

Quarterly analysis of PV manufacturing capacity expansion plans: 1H 2015

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ABSTRACT

In this quarterly report we will provide full first-half 2015 analysis that shows a massive shift in the geographical location of planned production plants, as well as details on key capacity announcements in the months of May and June. The analysis of April's capacity announcements were reported in the previous quarterly report. Despite April announcements being so low, May proved to be a blockbuster month. The return of meaningful solar cell capacity plans reiterates the strength in the recovery and the first attempts for many years by leading PV manufacturers to rebalance cell and module production as next-generation PERC technology leads the cell rebalancing act.

Total PV manufacturing capacity announcements topped 6.7GW in May 2015 (See Figure 1), setting a new monthly record for 2015 and surpassing any month in 2014. May announcements are more than double the 2.96GW announced in February and the 2.62GW announced in March.

The most significant trend from the May capacity expansion announcements was the significant 2.7GW of solar cell expansion plans, the highest in over three years and higher than the 2GW announced in May and November 2014. This was supported

by a further 1GW of joint-venture integrated cell and module capacity announcements in India by Trina Solar.

Solar cell capacity expansions lagged module assembly announcements overall through 2014. The majority of solar cell announcements relate to high-efficiency multicrystalline passivated emitter rear cell (PERC) technology, driven by Trina Solar and Hanwha Q CELLS as well as high-end n-type mono heterojunction technology expansion plans by Panasonic.

However, crystalline module

assembly announcements were also strong in May, totalling 2.1GW. Significantly, none of the announcements related to assembly expansions in China but included Thailand, Japan, India, South Korea, Brazil and the US. A more detailed analysis of regional trends is included in the first half of year analysis later in this report.

Lost in the noise of May announcements were plans by China-based integrated PV module manufacturer Seraphim Solar System to open a 300MW module assembly



Credit: JA Solar

The first half of 2015 has seen the return of meaningful cell capacity expansion announcements.

plant in Jackson, Mississippi in August 2015.

In recent years, several Asia-based PV manufacturers had closed down small-scale module assembly plants in the US due to chronic industry-wide overcapacity and massive ASP declines, but this was before the US imposed anti-dumping duties.

Several China-based tier-one module manufacturers, such as Yingli Green and Trina Solar, had previously touted plans to establish manufacturing in the US; both have since dropped those plans.

Recently, Trina Solar announced major capacity expansion plans in Thailand instead to avoid US import duties, while Yingli Green's financial state is dictating no added capacity in 2015 and has lowered planned module sales in the US this year.

Seraphim is therefore the first China-based module manufacturer to establish production in the US since Suntech Power Holdings operated a plant in Arizona. Suntech subsequently went bankrupt and the plant was closed in 2013.

Seraphim is also developing plans to double capacity of solar cell and module assembly production from 600MW in 2014 to 1,200MW by the end of 2015 at its highly automated 'Fab 1' in Changzhou China.

June exceeded expectations

With a lacklustre (380MW) of capacity expansion announcements in April and record-setting figures in May, expectations that June would prove to be muted proved unfounded. Instead, June recorded 2.7GW of new capacity announcements, similar in size to figures reported for February and March.

Perhaps not surprisingly there were no new dedicated solar cell capacity announcements made in June, following the bumper announcements made in the previous month. However, the surprising development was a massive 2.5GW of integrated capacity plans, driven by Trina Solar in India and China state-owned CNPV in South Korea.

The 2GW announced by Trina Solar should be treated with some caution, partly due to the few specific details made available and the fact the company had already announced 1GW of integrated production with two Indian firms in May. The decision by CNPV to build an estimated 500MW integrated plant in South Korea also lacks specific details.

