

# Analysis of PV manufacturing capacity expansion plans in 2014

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## ABSTRACT

Global PV end-market demand for PV modules is expected to reach around 50GW in 2014, which has prompted the need for manufacturers to expand capacity to meet demand. With effective module capacity standing at around 45GW at the end of 2013, *Photovoltaics International* (PVI) has analysed solar cell, c-Si and thin-film capacity expansion announcements that were extensively reported by sister website, PV Tech, from the beginning of 2014 through to the end of November to establish key trends.

## Next capacity expansion phase

After two years of chronic overcapacity, 2014 has heralded an end to profitless prosperity for most of the major PV manufacturers and the beginning of the next technology buy cycle and meaningful capacity expansion phase, according to the latest analysis of capacity expansions announced by the manufacturers of solar cells and PV modules, including thin-film variants, in 2014.

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In tandem with strong end-market demand that exceeded effective manufacturing capacity by the end of 2013, the first quarter of 2014 (Fig. 2) ushered in combined solar cell and PV module capacity expansion announcements totalling almost 6.8GW. This was followed by a further 4.5GW of capacity expansion announcements in the second quarter of 2014. The third quarter proved to be the least active quarter of the year: only 1.4GW of new capacity expansions were announced. But with 5.9GW announced in October and November, the fourth quarter had already easily surpassed the scale of capacity announcements in the second. During the 11 months analysed, a total of around 18.6GW of new capacity was announced.

Fig. 3 shows that c-Si module-assembly capacity expansion



Source: Hanwha Q CELLS

Figure 1. Hanwha Q CELLS is increasing its module production capacity in Malaysia in 2015.

announcements dominated in the first quarter of 2014, totalling over 4GW. This was followed by over 1.2GW of c-Si solar cell expansions and just over 1GW of thin-film capacity expansion plans. However, in the second quarter of 2014, over 2.7GW of c-Si solar cell expansion plans had been announced, compared with a further 1.8GW of c-Si module expansions. Only 100MW of new thin-film activity occurred during the quarter.

With the third quarter having by far the least activity, only around 830MW of c-Si module, 600MW of c-Si cell and 75MW of thin-film capacity expansions were announced. The fourth quarter (October and November) recovered strongly, as indicated by at least a further 4GW of c-Si module-assembly capacity expansion announcements, followed by c-Si cell expansions totalling over 2.1GW, and thin-film expansions

of over 500MW. In 2014 total new thin-film capacity expansion announcements are therefore estimated to have been around 1.7GW, while c-Si solar cell topped 6.7GW and c-Si module-assembly capacity expansion announcements exceeded well over 10GW (Fig. 4).

## Crystalline PV module capacity expansions

As Table 1 shows, there were around 30 companies announcing c-Si module capacity expansions, totalling around 10GW, in 2014. Not surprisingly, a large number of capacity expansion announcements occurred in the first quarter of 2014 (amounting to 4GW). This is primarily due to stock-market-listed companies typically providing full-year financial guidance and details of any production expansion plans when supplying fourth-quarter

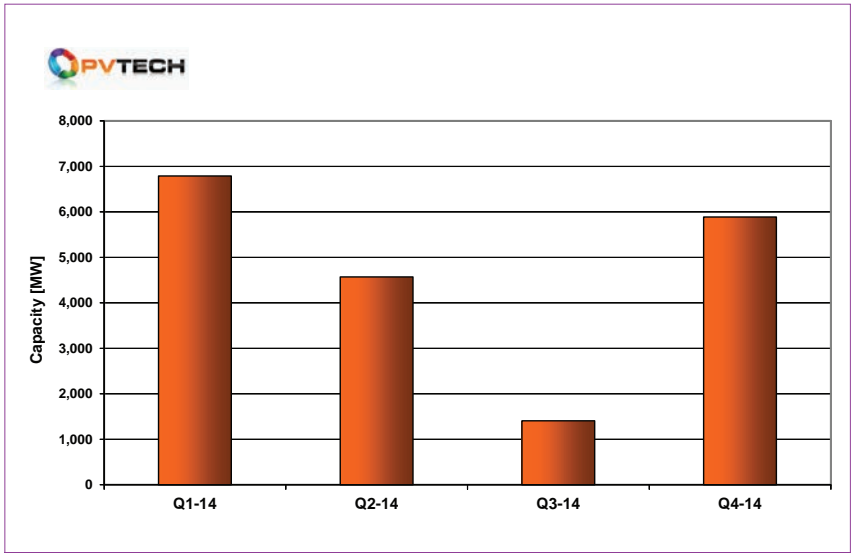


Figure 2. Cell/module manufacturing capacity expansions announced in 2014 by quarter (to end-November).

