

Quarterly analysis of PV manufacturing capacity expansion plans

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ABSTRACT

In edition 26 of *Photovoltaics International* the rebirth of PV manufacturing capacity expansions in 2014 was analysed; this covered announcements on a global basis from a wide range of companies and included thin film and dedicated solar cell and module assembly lines, as well as integrated cell and module assembly lines. Because of the current level of capacity expansion announcements, a roughly quarterly analysis of such plans will be undertaken during 2015.

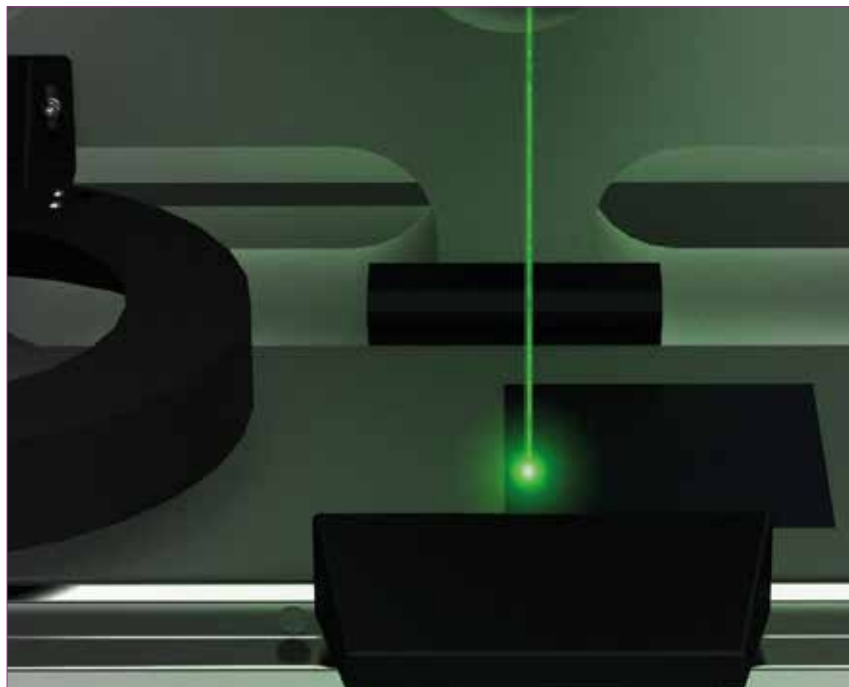
December 2014 review

The initial review of PV manufacturing capacity expansion plans in 2014 ran from January 2014 to November 2014; an analysis of announcements made in December will therefore be given first, and then a final tally provided for the year.

In December 2014 a total of seven companies announced expansion plans, primarily for integrated cell/module lines; this was especially noteworthy, as the majority were not Tier 1 c-Si manufacturers. A total of 1110MW of new c-Si solar cell capacity was announced, of which 300MW were classified as dedicated cell capacity. Because the majority of the announcements were for integrated lines, a total of 1160MW of c-Si module assembly line capacity was announced, which therefore closely matched the cell capacity expansions in December.

After four months of dormant thin-film activity, Hanergy Thin Film announced it would build a dedicated 300MW plant in China for the production of flexible CIGS thin-film substrates. Toolmaker Beijing Jing Cheng, a Hanergy Group subsidiary, was said to be providing the production lines for the facility, which would be in Changde, Hunan province. The new production facility would be built by the provincial government, with construction expected to be completed in June 2016.

Hanergy's plans, however, were not the largest announced in the last month of 2014; that honour goes to Bharat Heavy Electricals Ltd (BHEL), which announced plans to build an integrated c-Si plant with a nameplate capacity of 500MW, although this would be ramped in unspecified phases. BHEL was responding to India's plans for 100GW of PV installations by 2022, but as will be



Credit: SCHMID Group

Figure 1. SCHMID's laser process for PERC solar cells.

shown later in this paper, February 2015 marked a significant flurry of manufacturing capacity pledges in India based on the country's new targets.