Dedicated crystalline silicon module assembly announcements also fell

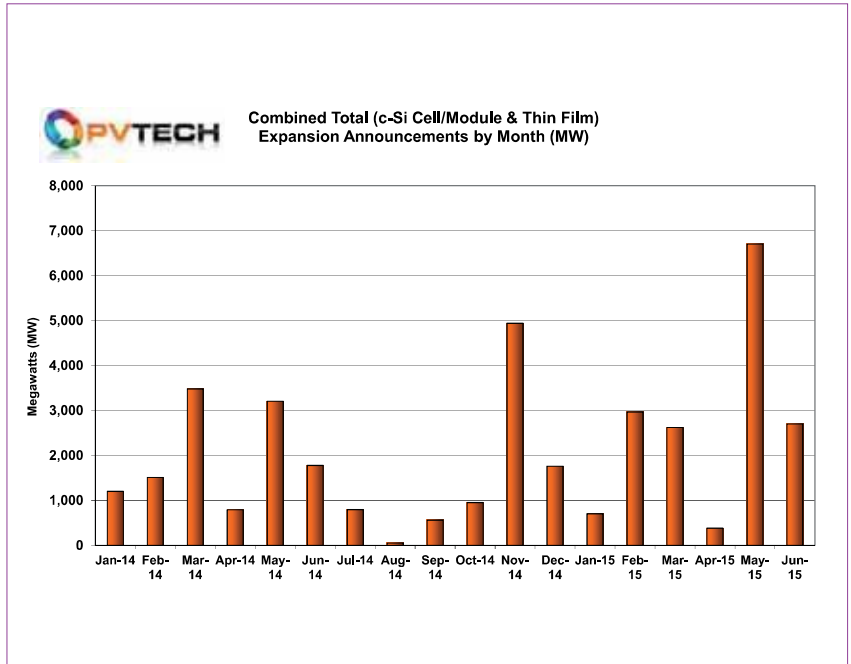


Figure 1: Combined total (c-si cell/module & thin film) expansion announcements by month (MW)

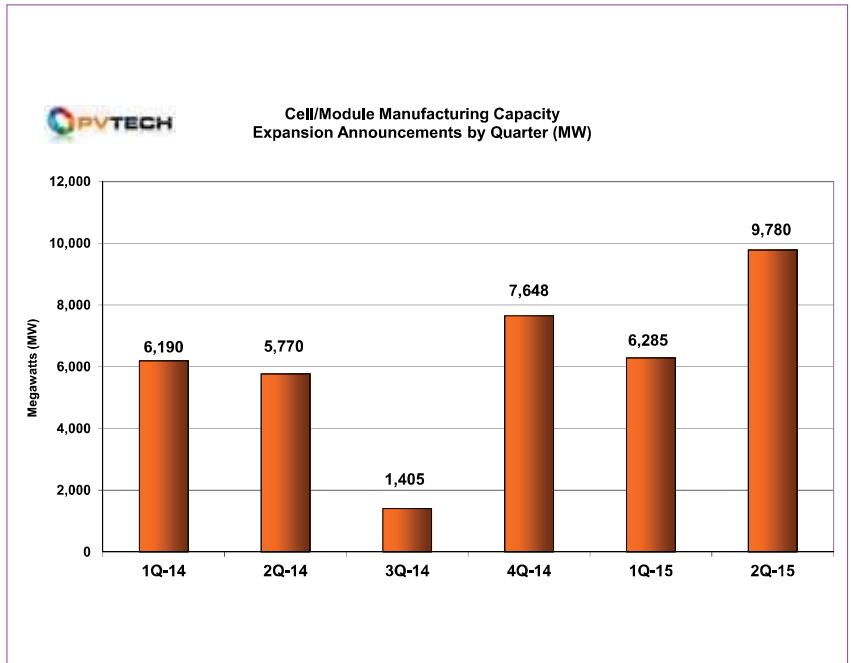


Figure 2: Cell/module manufacturing capacity expansion announcements by quarter (MW)

to only 50MW, matching the lowest monthly figure, previously set in April 2014.

