instead receiving funding from development bodies or as full-equity investments. Our survey suggested that the criteria for these investors are somewhat less strict than those of commercial banks – partly due to the intrinsically high market risk in most developing countries.

### 2.2. Is quality changing?

A director at one of the major global companies carrying out bankability benchmark testing and production line audits said: "The PV industry is certainly not providing the quality present in other sectors as for example the automotive one which is way more mature. PV modules are certainly a commodity since they are a standard product using a technology consolidated over the past decades. However it is still essential to differentiate products by their quality."

According to the same source, the general quality of modules produced rose in 2010 and 2011, but then decreased in 2012-13 as a consequence of overcapacity, higher competition to drive prices down, and the financial distress of manufacturers. The respondent commented: "Though in many cases you do have very good quality products coming from China, the impression is that manufacturers want to pass the tests in order to put the certifications on paper and make them more attractive to the final buyer. In China the work ethics are different than in Germany. Instead the right mind-set would be to increase quality allowing manufacturers to reduce their risk exposure from faulty modules at a later stage. Quality has to be in the mind, not only on paper."

Another technical expert from a competing firm believes there is no particular distinction depending on whether a product is produced in China or anywhere else. What really makes the difference is the competency of the manufacturer. In particular, manufacturers with a history in electronics were producing higher-quality modules. On average, 25-30% of the production lines assessed by this company get a negative rating.

This respondent added that assessing modules by their brand is not always fair since one brand can use up to 15 different OEMs. In general it is important to determine whether the modules are produced internally by the manufacturer or whether the job is outsourced to OEMs. The latter can use cells from various manufacturers with different technical properties, a mix that might not be ideal in one project, since modules might behave differently.

The market for technical assessment of factories and projects is strong, as banks and developers realise avoiding defective products is much cheaper than claiming on warranties later.

Outsourced manufacture declined in 2012 and 2013 as manufactures struggling to fill their own order books, though it is increasing again in early 2014 as the top manufacturers find their products in demand. In addition, there is a trend to open new production lines in emerging markets such as India and South Africa, driven by local content rules.

### 2.3. Buyers go for proven technology

According to most interviewees, banks have not tightened their lending criteria over the past two years, though they are asking smarter questions during technical assessments. The standard tests investigate certifications, component quality, production process & equipment and packaging and transport. Technical assessors such as Sgurr Energy, Black & Veatch, TÜV, E3 and OST Energy have expanded their teams to meet demand from banks and manufacturers for assessment of factories and projects.

As well as reliability, standardisation is important because the modules used in a single string must be almost identical, as the performance of the entire string is limited by the performance of the worst. Racking and mounting systems are also designed for specific module dimensions. Crystalline silicon modules are fairly standardised, so faulty modules could be replaced in future with extremely similar ones, but this can be a problem for thin-film.

Nearly every thin-film company (see Research Note *Thin-film PV: survival of the biggest*, 7 March 2014) has a manufacturing process of its own, and many have been in production for less than 10 years. This makes future degradation and failure rates particularly difficult to assess, and replacing faulty thin-film modules is particularly difficult if the manufacturer goes bankrupt.

From the perspective of the manager of a rating agency assessing PV assets worldwide, the most important question is whether on a project level the EPC contractor retains cash guarantees to replace faulty components or to deal smoothly with unforeseen circumstances. The manager will also be concerned to ensure that modules be replaceable with similar ones.

One EPC manager suggested that a technical solution to the failure of modules that cannot be replaced by similar ones is to rearrange the string so to create space for a new string. He shared with us the details of a case in which his company claimed the warranty on a large batch of defective modules.

