

Quarterly analysis of PV manufacturing capacity expansion plans

Mark Osborne, Senior News Editor, *Photovoltaics International*

ABSTRACT

In this first quarterly report of 2015 a full first-quarter analysis will be presented, as well as the planned capacity announcements for March and April. Notably this will include Tier 1 manufacturers' plans and a special look at Malaysia and its potential for another wave of companies planning manufacturing operations in the country. Finally, further analysis of the potential renaissance in thin-film production will be provided.

Housekeeping

From time to time, updated or new information is received regarding previous capacity expansion announcements or expansions that were not logged in previous reports. As a result, meaningful changes to previously issued data points are necessary.

In January 2014, JinkoSolar announced it would be taking over the production operations of bankrupt Chinese cell (500MW) and module (100MW) producer Topoint. However, JinkoSolar has since officially announced that the deal was subsequently cancelled, without providing much further information. Considering the scale of the operations that were expected to become restarted capacity, the 2014 cell and module capacity expansions have been adjusted accordingly. In addition, new information regarding small capacity expansions from South Korean monocrystalline cell producer Shinsung (70MW) and South Korean multicrystalline module producer Hansol Technics (100MW) have been included in the revised capacity expansion figures for 2014.

March 2015 capacity expansions

Since capacity announcements for January and February were covered in the previous edition of *Photovoltaics International*, the focus on key developments is confined to March, and a brief analysis of activity in April is given.

An area that has been hit extremely hard by overcapacity over the last three years is the ingot/wafer segment; as a result, only limited capacity expansions have taken place during this period. Other than monocrystalline expansions from Comtec and Longhi and a few others, only GCL-Poly has undertaken expansions with multicrystalline wafer



Figure 1. JA Solar is looking to build cell and module production through overseas partnerships.

Credit: JA Solar

Fab & Facilities

Materials

Cell Processing

Thin Film

PV Modules

Market Watch

Company	Announcement date	Manufacturing location	New nameplate PV module capacity [MW]	Production/product type
Jetion Solar	Jan-15	Thailand	200	integrated c-Si cell/module
Renovasol	Jan-15	Brazil	70	multi c-Si module assembly
Hanwha Q CELLS	Jan-15	Cyberjaya, Malaysia	230	(relocated) PERC multi c-Si solar cell
Hanwha Q CELLS	Jan-15	Cyberjaya, Malaysia	130	(relocated) multi c-Si module assembly
PT Len	Jan-15	Indonesia	60	integrated c-Si cell/module
Surana Solar	Jan-15	Fab City, Hyderabad, India	110	multi c-Si solar cell
SolarPark Korea	Feb-15	South Korea	600	integrated c-Si cell/module
LG Electronics	Feb-15	Korea	200	n-type bi-facial mono c-Si cells and modules
Zhongli Talesun	Feb-15	Rayong, Thailand	500	integrated c-Si cell/module
Silevo/SolarCity	Feb-15	California, USA	32	(relocated) pilot & R&D line
Waaree Energies	Feb-15	Surat, Gujarat, India	750	multi c-Si module assembly
Empresa de Componentes Electrónicos	Feb-15	Cuba	15	multi c-Si module assembly
Tainergy Tech	Feb-15	Taiwan	300	multi c-Si solar cell
Hanergy Thin Film/ Shangdong Macrolink New Resources Technology	Feb-15	China	600	a-Si thin-film BIPV plant
SolarWorld	Mar-15	Arnstadt, Germany	500	mono c-Si ingot production
SolarWorld	Mar-15	Arnstadt, Germany	700	upgrade PERC cell production
Vietnam Government	Mar-15	Hanoi, Vietnam	20	multi/mono c-Si module assembly
Ener Brazil	Mar-15	Brazil	50	semi-automated c-Si PV module assembly plant
JA Solar	Mar-15	South-East Asia (TBA)	400	integrated c-Si cell/module
JinkoSolar	Mar-15	Malaysia	500	multi c-Si PERC solar cell
JinkoSolar	Mar-15	Malaysia	450	multi c-Si module assembly
Hanergy Thin Film/ Inner Mongolia Manshi Investment Group	Mar-15	China	600	a-Si thin-film BIPV plant
Hanergy Thin Film/ Baota Petrochemical Group	Mar-15	China	600	a-Si thin-film BIPV plant
Flextronics	Apr-15	Ciudad Juarez, Mexico	200	multi/mono c-Si module assembly
Eclipse Brasil	Apr-15	Limoeiro do Norte, Ceará, Brazil	100	multi c-Si module assembly
Orange Solar Power	Apr-15	Netherlands	70	15MW 'Monoflex' and 55MW multi c-Si module assembly
Hanergy Thin Film	Apr-15	Wuhan, China	10	thin-film GaAs R&D/pilot line
Onyx Solar	Apr-15	Spain	1	c-Si BIPV