On a technological level the announced expansion by ERDM Solar, based in Mexico, is interesting, as the company plans to expand existing solar cell and module capacity from 60MW to 170MW through employing equipment and turnkey production supplier SCHMID's bifacial multi-busbar technology. ERDM Solar expects to ramp the new 110MW (two lines) expansion in the third quarter of 2015.

SCHMID was also busy in forming a partnership with Pekintas Group to build a 200MW turnkey c-Si cell and module manufacturing facility in Russia for start-up company Solar Systems. Financial details have not been disclosed, but Solar Systems was said to have been established by

Chinese shareholder Amur-Sirius in 2014. Production is planned to begin in the second quarter of 2016.

Final 2014 roundup

On a monthly basis December's combined 1760MW of announcements were in line with those in January, February, May and June, while the peak months of the year clearly turned out to be March (3480MW) and November (4938MW), as seen in Fig. 2.

This should not come as a surprise, because the two peak months for announcements primarily included major expansions from leading Tier 1 PV manufacturers. Indeed, looking back over these specific companies, Trina Solar, JinkoSolar, JA Solar and Canadian Solar are noteworthy, as these were the fastest-growing Tier 1 producers on the basis of PV module shipments in 2014.

“The first and fourth quarters of 2014 generated the most activity for capacity expansion announcements.”

2014 quarterly trends

On a quarterly basis it is clear that the first quarter (6.79GW) and fourth quarter (7.64GW) of 2014 generated the most activity for capacity expansion announcements, with significantly higher numbers than in the middle quarters of the year (Fig. 3).

Historically, the first quarter of a given year has always been recognized as a key quarter for capacity expansions, especially given that the majority of Tier 1 PV manufacturers are publicly listed and during this quarter will announce full-year financial results and guidance for the year ahead. From that perspective the first quarter of 2014 can be regarded as following historical trends.

The surprise, however, is the high number of announcements in the fourth quarter of 2014. Clearly, as already noted, some of the fastest-growing companies were responsible for further expansion announcements in the fourth quarter, and predominantly announced in November when reporting on the third-quarter financial period. This

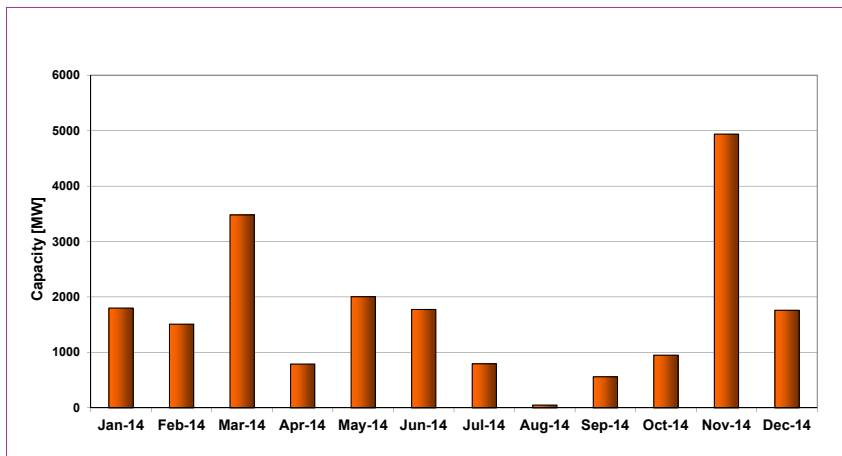


Figure 2. Cell/module manufacturing capacity expansions announced in 2014 by month.