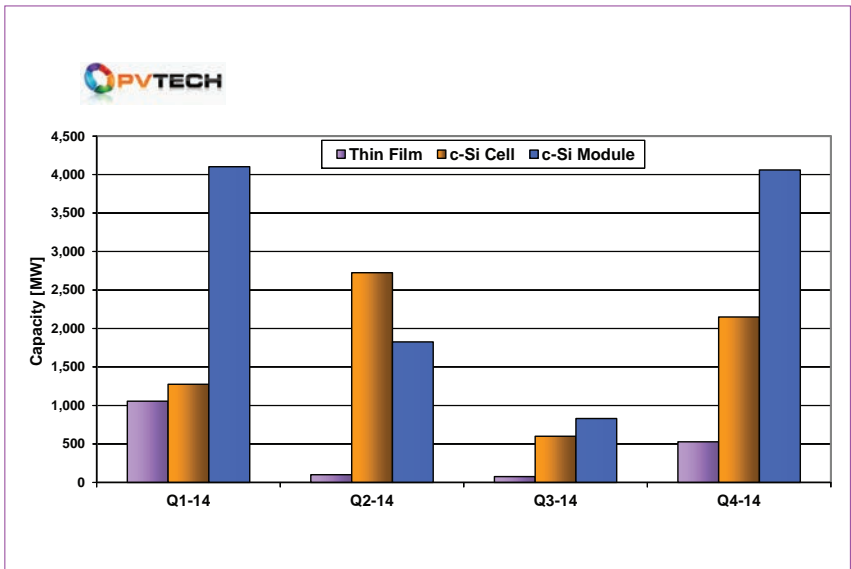


Figure 3. Capacity expansion announcements in 2014 by product type quarterly.

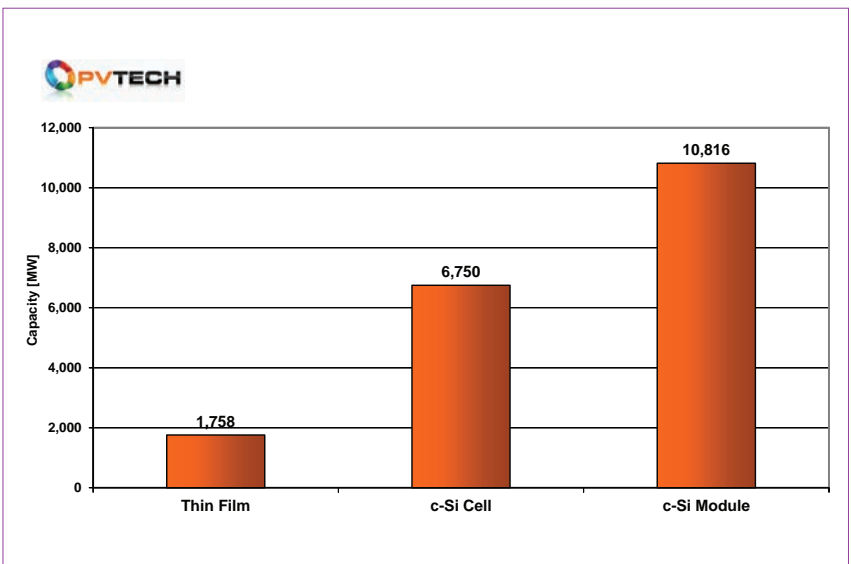


Figure 4. Total capacity expansion announcements in 2014 by product type.

and full-year financial results for the previous year in that quarter.

Three companies – Wuxi Suntech, Trina Solar and JA Solar – announced the largest module-assembly plans in the first quarter, all at 1GW. There have been no other companies in the first 11 months of the year that have announced expansions to this level.

However, in the fourth quarter of 2014, six tier-one module manufacturers – Hanwha Q CELLS, SunPower, Canadian Solar, JA Solar, Hanwha SolarOne and again JinkoSolar – announced module-assembly expansion plans that would be implemented in 2015. This indicates that measured capacity expansions that began in 2013 and went through the first half of 2014 were insufficient to meet end-market demand.

“Six tier-one module manufacturers announced module-assembly expansion plans that would be implemented in 2015.”

A good example of this comes from JinkoSolar, which had been one of the few companies that expanded capacity in 2013 and announced expansion plans in the first quarter of 2014. In November 2014 the company said that it planned to further expand capacity by around 20% in 2015, matching what it believed to be the overall growth of end-market demand that year. Full details of its 2015 expansion plans will be revealed in the first quarter of 2015, as expected, but guidance given indicates further capacity expansion of between 600 and 800MW can be expected.

JinkoSolar actually expanded module production a further 200MW than previously guided at the beginning of the year. This is because the company has been gaining market share on the basis of its claiming to be the lowest-cost producer and had guided module shipment growth of 65 to 82% compared with 2013, resulting in module shipment guidance of 2.9GW to 3.2GW in 2014. The company is expected to become the third largest in 2014, ranked by shipments, up from being ranked fifth in the previous year.