Table 1. Capacity expansion announcements in 2015 (January to April).

production when it added 1GW during 2014, but it has not guided further expansions yet in 2015.

It was therefore interesting to note in March that SolarWorld planned to add a total of 500MW of monocrystalline ingot production at the former Bosch solar manufacturing facilities in

Arnstadt, Germany, and upgrade all 700MW of solar cell production at the site to next-generation passivated emitter rear cell (PERC) technology. SolarWorld said that its module manufacturing capacity stood at 1.6GW. The solar cell upgrades will also permeate through to increased

capacity, but it is too early to calculate the meaningful capacity increase this will provide the company; therefore no expansion figure has been included with the monthly and quarterly analysis, but the expansion has been listed in rolling the first-quarter table of announcements.

efficiency



Wisdom creates efficiency.



Our Research and Development team is constantly thinking about paste. We are committed to developing leading-edge solutions, which improve the power output and performance of solar cells at a lower cost per watt. We are always mindful of the current and future technology needs of our customers, and are driven to deliver results. So when you think of paste...think of Heraeus.

Leadership through R&D. Breakthroughs via innovation.
Achievement by tradition.

Heraeus Photovoltaics Business Unit
www.pvsilverpaste.com
China | Singapore | Taiwan | Europe | America | Japan

Monocrystalline cell expansions also featured via a deal struck between Korea-based producer Shinsung Solar Energy and project developer SunEdison. In a new supply agreement, SunEdison is expected to purchase a total of 1,223MW of mono-Si solar cells from Shinsung through 2017, an increase of 660MW from a supply contract signed almost a year ago. The deal highlighted that Shinsung had planned to increase cell capacity in December 2014 to accommodate increased demand for high-efficiency cells that were not impacted by US anti-dumping duties. Shinsung is increasing capacity by 70MW to bring nameplate capacity to 420MW, almost the same figure that SunEdison is expected to purchase on an annual basis.

PV equipment and module

production-line specialist Spire Corporation said it had delivered and started the installation of a 20MW PV module line for a government agency in Vietnam. The company said the module production line was located outside of Hanoi and could be used for the assembly of both monocrystalline and multicrystalline modules, as well as being a centre for research activities and training and demonstrations.

Brazilian project developer and distributor Ener Brazil is planning to build a 50MW semi-automated c-Si PV module assembly plant with Meyer Burger equipment and technology. Ener is currently seeking funding for the project but expects to close on a financial deal in the next few months, which could see tool installation in the fourth quarter of 2015. The facility is

expected to produce around 204,100 of 245W c-Si modules per annum.

Major Tier 1 PV manufacturer JA Solar is planning to partner in both solar cell and module production in Southeast Asia to expand its shipments to the US market and avoid anti-dumping duties. In an earnings call to discuss fourth-quarter and full-year results, management noted that plans to build approximately 400MW of solar cell capacity in the region sometime in the second half of the year could be accelerated, should its petition on duties in the USA not be successful. JA Solar noted that it was seeking partnerships in overseas cell and module plants in order to keep capital expenditure down to around US\$30m, with module assembly primarily outsourced under an OEM agreement.