Second-quarter record

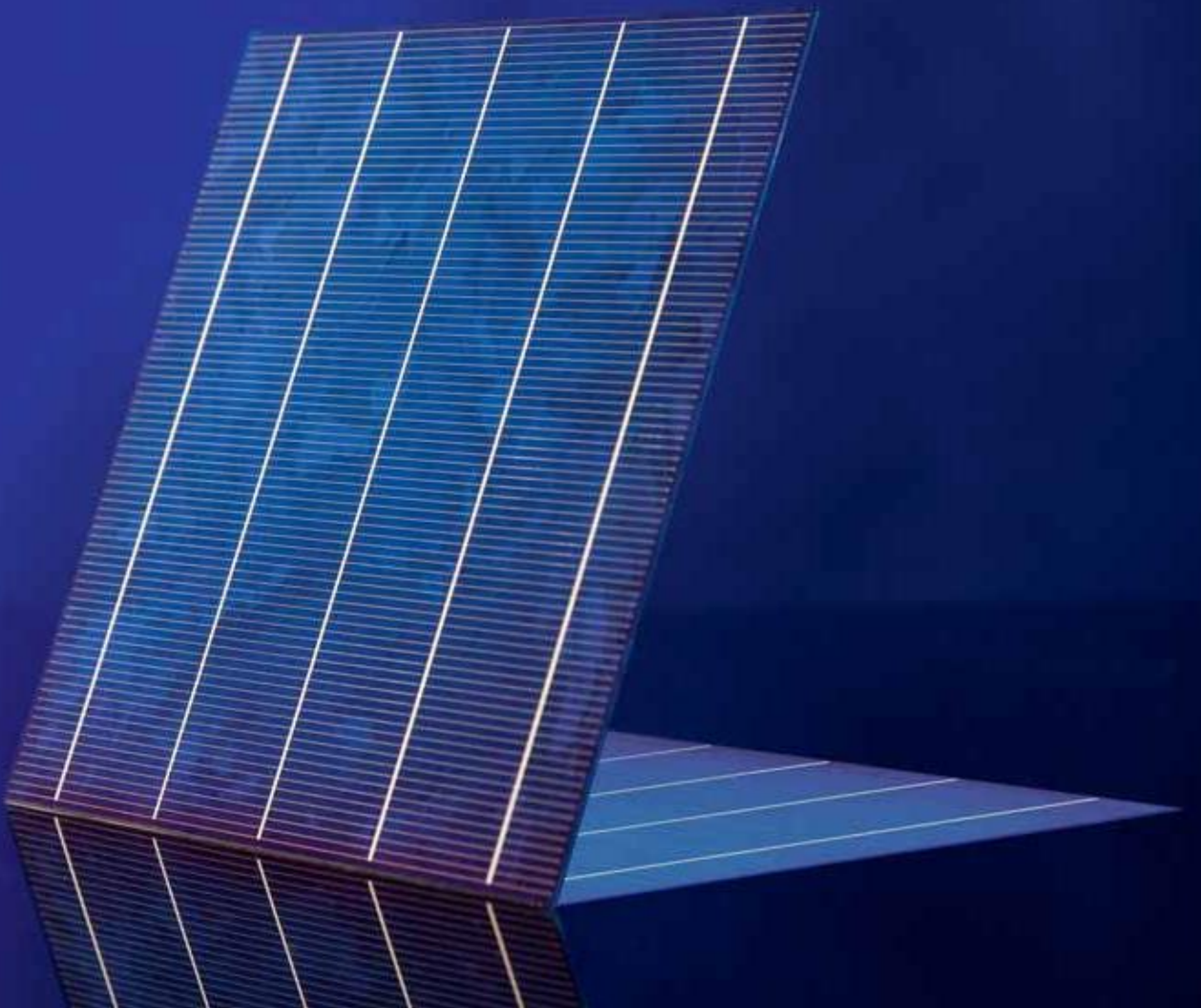
The May capacity expansion figures single-handedly helped the second quarter of 2015 exceed the 6.28GW of capacity announcements made in the first quarter.

The total new announcements made in the second quarter of 2015 topped 9.78GW (see Figure 2), again setting a new quarterly record.

Although 2014 was significant in ushering in the next major capacity expansion phase after three years of limited capital expenditures, the current and previous two quarters indicate a significant overall higher intensity to expansion plans, highlighted by the recent 1.5GW solar cell expansion by Hanwha Q CELLS.

The second quarter (see Figure 3) included 1GW of primarily a-Si thin-film expansions by Hanergy Group, 2.7GW of dedicated next-generation solar cells and 2.5GW of crystalline module assembly expansions,

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*Gain in energy depending on rear side illumination and module mounting.

Country	MW
China	2,710
Japan	300
South Korea	3,050
Taiwan	450
Malaysia	1,710
Thailand	2,250
Indonesia	60
India	4,360
Germany	1,200
Holland	70
Spain	1
USA	300
Mexico	200
Cuba	15
Brazil	570
Egpt	50

Table 1: PV manufacturing capacity announcements by country only (MW) 1H 2015

predominantly outside China. Integrated production announcements also gained momentum over the first quarter (1.96GW), reaching 2.5GW in the second quarter of the year.

