PV manufacturing capacity expansion announcement plans and analysis for 1Q 2016

Mark Osborne, Senior News Editor, Photovoltaics International

ABSTRACT
In this quarterly report on global PV manufacturing capacity expansion announcements in the first quarter of 2016, key analysis is devoted to the continued high level of intensity, which is continuing to track significantly higher than in the prior-year periods of 2014 and 2015. The report will also provide insight into the specific capacity expansion plans of the largest PV manufacturers, known as the 'Silicon Module Super League' (SMSL).

January 2016

PV manufacturing capacity expansion announcements for January 2016 revealed over 9.5GW of planned future expansions.

At 9.5GW of total expansions, which include dedicated crystalline silicon solar cell, integrated solar cell and module assembly and dedicated module assembly but no thin-film expansions, the January figure was the second highest monthly figure reported since the beginning of 2014. The record was set in November 2015 when over 25GW of new announcements were made after a regular reappraisal raised the figure from over 19GW, initially.

Around 2.67GW of dedicated c-Si solar cell announcements were made in January, notably with LG Electronics announcing it would expand n-type monocrystalline cell production from 1GW to 3GW by 2020 with capital expenditure of US$435 million. LG also revealed that it would add six cell production lines to its existing eight lines in a phased expansion, taking capacity to 1.8GW by 2018 and reaching 3GW by 2020.

January also delivered 5.35GW of planned module assembly capacity expansions and 1.5GW of integrated cell and module expansions.

The key announcement on c-Si module assembly was made by India-based integrated utility and solar developer Essel Infra and China-based Golden Concord Holdings (GCL), which owns GCL-Poly and GCL Integrated Technology Co. The companies announced a memorandum of understanding with the Andhra Pradesh government to invest US$2 billion in developing 5GW of module assembly capacity by 2020 in the Indian state.

Also announced were plans by Al-Afandi Group to build an integrated c-Si Solar cell and module plant in Saudi Arabia with an initial 120MW capacity and ambitions to expand in phases to 1GW over an undetermined time.

Geographical split

On a geographical basis, January continued the trend set in 2015 for capacity expansions outside China and the broadening of the PV manufacturing footprint around the world. Out of the nine main announcements of new capacity in January, only one was located in China, while plans included India, Malaysia, South Korea, Taiwan, Saudi Arabia and Italy.

Based on a preliminary analysis, conversion to effective capacity from announcements in January could be around 1GW by the end of 2016.

February 2016

Global PV manufacturing capacity expansion announcements for February 2016 revealed over 5.7GW of planned

Credit: Canadian Solar

Canadian Solar was one of the key contributors in another busy quarter for manufacturing capacity expansion announcements.

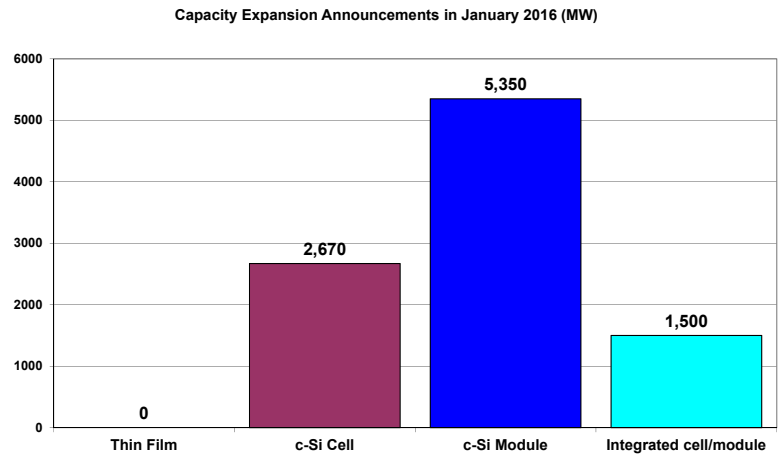

Figure 1. Capacity expansion announcements in January 2016 (MW)