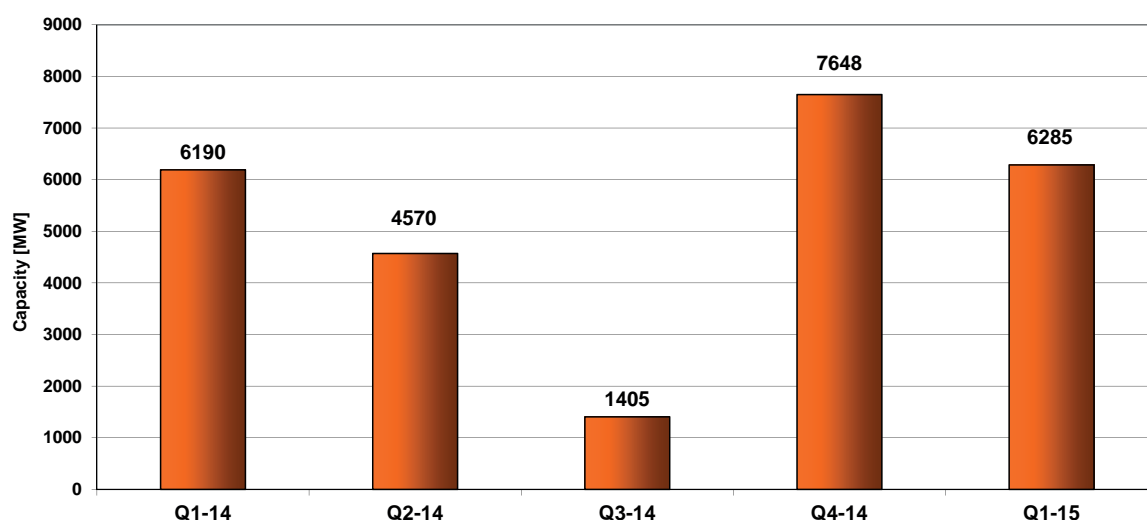


Figure 2. Cell/module manufacturing capacity expansion announcements by quarter.

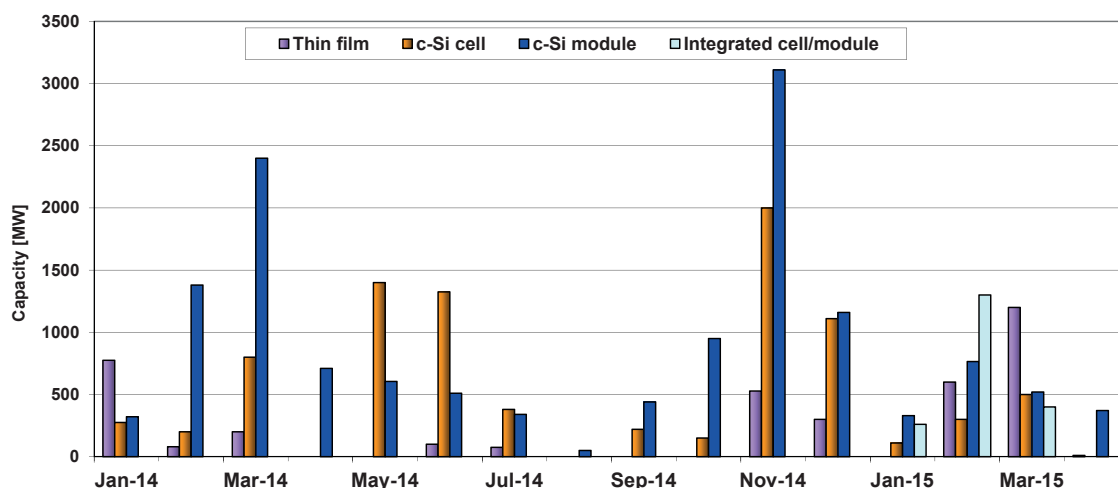


Figure 3. Cell/module manufacturing capacity expansion announcements by month.