As Table 2 shows, there are five top-10 ranked module suppliers that have guided significant PV module shipment growth in 2014 – Trina Solar, Canadian Solar, JinkoSolar, ReneSola and JA Solar. When those companies

	Company	Shipments [GW]	Growth [%]
1	Yingli Green	3.2	3–4.6
2	Trina Solar	2.58	40–42
3	Sharp Corp.	2.1	(9–5)
4	Canadian Solar	1.894	45–48
5	JinkoSolar	1.765	65–82
6	ReneSola	1.728	38–45
7	First Solar	1.6	12–19
8	Hanwha SolarOne	1.280	10–15
9	Kyocera	1.2	0–17
10	JA Solar	1.173	105–114

**Table 1. Top 10 PV manufacturers guided shipment growth for 2014 (Q3-14 guidance).**

are compared with capacity announcements in the first quarter, a direct correlation becomes evident.

However, the fastest-growing company in the top-10 list from 2013 is the company that was ranked 10th – JA Solar. It has guided module shipment growth in the range 105 to 114% in 2014, while guiding shipments of between 2.4 and 2.5GW. Not only is the growth rate remarkable and clearly the highest of all top-10 ranked producers, but also just a few years ago the company was primarily a merchant solar cell producer. Shifting to become predominantly a module supplier has proved to be a huge success and the company is seriously challenging to become a top-5 ranked supplier in 2014.

ReneSola, on the other hand, has adopted a strategy of expanding outsourced manufacturing; however, it has had two of its OEM partners – Jabil Circuit and Vitec Global Solar – add capacity in 2014 (Table 2) to meet its shipment guidance and demand requirements. This therefore indicates that all five of the shipment growth leaders have closely matched supply with demand in 2014 and are expected to follow a similar path in 2015.

Interestingly, when Tables 1 and 2 are compared, the largest PV manufacturer – Yingli Green – is guiding almost zero shipment growth in a boom year and did not announce any new capacity expansions in 2014.

Another interesting trend seen in Table 2 is the number of announcements from emerging markets, such as Latin America and Africa, as well as from other new entrants that are selecting alternative module-assembly technology to provide them with a differentiated product. These trends are also expected to gain momentum in 2015 and beyond.

### Crystalline solar cell capacity expansions

As Table 3 shows, there were 12 companies that announced dedicated c-Si solar cell capacity expansions in the first 11 months of 2014. Although c-Si module-assembly expansions significantly outweighed solar cell expansions overall, the latter have been significant and occurred throughout the year.

The biggest expansion was announced by Canadian Solar in a joint venture deal with GCL-Poly. However, in line with its significant shipment growth, JA Solar announced two large solar cell expansions in 2014, totalling 900MW. Not surprisingly, the majority of large capacity expansions were related to high-efficiency multi c-Si solar cells and PERC cell design technology.

Overall, dedicated c-Si solar cell expansions of around 4GW represent a massive improvement on the two previous

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Company	Announcement date	Manufacturing location	New nameplate PV module capacity [MW]	Production/product type
Jinko Solar/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	May-14	Tunis, Tunisia	30	multi c-Si module assembly Jurawatt Tunisie
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

\* Estimated

Table 2. Dedicated c-Si module capacity expansion announcements in 2014.



Company	Announcement date	Manufacturing location	New nameplate PV module capacity [MW]	Production/product type
Hanwha Q CELLS	Jan-14	Cyberjaya, Malaysia	204	c-Si PERC cell
Jinko Solar/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 cells
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 solar cell

\* Estimated

Table 3. C-Si solar cell capacity expansion announcements in 2014.

Company	Announcement date	Manufacturing location	New nameplate PV module 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

\* Estimated

Table 4. Thin-film capacity expansion announcements in 2014.

years of chronic overcapacity and underinvestment. The trend may still be to underinvest in solar cell capacity, because of the availability of capacity from large merchant suppliers and higher capital expenditure requirements for new cell lines than for module assembly; however, there are still a number of tier-one suppliers that have yet to make any cell capacity expansion announcements.

### Thin-film capacity expansions

Table 4 shows that thin-film announcements were limited in both scale and the number of companies, reflecting the overall decline in thin-film manufacturers over the last few years. Nevertheless, the table shows that the sector still has some life and that, after several cuts to its nameplate capacity, First Solar is planning to recommission

idled lines as well as adding a small amount of new capacity in 2015.