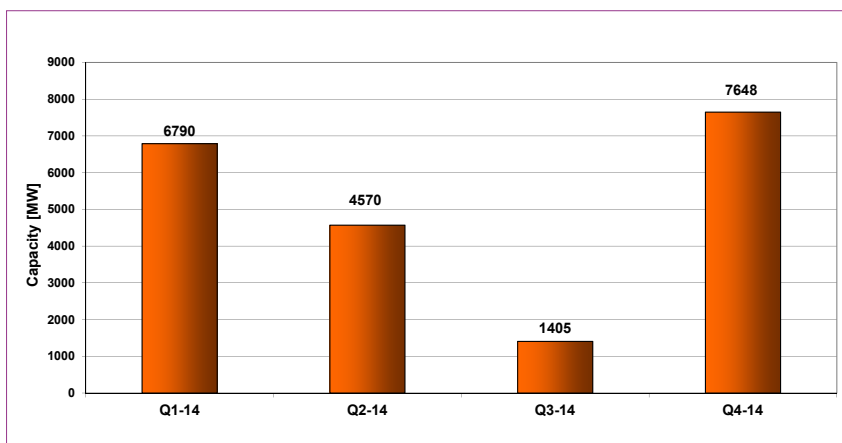


Figure 3. Cell/module manufacturing capacity expansions announced in 2014 by quarter.

Company	Announcement date	Manufacturing location	New nameplate capacity [MW]	Production/product type
Ascent Solar	Jan-14	Suqian, Jiangsu province, China	25	flex CIGS thin film
Solar Frontier	Jan-14	Tohoku, Japan	150	CIS thin film
Hanergy Solar	Jan-14	Caofeidian, Hebei province, China	600	CIGS thin film
TSMC	Feb-14	Taiwan	80	CIGS thin film
First Solar	Mar-14	Malaysia	200	CdTe thin-film upgrades
Stion Corp	Jun-14	Hattiesburg, Mississippi, USA	100*	CIGS thin-film module assembly
Siva Power	Jul-14	Silicon Valley, California, USA	CIGS pilot line	CIGS thin-film pilot line
SoloPower	Jul-14	Portland, Oregon, USA	75	flex CIGS thin film
First Solar	Nov-14	Perrysburg, Ohio, USA	178	CdTe thin-film modules
First Solar	Nov-14	Malaysia	350	CdTe thin-film module lines upgraded and recommissioned
Hanergy Thin Film	Dec-14	Changde, Hunan province, China	300	integrated flex CIGS thin-film plant
			Total 2058	

* Estimated

Table 1. Thin-film capacity expansion announcements in 2014.

was also supported by a relatively strong December from non-Tier 1 manufacturers.

Thin-film revival

Hanergy's 300MW announcement in December topped off a revival year for thin-film technologies. In total just over 2GW of new capacity expansions were announced in 2014, dominated by Hanergy's two separate CIGS thin-film plans for three of its acquired companies, totalling 900MW (Table 1).

Second was the return of CdTe leader, First Solar, which announced expansions and efficiency upgrades totalling 728MW at its plants in the USA and Malaysia. However, on a technology product basis, planned CIGS (including CIS) expansions exceeded 1230MW.

PERC cells lead c-Si capacity expansions

Another revival in 2014 was related to dedicated c-Si solar cell capacity expansions, also notable because the majority of expansions deployed PERC cell technology, as higher efficiency cells become a key path to product differentiation and offer the potential for lowering the cost per watt. Total

dedicated c-Si solar cell expansions announced in 2014 topped 5GW, while the figure reached 7.86GW when integrated cell/module expansions are included (Table 2).

Another aspect of the revival in solar cell expansions was the scale rather than the number of companies announcing dedicated mono c-Si expansions. Although some PV manufacturers switched some production lines to mono production in the course of the year, these were not technically new capacity expansions.

Yingli Green may have touted technical developments and the adoption of new technologies, such as ion implantation to produce its n-type mono Panda cells, but the company has not added any new capacity in 2014. Only SolarCity, Canadian Solar, Mission Solar, Shaanxi Youser, SolarWorld and Suniva announced dedicated mono c-Si expansions in 2014, totalling almost 2GW of the combined 7.86GW of solar cell announcements.