Not all the capacity announcements in the last two quarters are expected to be implemented in 2015. Initial analysis of all the announcements made in May indicate that around 2GW of the 6.4GW planned was highly unlikely to ramp until 2016 onwards. Those made in June, especially related to India, carry significant uncertainty until more specific developments take place. This also applies to the announcements from Hanergy, which are further analysed below.

Seismic shift

Analysis of global PV manufacturing expansion plans for the first half of 2015 on a geographical basis (see Figure 4) indicate that little if any meaningful or 'effective' new plans were announced by Chinese producers for production in China, representing a major shift in Chinese producers' plans.

Figure 4 classifies Asia to include key countries such as Japan, South Korea, Malaysia and Thailand, but excludes China to better show the location changes, while Table 1 provides individual country breakouts for the first half of 2015.

Instead of China, Chinese crystalline silicon-based PV manufacturers announced more than 6.7GW of planned capacity expansions in a number of overseas countries (see Table 1), including India, Malaysia,

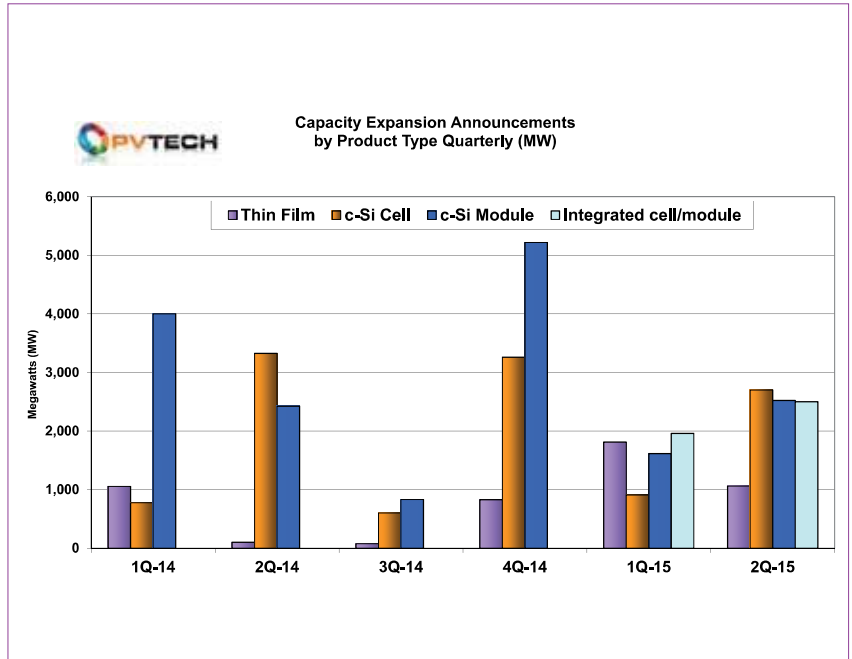


Figure 3: Capacity expansion announcements by product type quarterly (MW)