One company to watch is Hanergy Solar, which has bold plans to become the leading thin-film firm. But it must focus on ramping up its first wave of new capacity expansions before it is clear that even the 600MW of new capacity can be classified as effective capacity. Other activity is focused on much smaller players, and lack of transparency in these

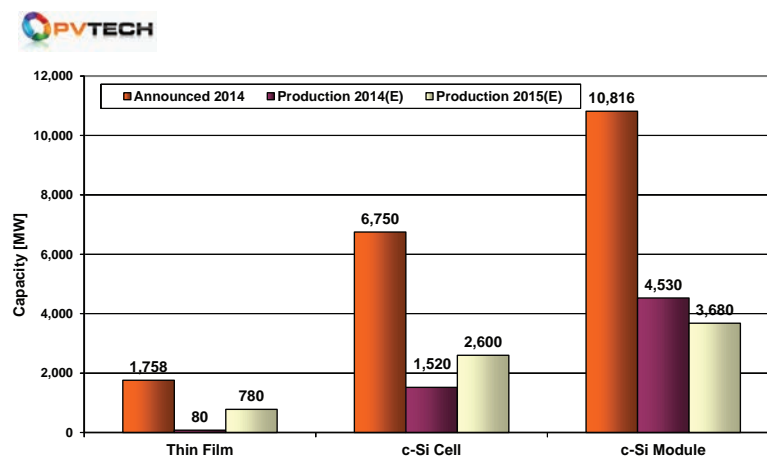


Figure 5. Capacity expansion announcements compared with estimated (E) new production online in 2014.

announcements requires a conservative approach as to when and if such capacity will come on stream.

### New capacity expansion announcements vs. online conversion

The key aspect of plotting new capacity announcement is to understand the impact that capacity will eventually have on effective capacity figures. Fig. 5 accounts for announced capacity expansions that are both believed to have come online in 2014 and expected to come online in 2015.

Clearly, not all the expansions announced in 2014 are expected to materialize as meaningful effective capacity in 2015. There are several key reasons for this. First, several large capacity expansions announced in 2014 are unlikely to see the light of day next year. For example, the 1GW fab planned by SolarCity only broke ground in the fourth quarter of 2014, indicating that – with construction, pilot production and an expected slow ramp-up because of the complexity of high-performance n-type mono cells – the integrated (cell/module) capacity will most likely not be online until 2016 and will then ramp up from there.

Also keeping executions lower than would be expected is the 1GW module expansion planned by Wuxi Suntech. Lack of updated information on those plans since the early part of the year, coupled with recently guided module shipments, suggests capacity expansions have yet to take place.

New entrants also play a part in new capacity, but they have historically taken longer to bring new facilities online than, say, tier-one producers; this impacts in particular both c-Si and thin-film start-ups. With several new module-assembly companies (such as

Hanplast) planning on adopting new assembly technology, and new entrants simply emerging with integrated cell/module lines (such as ViaSolis), a lower ramp-up rate has also been factored into the figures.

Fig. 5 shows that over 4GW of module-assembly capacity, primarily by major players, was estimated to have come online in 2014, contributing to a meaningful but measured increase in effective capacity in the year.

Fig. 5 also shows that around 1.5GW of the 6.7GW of c-Si solar cell capacity announced in 2014 came online in the same year. Lead times for cell equipment are longer than for module equipment, but the majority of cell equipment installs in 2014 came from announcements in the first quarter, with only a small element being announced in the second quarter. However, second quarter c-Si cell expansions were dominated by the SolarCity announcement, which is not expected to convert to meaningful effective capacity until 2017. Therefore, a further 3.68GW of effective c-Si solar cell capacity is estimated to come on stream from 2014 announcements in 2015. The higher levels expected in 2015 also reflect the need to add cell capacity, which has significantly lagged effective module capacity since 2013.

With the expected effective capacity additions in 2015 by thin-film leader, First Solar, and nearest rival, Solar Frontier, the overall effective online PV module capacity is expected to be in the region of 4.5GW, in line with capacity added in 2014 from announcements. This does not, however, take into consideration expected new capacity announcements from tier-one suppliers in the first quarter of 2015, indicating that effective module capacity coming

online in 2015 will be much higher than what was achieved in 2014.

*“Tracking new capacity announcements in 2015 will be essential to visualizing whether the industry retains a measured approach to expansions or reverts to over-exuberance.”*

### Conclusion

As shown in this paper, there has been a good recovery in PV capacity expansions in 2014, which have been measured to global demand growth. A number of major tier-one suppliers have benefited the most, with strong shipment growth projections mirroring their capacity expansion announcements. C-Si solar cell capacity has also increased and is expected to increase further in 2015. Advanced n-type cell expansions are also under way and are expected to gain further momentum in 2015.

Next year is expected to see higher levels of new capacity come online than in 2014, yet there is little evidence to suggest that this will be large enough to cause concern over the building-up of the next overcapacity phase. Indeed, should end-market demand growth projections of over 60GW be realized in 2015, more than 15GW of new capacity would need to be in place by year end to cause real concern in 2016.

Tracking new capacity announcements in 2015, especially in the first quarter, will therefore be essential to visualizing whether the industry retains a measured approach to expansions or reverts to over-exuberance.