“PV module capacity expansions continued to gain momentum in 2014.”

Module assembly leads capacity plans

PV module capacity expansions continued to gain momentum in 2014, with c-Si announcements reaching 11.9GW. As with solar cell expansions, major Tier 1 PV manufacturers dominated. However, new entrants such as SolarCity and a number of regionally small-scale players, certainly played a part in bulking-up the final tally (Table 3).

Africa (320MW) and Latin America (450MW) are notable, as they are clearly emerging downstream markets, and some specific countries – such as South Africa and Brazil – have local content rules.

January 2015 full of ambition

Early in January, major US-based fab-less photovoltaics energy provider (PVEP) SunEdison decided to add Gujarat in India to the list of potential sites in its eventual aim to become a fully integrated PV manufacturer. The company had signed a memorandum of understanding (MoU) with Indian conglomerate Adani Enterprises to establish a joint-venture (JV) fully integrated (polysilicon-to-module) manufacturing cluster in Mundra, Gujarat, at a cost of around US\$4bn.

Company	Announcement date	Manufacturing location	New nameplate capacity [MW]	Production/product type
Hanwha Q CELLS	Jan-14	Cyberjaya, Malaysia	204	c-Si PERC cell
JinkoSolar/Topoint	Jan-14	China	500	multi c-Si cell
Solland Solar	Feb-14	Heerlen, Holland	50	multi c-Si cell
Trina Solar	Mar-14	China	500	multi c-Si cell
JA Solar	Mar-14	China	300	c-Si cell
Hanwha SolarOne	May-14	China	200	c-Si cell
Canadian Solar/ GCL-Poly	May-14	Funing, Jiangsu province, China	1200	c-Si cell
Indosolar	Jun-14	India	250	multi c-Si selective emitter cell
Shaanxi Youser	Jul-14	China	380	multi c-Si cell
Hareon Solar	Sep-14	China	100*	c-Si PERC cell
TS Solartech	Sep-14	Malaysia	20*	multi c-Si cell
Canadian Solar	Nov-14	Funing, China	400	mono c-Si PERC cell
JA Solar	Nov-14	China	600	multi c-Si cell
Rolta Group	Dec-14	Mumbai, India	300	multi c-Si cell
		Dedicated	Total 5004	
		Incl. integrated	Total 7860	

* Estimated

Table 2. Dedicated solar cell capacity announcements in 2014.