#### Case study of replacement of a large batch of modules under warranty

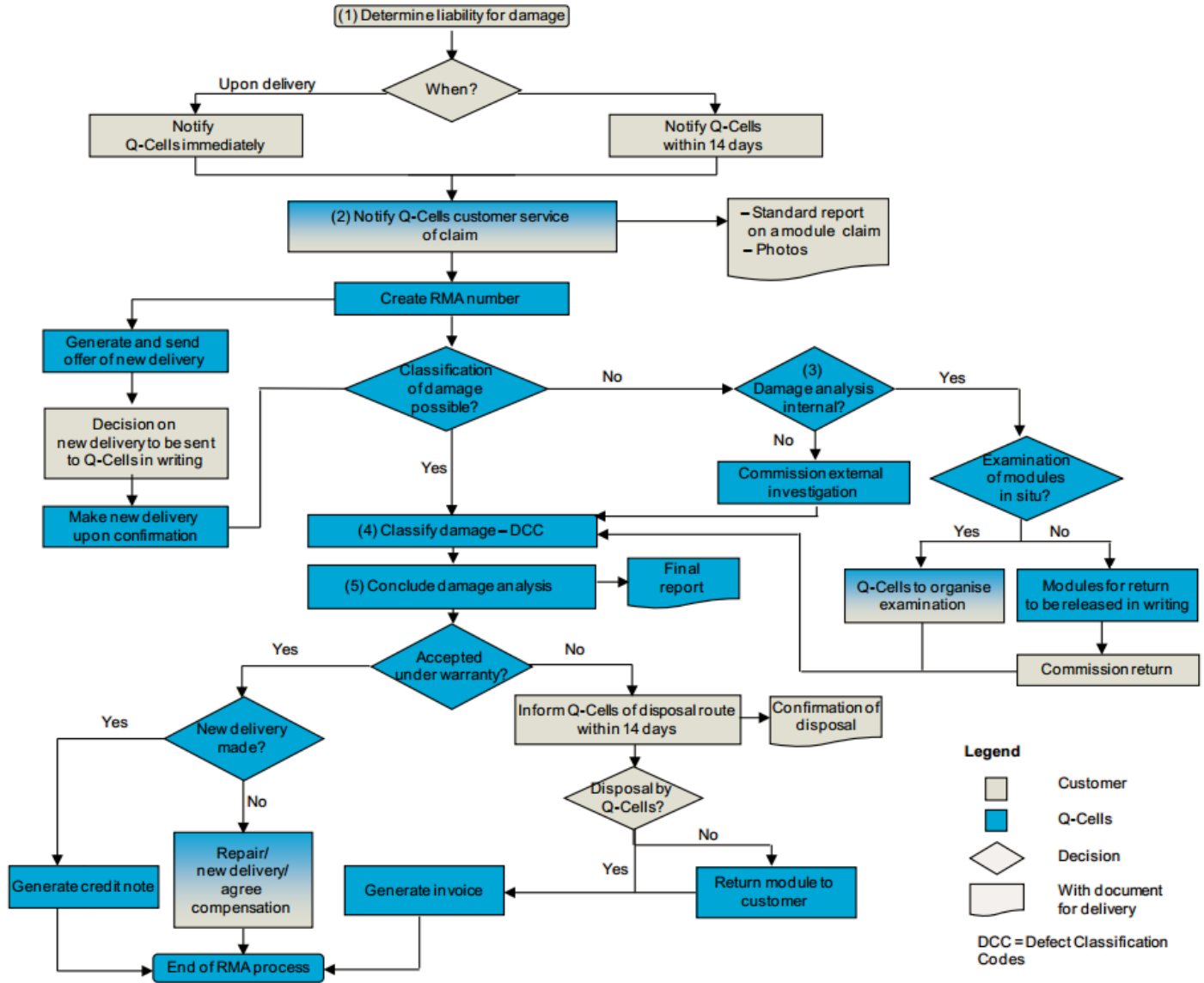
The EPC and owner of an 8MW plant in southern Europe noticed higher-than-normal potential-induced degradation (PID) levels, though overall output was just above business plan. The PID was being caused by system factors, which the EPC resolved by grounding the negative pole of arrays, with a ground fault detector interrupter provided by the inverter manufacturer. Some modules were highly degraded, which the EPC claimed on the module warranty. It took a year for the EPC to claim the warranty and replace the faulty modules since the bank's technical advisors did not detect the fault. Finally 9% of the entire plant's capacity was replaced, allowing the EPC to solve the core issue causing the high PID. The PV plant now has a performance 3% better than in the preceding year, leading to an increase in revenues of \$150,000/year.

The PID was completely removed from the plant, certified by an international independent engineering company. The total cost of this intervention amounted to around \$500,000, of which 15% was borne by the operations and maintenance contractor and the rest by the project suppliers.

The EPC company managed to convince the manufacturer to replace the modules thanks to an intense negotiation process helped by their past partnership.

Figure 2 shows Hanwha Q-Cells' claim process and how lengthy replacement times can be.