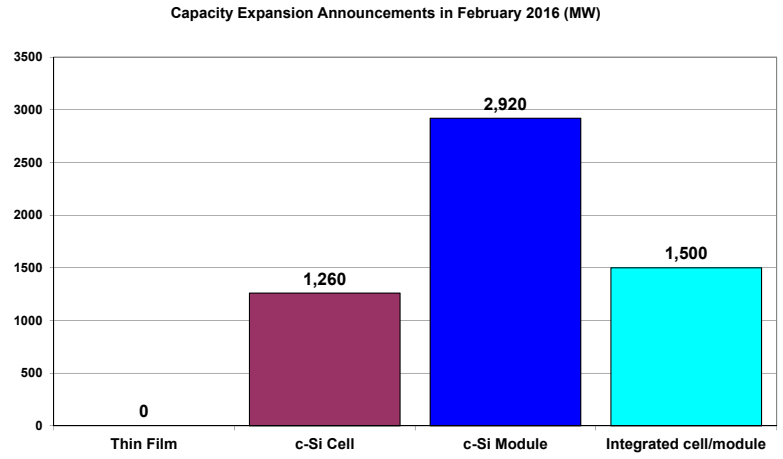

Figure 2. Capacity expansion announcements in February 2016 (MW)

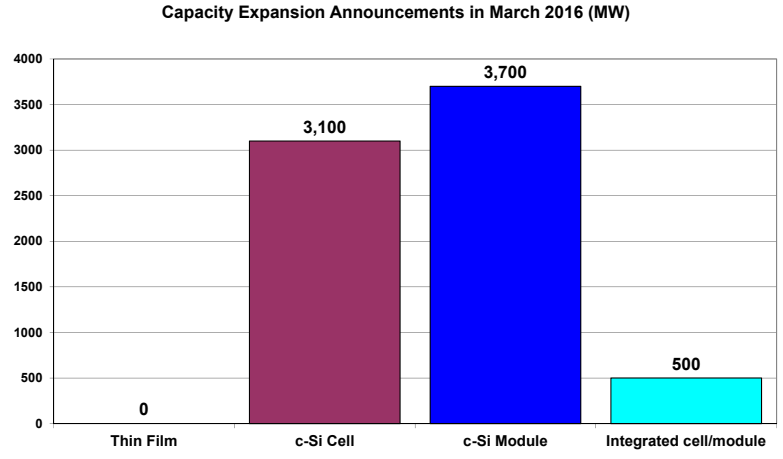

Figure 3. Capacity expansion announcements in March 2016 (MW)

future expansions.

Total expansion announcements included dedicated crystalline silicon solar cell, integrated solar cell and module assembly and dedicated module assembly. However, no thin-film announcements were made in the month, the fourth month in a row.

Total expansion announcements were down from January's 9.52GW), but up from more than 2.7GW in February 2015.

Dedicated solar cell capacity expansions announcements reached 1.26GW in February, less than half the figure in the previous month, while significantly higher than the 300MW announced in February 2015.

Integrated cell and module planned expansions totalled 1.5GW, the same level reached in the previous month. Dedicated module assembly capacity expansions announced in February reached 2.72GW, down from 5.35GW announced in the previous month, yet significantly higher than the 765MW announced in February 2015.

Overall capacity expansion announcements in 2016 are tracking significantly higher than in the prior-year period, driven by several announcements in the multi-gigawatt range. However, these (LG Electronics, Essel Infra/GCL and Jinneng Group/SunEdison) are mainly phased expansions over a number of years.

Geographical split

On a geographical basis, capacity expansion announcements continue to be broadly based. In February 2016 only two announcements (Jinneng Group/SunEdison and GCL Systems) were located in China, though these totalled 3.8GW. This compares with only one announcement in January (500MW) being located in China.

Southeast Asia accounted for just over 1GW of planned expansions, while smaller announcements for smaller projects were made for locations including Brazil (300MW), Algeria (120MW) and Italy (50MW).

Also notable was the planned restart of solar cell production (200MW) at the former Solland Solar facility in the Netherlands by Trina Solar. Asia-based companies have been playing a key role in driving the acquisition of idled capacity in Europe over the last three years.

March 2016

Our preliminary analysis of global PV manufacturing capacity expansion announcements for March 2016 has revealed over 7.3GW of planned future expansions of solar cell and module production.

Total expansion announcements include dedicated crystalline silicon solar cell, integrated solar cell and module assembly and dedicated module assembly, while no thin-film announcements were made in the month, the fifth month in a row.