Major Tier 1 PV manufacturer JinkoSolar has finally said its first major overseas solar cell and module manufacturing facility is to be based in Penang, Malaysia. It confirmed that the Malaysian fab would have an initial solar cell capacity of 500MW, and 450MW of PV module capacity. The company expects to spend around US\$100m on the facility: high-efficiency multicrystalline technology will be used and is expected to be PERC based. JinkoSolar reiterated that it anticipated that the facility would be operational in May 2015.

An expected announcement in the first quarter that did not materialize was from Chinese manufacturer Wuxi Suntech. It confirmed in March that a proposed manufacturing facility in South Africa remained on hold until details of the fourth round of the country's national renewable energy programme are finalized. The company said that it was still considering establishing the facility, but was awaiting clarification of the local content rules in the fourth round of the renewable-energy independent power producer procurement programme before proceeding. Rivals, such as JA Solar, JinkoSolar and SunPower, have established small module assembly lines in South Africa for meeting previous local content rules.

“Compared with 6,190MW in first quarter of 2014, a total of 6,285MW of new capacity plans were announced in the first quarter of 2015.”

First quarter 2015 analysis

Compared with 6,190MW in the first quarter of 2014, a total of 6,285MW of new capacity plans were announced in the first quarter of 2015 (see Fig. 2); this was a continuation from the momentum built up in the fourth quarter of 2014, when around 7,648MW of new capacity was announced.

The Hanergy Thin Film Power Group Ltd announcements, however, should be treated with a level of caution; excluding its a-Si BIPV production plants for third parties, around 4,485MW of effective capacity announcements were therefore made in the quarter. This is more in line with reality, especially taking into account Tier 1 announcements from the likes of Jettion, SolarPark Korea, LG, Waaree, JA Solar and JinkoSolar, which made up the typical bulk of larger-capacity announcements. Indeed, at around 4.5GW in the first

quarter of 2015, the number and scale of announcements had significantly dropped off from the fourth quarter of 2014, indicating once more that capacity expansions are being driven by market demand, primarily on a company-by-company basis.

Again, excluding Hanergy Thin Film from the analysis, the quarter-on-quarter decline in expansions in the first quarter can be attributed to the announcement of plans by a number of Tier 1 manufacturers in the fourth quarter of 2014. Major manufacturers – such as Hanwha Q CELLS, SolarWorld, First Solar, Canadian Solar, JinkoSolar and several others – all announced healthy expansions in the fourth quarter. However, there was notable absence of announcements in the first quarter of 2015 from the two largest producers, Trina Solar and Yingli Green; this compounded the contrast between the figures for the two quarters.

Yingli Green Energy has said it would not be adding new manufacturing capacity in 2015, as it is focusing on its high debt ratios and needs to restructure over US\$2bn of its US\$4bn debt this year. The company has said that capital expenditure in 2015 would be pegged at somewhere between US\$50m and US\$70m, which would be

VON ARDENNE

www.vonardenne.biz

Our experts are looking forward
to meeting you at the **Intersolar**
in hall A2 at booth 130.

EASY AND PRECISE
SIMULTANEOUS
DOUBLE-SIDED
VACUUM COATING

With our horizontal wafer coating system XEA|nova, even very thin
substrates can be coated on both sides without breaking the vacuum
or flipping the substrates. The system enables both sequenced and
simultaneous treatment.

XEA|nova

allocated to production line upgrades and maintenance only.

With regard to Trina Solar, in early May, as this journal was going to press, the company announced it had selected Thailand for its first overseas plant to meet demand in the USA without attracting anti-dumping duties. As this announcement came in the second quarter of the year it will be covered in detail in our next capacity expansion report. It is likely other Tier 1 producers in China and Taiwan have already decided to establish production in locations such as Malaysia or Thailand to avoid US tariffs, and that official announcements will follow over the next quarter or so.