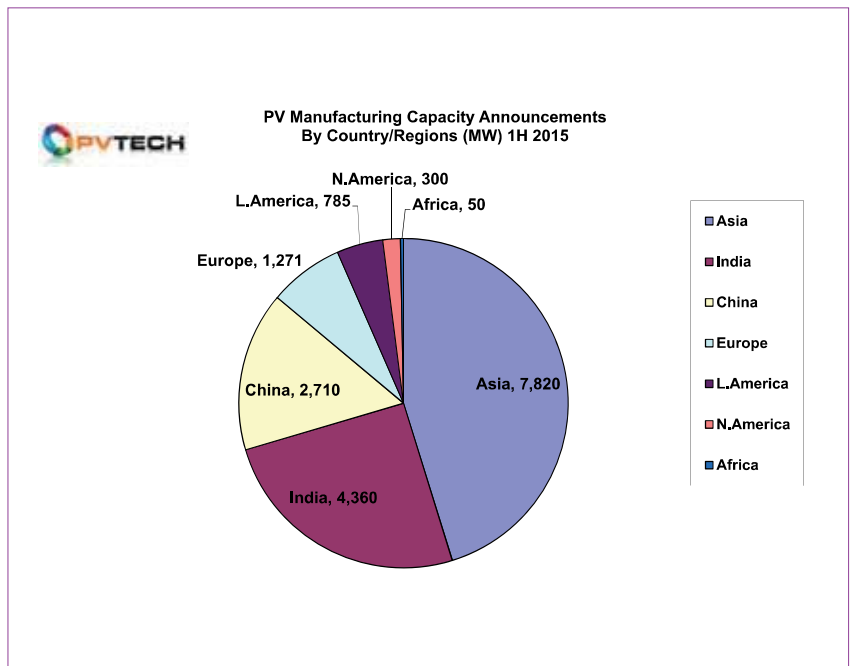


Figure 4: PV manufacturing capacity announcements by country/regions (MW) 1H 2015

Thailand, South Korea, Brazil and the US.

To put this in perspective, Chinese crystalline silicon-based PV manufacturers dominated the 19GW of new capacity plans announced in 2014 for production in China (see Figure 5).

The first half of 2015 has seen several of the same tier-one companies that announced new production plans in China last year, such as Trina Solar, JinkoSolar and JA Solar, lead an exodus overseas. This has been driven by US anti-dumping duties as well as plans

to become major players in emerging markets such as India and Latin America.

The lack of new capacity expansions in China contrasts with over 12GW of new announcements in 2015 for other regions across Asia, with Chinese producers accounting for just over half of the capacity announcement figures.

Southeast Asia attracted nearly 4.5GW of new PV manufacturing capacity plans in the first half of 2015, led by Thailand with over 2GW announced and over 1.5GW announced for Malaysia. This included

Company	Announcement Date	Manufacturing location	New Nameplate Capacity (MW)	Production Product Type
Jetion Solar	Jan-15	Thailand	200MW	Integrated c-Si Cell/Module
Renovasol	Jan-15	Brazil	70MW	Multi c-Si Module Assembly
Hanwha Q CELLS	Jan-15	Cyberjaya, Malaysia	230MW	(Relocated) PERC multi c-Si solar cell
Hanwha Q CELLS	Jan-15	Cyberjaya, Malaysia	130MW	(Relocated) Multi c-Si Module Assembly
PT Len	Jan-15	Indonesia	60MW	Integrated c-Si Cell/Module
Surana Solar	Jan-15	Fab City, Hyderabad India.	110MW	Multi c-Si solar cell
SolarPark Korea	Feb-15	South Korea	600MW	Integrated c-Si Cell/Module
LG Electronics	Feb-15	South Korea	200MW	N-type bi-facial mono c-Si cells and modules
Zhongli Talesun	Feb-15	Rayong, Thailand	500MW	Integrated PERC c-Si Cell/Module
Silevo/SolarCity	Feb-15	California, USA	32MW	(Relocated) Pilot & R&D line
Waaree Energies	Feb-15	Surat, Gujarat, India	750MW	Multi c-Si Module Assembly
Empresa de Componentes Electrónicos	Feb-15	Cuba	15MW	Multi c-Si Module Assembly
Tainergy Tech	Feb-15	Taiwan	300MW	Multi c-Si solar cell
Hanergy Thin Film/Shangdong Macrolink New Resources Technology	Feb-15	China	600MW	a-Si Thin Film BIPV plant
SolarWorld	Mar-15	Arnstadt, Germany	500MW	mono c-Si ingot production
SolarWorld	Mar-15	Arnstadt, Germany	700MW	Upgrade PERC cell production
Vietnam Government	Mar-15	Hanoi, Vietnam	20MW	Multi/Mono c-Si Module Assembly
Ener Brazil	Mar-15	Brazil	50MW	Semi-automated c-Si PV module assembly plant
JA Solar	Mar-15	Penang, Malaysia.	400MW	Integrated c-Si Cell/Module
JinkoSolar	Mar-15	Malaysia	500MW	Multi c-Si PERC solar cell
JinkoSolar	Mar-15	Malaysia	450MW	Multi c-Si Module Assembly
"Hanergy Thin Film/Inner Mongolia Manshi Investment Group"	Mar-15	China	600MW	a-Si Thin Film BIPV plant
Hanergy Thin Film/Baota Petrochemical Group	Mar-15	China	600MW	a-Si Thin Film BIPV plant
Flextronics	Apr-15	Ciudad Juarez, Mexico	200MW	Multi/Mono c-Si Module Assembly
Eclipse Brasil	Apr-15	Limoeiro do Norte, Ceará, Brazil	100MW	Multi c-Si Module Assembly
Orange Solar Power	Apr-15	Netherlands	70MW	15MW 'Monoflex' & 55MW Multi c-Si Module Assembly
Hanergy Thin Film	Apr-15	Wuhan, China	10MW	Thin Film GaAs R&D/Pilot Line
Onyx Solar	Apr-15	Spain	1MW	c-Si BIPV
Hanergy Thin Film/ Hanergy Group	May-15	China	900MW	a-Si Thin Film BIPV plant
Trina Solar	May-15	Rayong, Thailand	700MW	Multi c-Si solar cell (PERC)
Trina Solar	May-15	Rayong, Thailand	500MW	Multi c-Si Module Assembly
Gintech Energy	May-15	Thailand	350MW	Multi c-Si solar cell (inc,PERC)
Seraphim Solar System	May-15	Jackson, Mississippi, USA	300MW	Multi c-Si Module Assembly
Intéling soluções inteligentes	May-15	Bento Gonçalves, Brazil	?	Multi c-Si Module Assembly
Panasonic Corp	May-15	Shimane, Japan	150MW	HJ mono c-Si cell
Panasonic Corp	May-15	Shiga, Japan	150MW	HJ mono c-Si Module Assembly
JA Solar/ Essel Group JV	May-15	India	500MW	Integrated c-Si Cell/Module
Trina Solar/ Welspun JV	May-15	India	500MW	Integrated c-Si Cell/Module
Vikram Solar	May-15	India	250MW	c-Si mono/multi Assembly
Vikram Solar	May-15	India	250MW	c-Si mono/multi Assembly
BYD Company	May-15	São Paulo, Brazil	400MW	Multi c-Si Module Assembly
Hanwha Q CELLS	May-15	South Korea	250MW	Multi c-Si Module Assembly
Hanwha Q CELLS	May-15	Jincheon, South Korea	1,500MW	Multi c-Si PERC solar cell
Sunprism Energy	Jun-15	Cairo, Egypt	50MW	Multi c-Si Module Assembly
CNPV Power	Jun-15	Saemangeum, South Korea	500MW(E)	Integrated c-Si Cell/Module
Trina Solar	Jun-15	India	2,000MW	Integrated PERC c-Si Cell/Module
Hulk Energy Technology	Jun-15	Taiwan	150MW	CIGS thin film