The 7.3GW of planned future expansions, up from around 5.7GW in the previous month (figure updated from 5.4GW), is primarily due to several 'Silicon Module Super League' (SMSL) members (JinkoSolar, Trina Solar and Canadian Solar) adding meaningful

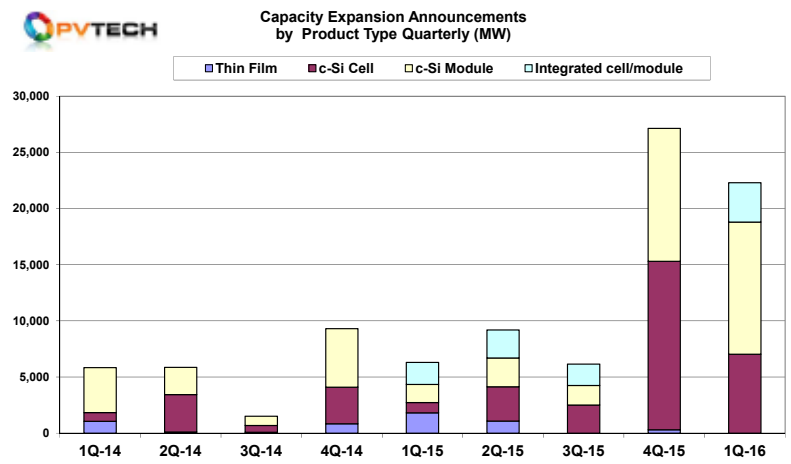

Figure 4. Capacity expansion announcements by product type, quarterly (MW)

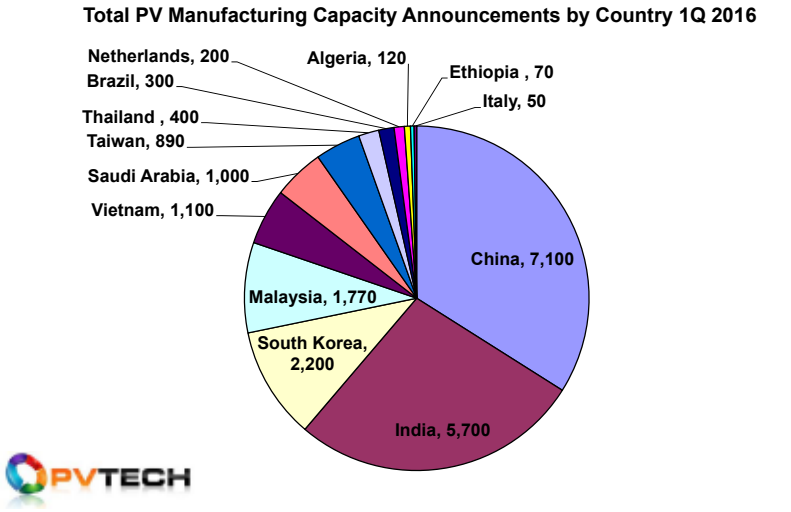

Figure 5. Manufacturing capacity announcements by country Q1 2016 (MW)

capacity to meet expected global demand in 2016.

SMSL members, including JA Solar, Trina Solar and new entrant, GCL Systems, were also behind the strong February figures, as nine companies in February had announced new plans to expand capacity, while the higher March figures include just 10 companies.

Dedicated solar cell capacity expansions announcements reached 3.1GW in March, compared to 1.26GW in the previous month. The increase was primarily driven by JinkoSolar, Trina Solar and Taiwan-based Tainergy Tech.

Although not technically new capacity additions, both SolarWorld and REC Solar are undertaking complete manufacturing line upgrades to PERC (passivated emitter rear cell) technology in 2016, which would boost megawatt nameplate capacity due to efficiency gains.

Integrated cell and module planned expansions in March 2016 totalled 500MW, down from 1.5GW seen in each of the first two months of the year. Dedicated module assembly capacity expansions announced in March reached 3.7GW, up around 1GW from 2.72GW announced in the previous month. Around 3GW of the total in March can be attributed to three SMSL members, JinkoSolar, Trina Solar and Canadian Solar.

Geographical split

In March, expansions were announced for around nine country locations, all in Asia, compared to eight country locations in February, including the Netherlands in Europe, Algeria in North Africa and Saudi Arabia in the Middle East as well as Brazil in South America.