On a monthly basis, February proved to be the most active for capacity

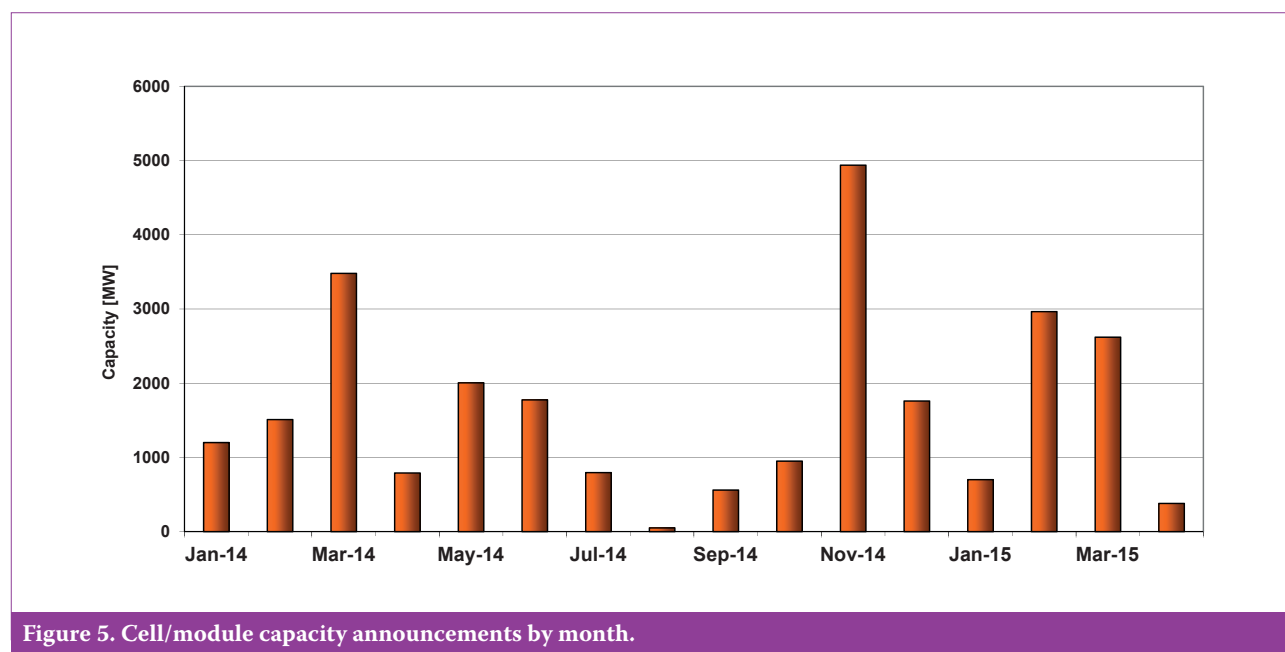
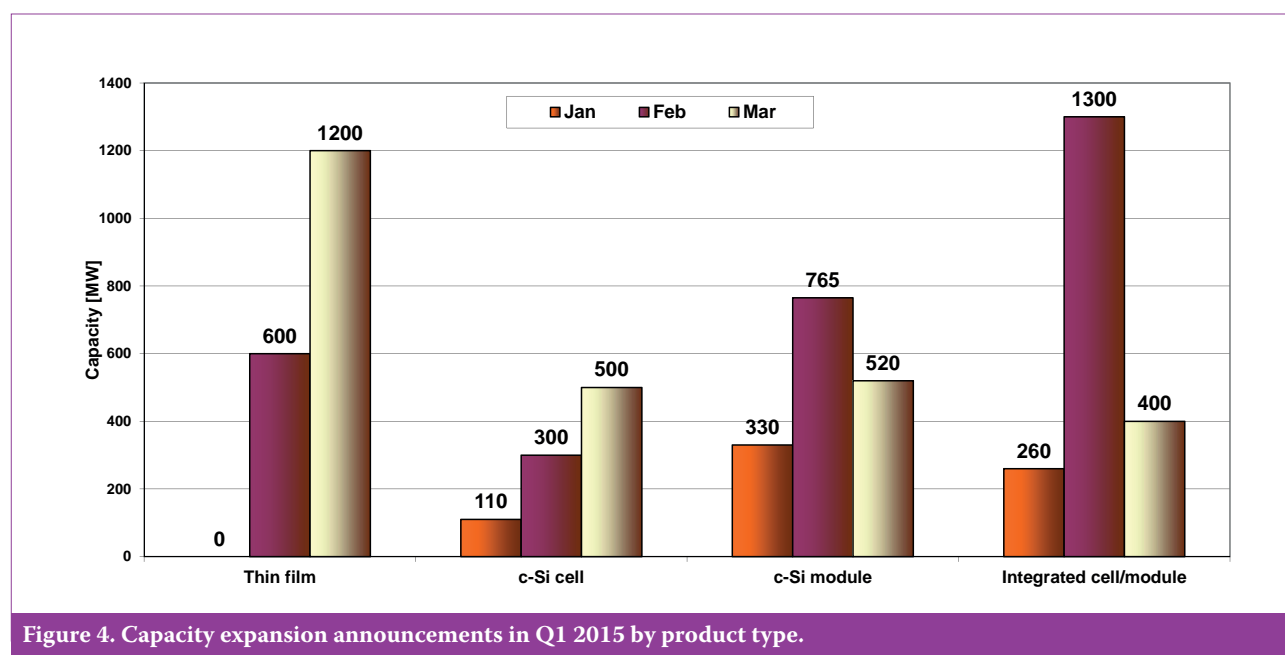
announcements, whereas March claimed that honour in the prior-year period. As shown in Fig. 3, the first quarter was notable for almost 2GW of integrated c-Si cell and module plant announcements driven by several Tier 1 producers. February proved to be the most active month for these types of announcement, although the other two months were also active.