PV manufacturing capacity expansion announcements in 2015

the relocation of production lines by Hanwha Q CELLS from Germany to Malaysia and also plans by Taiwan-based solar producer Gintech, in establishing production in Thailand.

The seismic shifts did not stop in China as South Korea re-emerged with new PV manufacturing expansion plan announcements estimated to be in the region of 3GW.

Both Hanwha Q CELLS and SolarPark Korea significantly contributed to the 3GW total in just the first half of the year, potentially marking a renaissance in PV manufacturing in South Korea and enabling Korean firms to fill the module demand void in the US left by many Chinese competitors.

In contrast, the renaissance in PV manufacturing announcements in the US that was noted last year has waned significantly. In 2014, the US had over 1.8GW of new capacity plans announced but has so far slumped to around 300MW, driven by a single Chinese producer, Seraphim.

Although much speculation still surrounds India and its ability to meet a highly ambitious 100GW of PV installations by 2022, around half of over 4GW of capacity expansion plans announced in the first half of 2015 include Indian and Chinese firms via joint ventures.

This is in contrast with only around 1.4GW of announcements that were made for India in the whole of 2014, with little of that figure yet to materialise in actual production.

Indian and other companies such as US-based SunEdison and JVs between Japan's SoftBank and Taiwanese OEM Foxconn have made pledges to build PV manufacturing plants in India that equate to significant capacity additions. But the vast majority have remained outside the scope of this analysis until more definitive announcements are made.

Meaningful capacity expansion announcements in the first half of 2015 have not been restricted to Asia alone, although its geographical dominance clearly remains.

Analysis of manufacturing capacity announcements made in this period for Latin America indicate the milestone of over 1GW of planned production in the region was surpassed in the first half of the year and took less than 18 months to achieve.