Figure 2: Overview of Hanwha Q-Cells' claim process



Source: Hanwha Q-Cells

#### 2.4. Technical due diligence matters more than module insurance

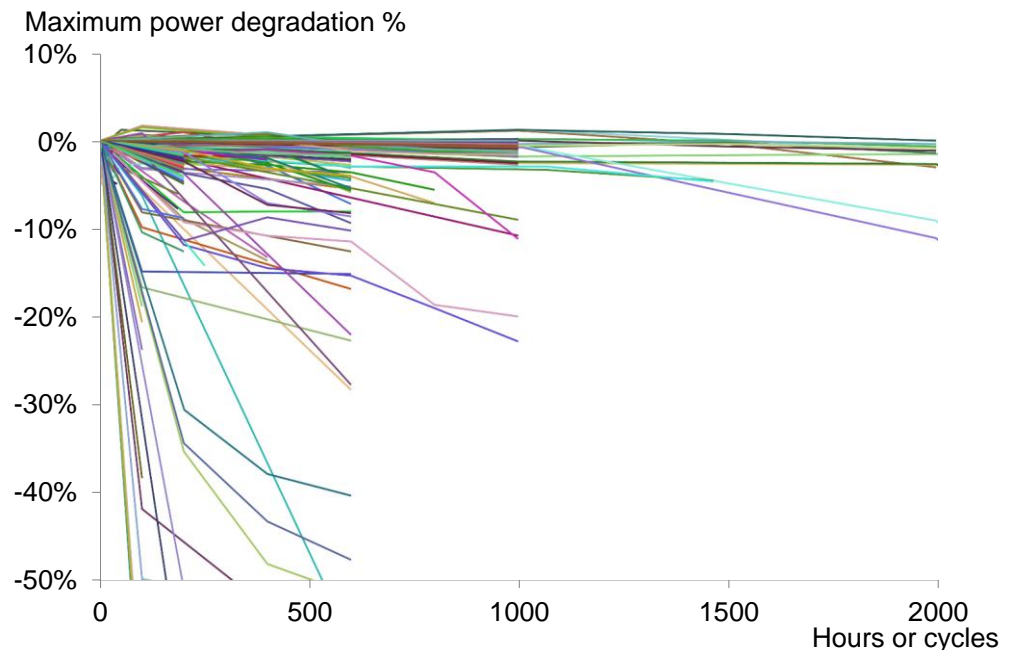
Compared with 2-3 years ago, banks are insisting on more independent flash/electrical tests. PV Evolution Labs, a facility that began doing module evaluation in 2010, shared with us the data regarding PV module degradation through various accelerated lifetime tests in special chambers at their labs. Figure 3 shows results for over 30 brands, with tests conducted on roughly 450 modules.

Table 1: Tier 1 module manufacturers by production capacity, Q1 2014 (MW)

Brand	MW
Yingli	3000
First Solar	2200
Trina	2400
Canadian Solar	2400
JA Solar	1800
Hanwha SolarOne	1500
Jinko Solar	1500
SunPower	1200
Hanwha Q-Cells	1100
ReneSola	1200
REC Solar	1200
Kyocera	1080
ET Solar	1000
Solar Frontier	960
Solarworld	850
CNPV	800
Risen Energy	800
BYD	750
Phono Solar	450
Vikram Solar	150

Source: Bloomberg New Energy Finance Note: Tier 1 criteria here. SunEdison would meet the criteria as a brand, but owns no module manufacturing capacity.

Figure 3: PV module degradation results from PV Evolution Labs



Source: PV Evolution Labs Note: Each line corresponds to a different module type

We notice a substantial spread in performance and reliability in the tested modules. This confirms the importance of picking a good quality product more than relying on product warranties and/or insurance on the module.

The prevailing sentiment from interviewees is that you should spend money to avoid the defect rather than to fix or insure it. Many feel insurance products are mostly taken on by module manufacturers to help them sell their products rather than to cover either the manufacturer in case of panel failure, or the customer in case of bankruptcy of the manufacturer. Insurance policies have significant exclusions, and in some cases they have caps on how much capacity the insurer can replace per year. In an extreme scenario where a particularly large bad batch of modules has to be covered by the insurer, an owner might be unable to have a faulty module replaced.

Also, most insurance coverage does not protect fully from poor module performance and specifically from lost revenue during downtime (unless the system owner signs up for project insurance – which certain insurers provide), dismantling and shipping defective modules and labour for the reinstallation. Banks and investors are increasingly aware of this but some still decide to sign up for module insurance.

Bloomberg New Energy Finance analysed insurance products for solar and wind projects in a White Paper, *Profiling the risks in solar and wind*.