Despite a continued geographical footprint expansion, China continues to be the dominant location for solar cell and module expansions. In March, China accounted for 2.8GW of total announced expansions.

In February 2016 only two announcements (Jinneng Group/ SunEdison and GCL Systems) were located in China, though totalled 3.8GW. This compares with only one announcement in January (500MW) being located in China.

However, Southeast Asia continues to attract further capacity expansion plans. PV Tech has previously highlighted that Malaysia and Thailand have been the dominant locations in the region over the last two years, attracting mainly China and Taiwan-based PV manufacturers.

In the last two years, Malaysia attracted over 2.6GW of new capacity announcements, while Thailand attracted over 2.3GW. Southeast Asia accounted for just over 1GW of planned expansions in February 2016 and over 2.8GW in March.

An interesting trend under development that started in 2015 is the emergence of Vietnam, primarily for dedicated module assembly, driven by low costs and as an alternative location to Malaysia and Thailand. Chinese PV manufacturers have been behind the Vietnam push, initiated by Powerway Group (Boviet Solar) in 2013 and more recently plans from Tainergy Tech, Canadian Solar and Trina Solar.

Overall capacity expansion announcements in 2016 are continuing to track significantly higher than in the prior-year periods of 2014 and 2015.

However, dedicated solar cell and integrated cell and module plant expansions have been running almost at comparable levels since roughly the second half of 2015, indicating that after a two-year period of mainly dedicated module assembly expansions, which require comparatively low capital expenditure, PV manufacturers are having to correct major cell to module imbalances or add cell capacity as further module assembly expansions are also planned in 2016.

Analysis Q1 2016

Total global PV manufacturing capacity expansion announcements in the first quarter of 2016 surpassed 22.3GW, the second highest quarterly figure. The previous quarter (Q4 '15) holds the record at over 27GW. Therefore, the total announcements in back-to-back quarters exceed 49.4GW, completely overshadowing the prior-year period when announcements topped 16GW.

With regards to dedicated solar cell capacity expansion announcements the first quarter exceeded 7GW, compared to 15GW in the previous quarter, yet the second highest on a quarterly run rate since the beginning of 2014.

New announcements of integrated solar cell and module assembly lines reached 3.5GW in the quarter, while the fourth quarter of 2015 did not generate any announcements. Dedicated module assembly announcements in the quarter reached around 12GW, almost identical to the previous quarter.

As with some major announcements made in November 2015 a number of announcements in the first quarter of 2016 were planned phase expansions. In the first quarter (February) for example, the 1.5GW Jinergy Clean Energy Technology Co and SunEdison partnership announcement actually included plans for a first phase expansion of only 500MW in 2016. Another 1GW integrated cell/module plant in January was touted as 1GW but the first phase would be 120MW.

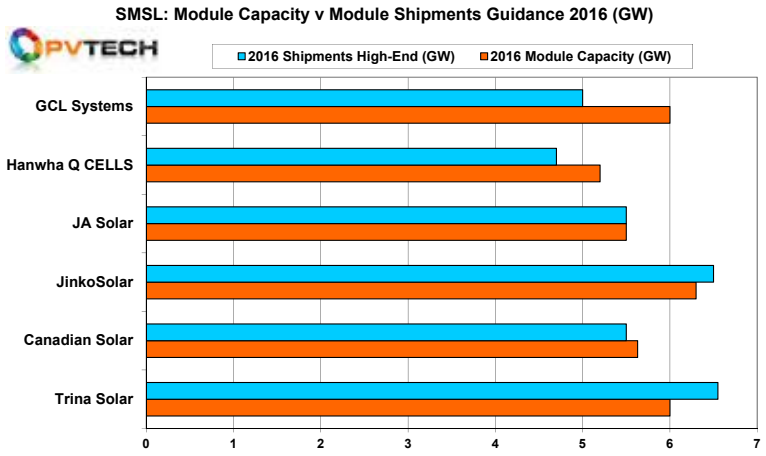

Figure 6. SMSL: Module capacity versus module shipments guidance 2016 (GW)

Geographical split

Month to month and quarter to quarter, the geographical location for new capacity announcements can vary considerably. As already highlighted March 2016 expansions all resided in Asia, compared to eight country locations outside Asia in February. Therefore, it is prudent to look at full-year geographical splits to identify real trends.