“The first quarter was notable for almost 2GW of integrated c-Si cell and module plant announcements driven by several Tier 1 producers.”

Dedicated solar cell capacity announcements in the first quarter totalled 910MW (Fig. 4), indicating continued caution towards cell expansions and towards allocating the required capital expenditure. Dedicated c-Si module assembly announcements totalled 1,615MW. With no major plans announced by Waaree and JinkoSolar, actual dedicated module assembly capacity announcements were significantly lower than either the previous quarter or the same period in 2014 (Fig. 3).

Thin-film analysis

Previous reports have highlighted something of a recovery in thin-film capacity expansions after more than four years of notable bankruptcies,



closures and exits. The recovery results predominantly from just three companies: First Solar, Solar Frontier and Hanergy Thin Film.

The real force remains CdTe leader First Solar, which is currently operating a total of 30 manufacturing lines after restarting some idled lines in Malaysia later last year. According to the company, each line at the end of 2014 was able to produce approximately 2,500 modules per day, equating to around 70,000 modules in total across its lines. However, when First Solar's efficiency and throughput roadmap are combined, it is estimated that the company would have around 3GW of capacity from those 30 lines in operation by 2017, up from a nameplate capacity of around 1.8GW at the end of 2014.

First Solar therefore has room to expand capacity in order to meet a certain level of shipment growth and end-market demand with relatively low capex requirements. Indeed, the company also has 10 lines in storage after closing its two manufacturing plants in Germany, equating to around 1.3GW of nameplate capacity as they stand. As a result of the excess warehoused capacity, First Solar has a potential manufacturing capacity of around 4.3GW. This would suggest that capex requirements, excluding relocating the 10 stored lines (perhaps for installing in a new facility in India), will remain low for several years to come. First Solar has made a 5GW pledge to India's 100GW installation target by 2022 and hinted at manufacturing in the country.

The real conundrum in the thin-film sector remains Hanergy Thin Film and parent company Hanergy Holding Group. Last year's announcements of plans to build CIGS plants in China based on the acquired company's technology are not an issue, especially since the company has been placing orders with suppliers for equipment deliveries later in 2015. The challenge comes when analysing the credibility of its recent three orders for equipment and plants in the a-Si BIPV market with companies that have no known history of manufacturing, and Hanergy Thin Film's inability to ramp up similar plants for its parent company. As already highlighted, a sizable element of the thin-film revival rests with Hanergy and its acquired companies, and for many reasons Hanergy's plans are being treated with the highest level of caution.