Company	Announcement date	Manufacturing location	New nameplate PV module capacity [MW]	Production/ product type
JinkoSolar/Topoint	Jan-14	China	100	multi c-Si module assembly
JA Solar/Powerway	Jan-14	Port Elizabeth, South Africa	150	multi c-Si module assembly
ELIFRANCE	Feb-14	La Talaudière, France	20*	multi c-Si module assembly
EL.ITAL	Feb-14	Avellino, Italy	20*	multi c-Si module assembly
Pure Energy Generation	Feb-14	Marechal, Brazil	70	multi c-Si module assembly
Wuxi Suntech	Feb-14	Wuxi, China	1000	multi c-Si module assembly
REC Solar	Feb-14	Singapore	120	multi c-Si module assembly
Vitec Global Solar	Mar-14	Otawara City, Tochigi Prefecture, Japan	80	multi c-Si module assembly
Trina Solar	Mar-14	China	1000	multi c-Si module assembly
Canadian Solar	Mar-14	China	400	multi c-Si module assembly
JA Solar	Mar-14	China	1000	c-Si module assembly
Jabil Circuits	Apr-14	Kwidzyn, Poland	240	multi c-Si module assembly
REC Solar	Apr-14	Singapore	300	multi c-Si module assembly
Solargiga/Jinzhou Yangguang	Apr-14	China	170	mono c-Si module assembly
Hanwha SolarOne	May-14	China	500	multi c-Si module assembly
Green Panel Technology Jurawatt Tunisie	May-14	Tunis, Tunisia	30	multi c-Si module assembly
Tata Solar	May-14	Bangalore, India	75	c-Si module assembly
Hanplast	Jun-14	Poland	85	Meyer Burger's 'SmartWire' module assembly
Gintung Energy	Jun-14	Taiwan	150	c-Si module assembly
Kyocera	Jun-14	Japan	200	c-Si module assembly
Suniva	Jul-14	Saginaw, Michigan, USA	200	n-type mono module assembly
BYD	Jul-14	Sao Paulo, Brazil	20*	c-Si module assembly/ R&D
Tecnova Renovables/Sky Solar	Aug-14	Paysandú, Uruguay	50	c-Si module assembly
Grupo IUSA	Sep-14	Mexico	50–200	c-Si module assembly
SolarTech	Sep-14	Riviera Beach, Florida, USA	80+	Meyer Burger's 'SmartWire' module assembly
Hanwha Q CELLS	Oct-14	Cyberjaya, Malaysia	800	c-Si PERC/module assembly
SunPower	Nov-14	Cape Town, South Africa	160	n-type mono module assembly
Canadian Solar	Nov-14	Changshu and Luoyang plants, China	500	mono/multi c-Si PERC modules
JA Solar	Nov-14	China	600	multi c-Si module assembly
Hanwha SolarOne	Nov-14	South Korea	250	multi c-Si module assembly
JinkoSolar	Nov-14	China	200	multi c-Si module assembly
JinkoSolar	Nov-14	China	640–800	c-Si PERC/module assembly
Bharat Heavy Electricals Ltd (BHEL)	Dec-14	Maharashtra, India	500	integrated c-Si cell/module lines
PSC Solar Industries	Dec-14	Warewa, Nigeria	10	multi c-Si module assembly
tenKsolar	Dec-14	Thailand	50–100	multi c-Si module assembly
ERDM Solar	Dec-14	San Andrés Tuxtla, Mexico	110	integrated c-Si bifacial cell/module lines
Solar Systems	Dec-14	Alabuga, Russia	200	integrated c-Si cell/module lines
Rolta Group	Dec-14	Mumbai, India	240	multi c-Si module assembly
* Estimated			Total 10,700	

Table 3. Dedicated c-Si module capacity expansion announcements in 2014.

However, despite the worldwide headlines proclaiming the MoU to be a done deal, the statement from SunEdison included a caveat that a decision on progressing with the MoU would only be made after it had conducted a feasibility study, without giving any timelines. Therefore, as SunEdison had already touted similar potential manufacturing deals in Saudi Arabia and China in 2014, the India plans will prudently not be included in the database until more concrete proposals have been announced, and such announcements will be classified as mere pledges for now.

On a more solid basis, China-based PV manufacturer Jetion Solar said that as part of its success in Thailand's PV market, it expected to have a 200MW cell and module facility operational in May 2015. PV module assembly manufacturing consultancy specialist J.v.G. Thoma said mid-month that it would supply a 70MW turnkey production line to start-up company Renovasol in Brazil and would be responsible for the complete toolset as well as certification, training and ramp-up. Module production is expected to start sometime in 2015.

Hanwha Q CELLS (to be merged with sister company Hanwha SolarOne and retain the Q CELLS name) said it will be closing down all solar cell and module manufacturing production in Germany; 230MW of solar cell nameplate capacity and 130MW of PV module capacity will be relocated to its main production facility in Cyberjaya, Malaysia. The company announced plans last year to add new capacity in Malaysia during the year, so the production capacity relocation has been included as added capacity, with the intention of highlighting for future reference actual nameplate capacity figures for what will be Hanwha Q CELLS' only manufacturing facility in Malaysia at this time.