As a reference point for the first quarter of 2016, a total of 13 countries were locations for companies to announce planned expansions and new PV manufacturing plants.

Dedicated solar cell and module assembly announcements in the quarter were led by China with 7.1GW of new expansion plans in eight separate announcements. India followed with a total of over 5.7GW with only three announcements. The third leading country was South Korea with 2.2GW of new expansion plans from only two announcements. Malaysia with four announcements was fourth with a total of 2.2GW.

The fifth most popular location with four announcements in the first quarter of 2016 was Vietnam, which attracted 1.1GW of expansions and new plants.

SMSL update

When we first produced the 'Silicon Module Super League' (SMSL) in 2015, members initially included Yingli Green, Trina Solar, Canadian Solar, JinkoSolar, JA Solar and Hanwha Q CELLS. Our analysis showed that significant existing and planned gigawatt levels of nameplate capacity coupled to PV module shipment levels had created a gap of more than 2GW between these players and all other silicon-based PV manufacturers (with the exception of CdTe thin-film leader First Solar).

Through 2014 and 2015, the SMSL members had continued to outpace their rivals in both capacity expansions and shipments and were responsible for turning the most announced expansions into effective capacity during this period.

Since the first quarter of 2016, China-based GCL Systems Integration Technology Co has been added to the SMSL membership, due to its significant capacity additions and shipments in 2015 and planned expansions in 2016. Yingli Green Energy, meanwhile, has been dropped from the SMSL list as its declining shipments in 2015 mean it does not meet the criteria for inclusion in the rankings for 2016.

Trina Solar

First-ranked SMSL member Trina Solar reported full-year 2015 total solar module shipments of 5.74GW, an increase of 56.8% from 3.66GW in 2014.

Trina Solar guided manufacturing nameplate capacity of ingots of 2.3GW by the end of 2016 and wafer capacity of 1.8GW. Solar cell capacity is expected to reach 5GW and module assembly capacity 6GW by the end of the year. Both ingot and wafer capacities will therefore remain unchanged from 2015, while solar cell capacity will increase 2.5GW in 2016 and module capacity by 1GW.

Trina Solar expects total PV module shipments between 6.3GW and 6.55GW in 2016, indicating a continued dependence on third-party modules to meet guided shipment demand.

Canadian Solar

Second-ranked Canadian Solar is finally getting serious about rebalancing its solar cell-to-module in-house capacity as well as dedicating a significant amount of cell capacity to monocrystalline PERC technology.

In November 2015 Canadian Solar announced a major expansion of solar cell capacity after falling to below 50% of in-house module assembly capacity. The driver was to reduce manufacturing costs as OEM prices were on the rise for multicrystalline cells as wafer ASPs increased on tight supply, while monocrystalline wafer and cell prices had been falling on overcapacity issues. The company was more highly dependent on multi c-Si than mono.

To recap, Canadian Solar announced last year that it would increase in-house wafer production from 400MW to 1GW by mid-2016, while solar cell capacity would be expanded from 2.5GW to 3.4GW by the end of 2016, a 900MW increase.

However, the biggest proposed capacity increase was to PV module production, which would be expanded from 4.33GW at the end of 2015, to 5.63GW by the end of 2016, a 1.3GW increase.

Canadian Solar specifically noted that wafer manufacturing capacity at its plant in Luoyang, Henan Province, is expected to reach 1.0GW by June 2016, while cell manufacturing capacity at its plant in Suzhou, Jiangsu Province, is expected to reach 2.0GW by the end of 2016. Cell manufacturing capacity at its Funning plant in Jiangsu Province is expected to reach 1.0GW by July of 2016.

However, new manufacturing plants were also announced that included 300MW in Vietnam, 30MW in Indonesia, 300MW in Brazil and 400MW in Southeast Asia of module assembly capacity.

Canadian Solar also said that a new 400MW cell manufacturing plant, to be located in Southeast Asia, was expected to be commissioned in the second half of 2016.

The capital expenditure budget for all of the capacity expansions planned included an estimated US$104.0 million to be spent in the second half of 2015 and a further US$297.0 million allocated to the expansions in 2016, according to the company.

However, fast forward to the first quarter of 2016 and Canadian Solar made further tweaks to the previously announced plans. Overall, the company expects module assembly capacity to reach 4.63GW by the end of June 2016 and 5.7GW by year-end, compared to previous guidance of 5.63GW, a 1,370MW increase.