Key to the 1GW target being reached was the planned module assembly plant in Brazil by China-based BYD.

Latin America is forecast to install 2.2GW of PV in 2015, a 352% increase from 625MW in 2014, according to GTM Research. However, like India,

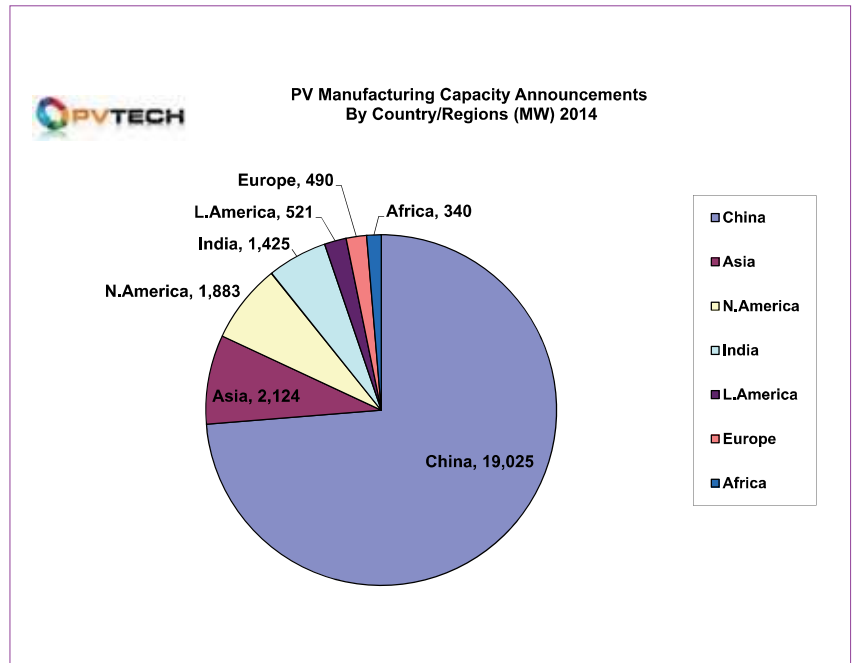


Figure 5: PV manufacturing capacity announcements by country/regions (MW) 2014

raising capital is a major issue and has slowed production projects getting to the line, especially without overseas JV involvement.

The only potential discrepancy in the first-half year analysis is whether the 2.7GW of primarily new a-Si thin-film capacity announced by Hanergy Thin Film should be recognised.

Remarkably, Hanergy TF actually accounted for all of the new capacity announcements for China in the first half of the year.

Hanergy TF only announced another 900MW expansion for its parent company, Hanergy Group, in May, yet while the company remains under investigation by Hong Kong securities and its share trading halted it announced the contract had been cancelled, without providing any explanation.

Hanergy TF previously made three other a-Si thin-film manufacturing contract announcements this year, totalling a further 1.8GW to companies with no prior PV involvement. A key omission from the contract announcements was the locations for the production plants.

It should be noted that in excluding Hanergy TF announcements of plants in China, no new capacity expansions were effectively made for China in the entire first half of the year.

Of course, capacity expansions announced last year for China are ongoing and a number of tier-two Chinese producers are benefiting from some OEM outsourcing deals and increased domestic demand, pushing utilization rates higher. However, new

capacity announcements from this sector are often not easy to detect or decipher from higher utilisation rates.

Elsewhere, PV manufacturing capacity expansion plan announcements in Europe, North America and Africa remained limited and down to primarily one individual company in each region.

In the case of Europe, SolarWorld announced major line upgrades to PERC and the restart of monocrystalline ingot/wafer production. The increased cell efficiencies boost line megawatt capacity but it is unclear by how much. We have listed these cell developments but as such they are not new capacity announcements, highlighting the lack of activity in Europe as a whole in the first-half of the year.

Conclusion

The first-half year analysis highlights that with 16GW of announcements made, compared to around 12GW in the prior year period, overall momentum has been building. Greater emphasis is being placed on next-generation solar cell capacity expansions compared to 2014 and a more balanced approach, highlighted by further integrated capacity announcements.

The significant change in geographical location has been the most surprising aspect to the first half of 2015, although whether this trend continues into the second half of the year remains to be seen as does the question of whether the intensity of capacity expansion announcements will continue.