Indonesian state-owned electronics firm PT Len Industri plans an integrated solar cell and module assembly plant in the country, confirming reports that go back to 2012, when proposals were said to target a 60MW capacity. Funding for the project has remained an issue, however.

India-based PV module assembly manufacturer Surana Solar is to start solar cell production in March 2015, having previously acquired two production lines from shuttered manufacturer Schott Solar in Germany. In 2013 Surana Solar had planned to acquire two solar cell lines, each having

an annual nameplate capacity of 55MW, to integrate into its existing module assembly lines with a capacity of 40MW.

In total, 440MW of new capacity were announced in January, compared with 1.8GW announced in the first month of 2014. The key difference was the lack of announcements from major Tier 1 suppliers. Only 110MW of dedicated solar cell capacity were announced during the month, while integrated capacity totalled 260MW. Dedicated module assembly expansions totalled 70MW, but no thin-film announcements were made.

February 2015 capacity plans full of pledges

As noted earlier, India has significantly raised its PV installation target to 100GW by 2022. In mid-February, India's Prime Minister, Narendra Modi, and Minister of State for power, Piyush Goyal, attended the first government-backed event to kick-start investment in Modi's plans. This led to significant 'pledges' by India's PV manufacturers to expand production in line with the downstream targets. In total the capacity expansion pledges by at least 12 local firms exceeded 41GW. However, as they do not represent planned or announced expansions, the pledges should be treated with caution, similarly to the comments made about SunEdison's 'ambition' for establishing its first production facility in India. On the basis of several actual announcements of capacity expansions in India that have been driven by India's new PV targets, developments will nevertheless be closely monitored and reported as they happen.

Key capacity plans announced by mid-February include SolarPark Korea's proposals to expand its module capacity to 1.2GW, up from its current capacity of 600MW. LG Electronics is planning to spend around US\$145m on expanding its capacity by around 200MW for its n-type monocrystalline cells and modules; the capital expenditure plans would be undertaken by the end of July 2015. Chinese PV manufacturer Zhongli Talesun has officially started construction of a 500MW integrated solar cell and module assembly plant in the Thai-Chinese Industrial Zone in Rayong, Thailand. Talesun said that the production plant would be fully automated and employ advanced processing technology to produce high-efficiency solar cells and modules; production is expected to start in October 2015.

Waaree Energies, one of India's largest PV module manufacturers, is significantly adding capacity to meet demand, having already expanded capacity to 500MW, and is planning to double that to 1GW over the next four months. Waaree recently completed a 250MW module assembly expansion phase at its plant in Surat, Gujarat, taking nameplate capacity to 500MW. The company claimed that as a result of the expansion it had become the largest single location for PV module manufacturing in India. In November 2014 Waaree said it was working with GT Advanced Technologies (GTAT) on incorporating its new Merlin cell metallization and interconnection technology into its existing module production lines.

In total, 2.39GW of new capacity announced in February 2015 were logged, compared with around 1.5GW announced in the second month of 2014. The key differentiator was the large expansions by SolarPark Korea, Waaree and Zhongli Talesun. Dedicated solar cell capacity expansion announcements in the month totalled 300MW, while integrated capacity announcements were 800MW. In the case of module assembly expansions, dedicated capacity totalled 765MW, while integrated capacity was 1.3GW. No thin-film announcements were made in February.

“Capacity expansion announcements in the first two months of 2015 are in line with those for the same period last year.”

Conclusion

Capacity expansion announcements in the first two months of 2015 are in line with those for the same period last year. However, the majority of announcements were from Tier 2 and start-up suppliers, and the absence of major Tier 1 suppliers may be due to looming full-year financial results in March, which is expected to generate another wave of expansions.

In the next quarterly report full details of Tier 1 announcements and a full quarterly analysis will be presented. As part of the analysis, an assessment of expected manufacturing capacity ramps from over a full year's worth of announcements will also be included, in order to understand supply and demand dynamics.