### 3. BNEF'S TIERING METHODOLOGY GETS MORE STRINGENT

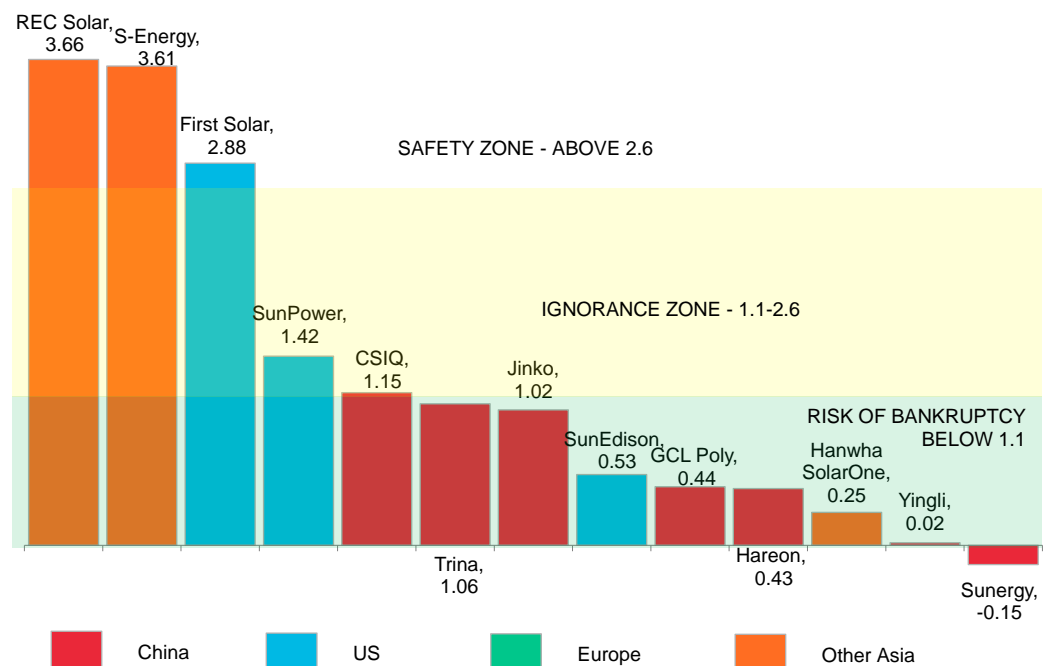
Figure 4 shows the module makers that meet our Tier 1 criteria as of Q1 2014. As of Q2 2014, we consider as Tier 1 those modules that have been used in at least five projects financed with non-recourse debt from non-development banks in the past two years, and whose manufacturers have not since gone bankrupt. These projects must be recorded individually in our database. This is an increase from three banks in Q1 2014, which we felt was insufficient given industry-wide rising standards of disclosure. The BNEF Tiering methodology should never be used instead of due diligence, but does indicate which brands have passed due diligence by a number of banks.

The BNEF tiering methodology is imperfect, because certain manufacturers have been more diligent than others in sending us lists of their projects to add to our database.

The full list of tiers for the surveyed brands is shown in Appendix 1. BNEF tier is only loosely correlated with whether the survey participants consider a brand bankable, and can be influenced by, for example, a company hiring an active public relations officer to send BNEF lists of projects with bank finance details for inclusion in the BNEF database. Japanese manufacturers like Panasonic and Sharp are perhaps undervalued by the BNEF tiering methodology, as they are concentrating on their booming domestic market, where data on bank finance are scanty.

Figure 4 shows the Altman-Z scores as of Q4 2013 for publicly listed PV manufacturers. This is a ratio of metrics of a company's financial health, ascertained by academic research to be a useful indicator of the probability of a company entering bankruptcy within the next two years. The higher the value, the lower the probability of bankruptcy. A score above 2.6 indicates bankruptcy is unlikely, below 1.1 bankruptcy is possible. According to this measure, First Solar, REC Solar (REC Solar ASA, the Singapore-centred spin-off from Norway's REC Group), SunPower and small Korean module assembly firm S-Energy are the only quoted pure-play module companies in the 'safety zone'.

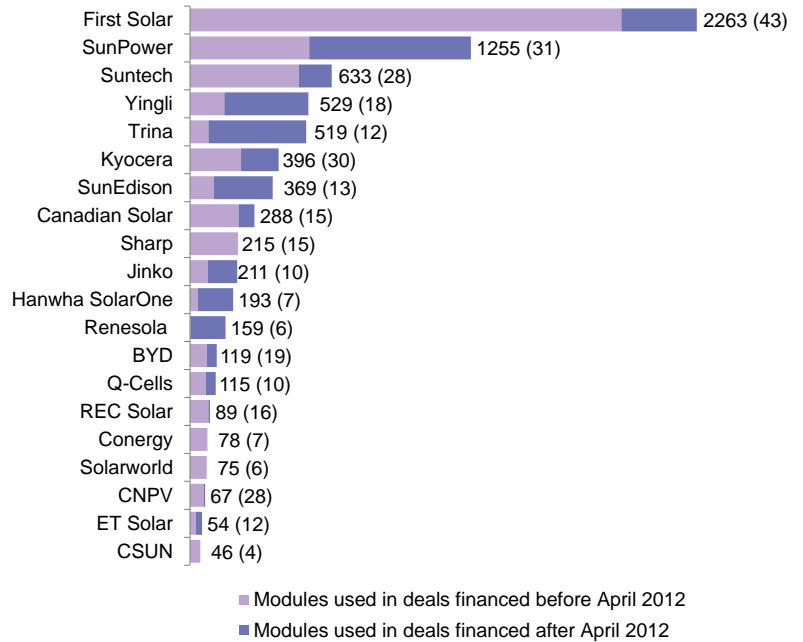
**Figure 4: Altman-Z scores of selected quoted pure-play PV companies, as of Q4 2013**