Japan-based CIS thin-film module manufacturer Solar Frontier completed the construction of its Tohoku Plant in March 2015 as expected and plans

to start ramping up production immediately. The 150MW Tohoku Plant is also the test bed for ramping up production-ready cell-efficiency gains, previously developed at its Atsugi Research Center, creating modules with conversion efficiencies of 15% and higher. Solar Frontier announced the Tohoku Plant plans in January 2014 and has met the timelines it originally set out. The new plant pushes Solar Frontier's volume production nameplate capacity to over 1GW, including its main Kunitomi Plant with capacity of 900MW in southern Japan. The company has publicly stated its interest in establishing similar-sized fabs in the USA and possibly other booming markets, as First Solar has suggested it might be doing in India.

Therefore, when excluding Hanergy Thin Film from the equation, the prospect of an expansion of thin-film production still holds a level of validity over the next two years.

April 2015 capacity expansions

With effective capacity expansion announcements in the first quarter of 2015 significantly below Q4 2014 and just slightly above Q1 2014, the announcements made in April indicate a further slowdown in the second quarter of 2015. Only a combined 380MW of capacity expansion announcements have been logged for the month of April, down from 790MW in the prior-year period (Fig. 5). Although much stronger levels of planned expansions were seen in the months following the first quarter last year, the current expectation is for muted activity, bar the possibility of new plants being announced by Chinese and Taiwanese producers heading for Malaysia.

In April 2015, Italian module manufacturer Eclipse announced it was planning a 100MW factory in Brazil, with plans to invest around US\$8m in the plant, but said it was waiting for local approvals.

Taiwan-based solar cell producer Sunrise Global, a subsidiary of wafer producer Sino-American Silicon Products (SAS), was also said to be planning to expand capacity by 250MW in 2015, taking nameplate capacity to 850MW. This would include the expansion of PERC cell production, as well as the upgrade of around 100MW of existing capacity to PERC.

Following its theme of establishing the manufacturing of acquired technology in China, Hanergy Thin

Film Power Group Ltd said it would build a 10MW gallium arsenide (GaAs) thin-film solar cell R&D and manufacturing plant using recently acquired US start-up Alta Devices technology. According to Hanergy Thin Film, the first phase of the plant would include a 3MW production line.

The new facility in Huangpi Linkong Industrial Park, Whan City, is expected to be completed in the next 10 months, while tool installation is envisaged in 12 months. Equipment and manufacturing line testing ahead of initial ramping up of production is expected to start within 18 months (by October 2016).

Conclusion

In the first quarter of 2015 the pace of capacity expansion announcements has clearly slowed, both in number and in scale, when excluding announcements from Hanergy Thin Film. The incredibly strong fourth-quarter activity of 2014 has certainly had a negative knock-on effect in the first quarter of 2015, and looks likely to lead to further softening of activity in the second quarter of the year.

The full extent of the impact of US anti-dumping duties from 2014, however, has yet to materialize with respect to Chinese and Taiwanese companies' manufacturing strategies to circumvent duties by locating production in places like Malaysia.

“In the first quarter of 2015 the pace of capacity expansion announcements has clearly slowed, both in number and in scale.”

With end-market demand in the USA expected to exceed 9GW in 2015, and potentially to be much higher in 2016 ahead of the ITC changes, catching that opportunity for some will be a priority. Announcements could therefore be imminent and on the scale already revealed by JinkoSolar and JA Solar.

Market demand in China is also a factor that could potentially lead to further announcements coming through, as the Chinese government has set a 17.8GW target for the year. With access to the utility-scale market now unfettered, and their own downstream ambitions riding high, Tier 1 suppliers should experience strong product demand, leading to tight supply throughout the year.