Source: Bloomberg New Energy Finance Note: Developed by Edward Altman in 1968, Altman-Z score is a measure shown to correlate with the probability of business failure leading to bankruptcy. It is a function of tangible assets, working capital, retained earnings, EBIT, market value of equity, total liabilities, and historical revenue

Figure 5 below shows which brand modules have been used most in debt-financed projects tracked by the BNEF Desktop. This is an imperfect measure of company reliability, since Suntech and Conergy have supplied many projects but have now filed for insolvency protection, and LDK has defaulted on a major bond issue.

Figure 5: Top 20 list of PV module brands used in debt-financed projects, by MW total (number of projects)



Source: Bloomberg New Energy Finance Note: Numbers in brackets represent the number of deals. Only projects from the Bloomberg New Energy Finance database were included with capacities higher than 1MW.



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Appendices

Appendix A: BNEF bankability survey results

Manufacturer's Name	BNEF Tier	Country	Share of respondents who are aware of this brand	Percentage of responders who regard this brand as bankable
First Solar	1	USA	100%	100%
Hanwha SolarOne	1	China	100%	93%
JA Solar	1	China	100%	93%
Trina Solar	1	China	100%	93%
Yingli	1	China	100%	93%
Hanwha Q-Cells	2	China	100%	87%
Jinko Solar	1	China	100%	87%
REC Solar	1	Singapore	93%	83%
Canadian Solar	1	China	100%	80%
Panasonic	2	Japan	100%	80%
Renesola	1	China	100%	80%
SunPower	1	USA	100%	80%
Solar Frontier	1	Japan	87%	77%
Sharp	2	Japan	100%	73%
Kyocera	1	Japan	93%	70%
Mitsubishi	2	Japan	100%	67%
SunEdison	-	USA	100%	63%
ET Solar	1	China	87%	60%
China Sunergy (CSUN)	1	China	87%	57%
SolarWorld	1	Germany	100%	50%
BYD Solar	1	China	93%	47%
Risen Energy Co Ltd	1	China	93%	43%
Gintech	2	Taiwan	67%	37%
Hyundai Heavy Industries	1	South Korea	87%	33%
Hanergy Solar Group	2	Hong Kong	100%	30%
Motech	2	Taiwan	67%	27%
AU Optronics/ BenQ	2	Taiwan	67%	23%
Vikram Solar	1	India	87%	20%
Moser Baer Solar	2	India	73%	20%
ZNShine Solar	2	China	67%	20%
Centrosolar	2	Germany	93%	17%
Hareon Solar	1	China	87%	17%
Tianwei New Energy	2	China	67%	17%
LDK Solar	3	China	100%	13%
Isoton	3	Spain	80%	13%
Phono Solar	1	China	67%	13%
Neo Solar Power	2	Taiwan	60%	13%
Wuxi Suntech/ Shunfeng Photovoltaic	3	China	87%	10%
Mage Solar	2	Germany	73%	10%
Sun Earth Solar Power Co (Ningbo Solar)	2	China	67%	10%

Manufacturer's Name	BNEF Tier	Country	Share of respondents who are aware of this brand	Percentage of responders who regard this brand as bankable
Recom	3	Greece	67%	7%
Eging	2	China	60%	7%
MiaSole Inc	3	USA	53%	7%
Jetion Holdings	2	China	47%	7%
NexPower Technology Corp	2	Taiwan	40%	7%
CNPV	3	China	67%	3%
China Electronics Technology Group Corp. (CETC)	3	China	53%	3%
Celestica Inc	2	Canada	33%	0%
Jiangsu Shunda	3	China	33%	0%

Source: Bloomberg New Energy Finance Note: Based on survey results for a selected range of companies. SunEdison would meet the criteria as a brand, but owns no module manufacturing capacity.