On the solar cell side, overall capacity increased 200MW to 2,700MW in the fourth quarter of 2015 and is set to remain unchanged at 2.7GW through to the end of June 2016, but capacity is expected to reach 3.9GW at year-end, compared to previous guidance of 3.4GW by the end of 2016. Total cell capacity expansions between Q3 2015 and the end of 2016 are targeted at 1.4GW.

Digging deeper, the subtle changes include its new solar cell plant in Southeast Asia being ramped to 700MW beginning in the third quarter of 2016, compared to 400MW previously announced. The new module assembly plant in Southeast Asia is also expected to ramp higher in 2016 – to 500MW, rather than the previously planned 400MW. The reality is that the imbalance between cell and module capacity has not been tackled.

Canadian Solar is expecting total module shipments in 2016 to be in the range of approximately 5.4GW to 5.5GW

JinkoSolar

Third-ranked JinkoSolar is adding 1GW of solar module capacity per quarter through to the end of the first half of 2016 to meet the 'minimum' expected demand for its products.

JinkoSolar recently noted that it would add 300MW of wafer capacity in the first quarter of 2016, followed by a further 200MW in the second quarter, taking nameplate in-house wafer capacity from 3GW at the end of 2015 to 3.5GW by the end of the first half of 2016.

Solar cell capacity, JinkoSolar's weakest link with respect to in-house nameplate capacity, is planned to be expanded by 200MW in the first quarter of 2016 and by a further 700MW by the end of the second quarter of 2016. Total nameplate capacity by mid-year is expected to reach 3.5GW, up 900MW from 2.5GW at the end of 2015.

Not surprisingly, the company is expanding module assembly to much higher levels than wafer and cell combined. JinkoSolar is adding 1GW of nameplate module capacity in the first quarter of 2016, and a further 1GW by the end of the second quarter of 2016. The company plans to reach 6.3GW of nameplate module capacity by the end of the first half of the year, up from 4.3GW at the end of 2015.

The initial analysis of these planned expansions and production ramp rates indicates that the company could be purchasing over 3GW of third-party solar cells in 2016 and more than 1GW of third-party modules to meet shipment guidance this year.

In its latest earnings call management were reluctant to provide financial analysts with clear details regarding where the capacity expansions were being undertaken. In its third quarter earnings call, management guided 500MW of solar cell capacity expansions, noting that it would confirm at a later date whether the expansions were planned in China or at its new manufacturing hub in Malaysia. The company said the same in its latest earnings call about the new expansions.

The company guided total module shipments in 2016 to be in the range of 6GW to 6.5GW.

JA Solar

Fourth-ranked JA Solar is increasing its manufacturing capacity to match expected demand, which will include expanding in-house wafer capacity to 2.0GW, solar cell capacity to 5.5GW and module capacity to 5.5GW by the end of 2016.

The majority of the capacity expansions would take place at its existing facilities in China. However, its integrated cell/module plant in Malaysia could ramp to 600MW to 800MW in 2016, dependent on overseas demand.

JA Solar said it expected full-year 2016 shipments to be in the range of 5.2GW to 5.5GW

Hanwha Q CELLS

Fifth-ranked Hanwha Q CELLS has said it expects to reach nameplate capacity of 5.2GW for both solar cells and modules by the middle of 2016 as the company continues major expansions from 2015 announcements. Those expansions would enable in-house production capacities for solar cells and modules to both reach 4.3GW by the end of 2015.

The company reiterated that 600MW of new solar cell capacity expansions come from Hanwha Q CELLS Korea, an affiliate of Hanwha Q CELLS in 2015, while a further 900MW of new cell capacity would also come on stream for the affiliate in 2016. The company also noted that in-house ingot production stood at 1.35GW and wafer production stood at 900MW at the end of the first nine months of 2015.

Hanwha Q CELLS is guiding PV module shipments in 2016 to be in the range of 4.5GW to 4.7GW.

GCL Systems

Sixth and newest SMSL member GCL Systems has undergone an aggressive module capacity expansion drive in 2015, having acquired bankrupt Chinese firms Topoint and Chaori Solar in 2014.

After the acquisition by GCL Systems, the former Chaori Solar facilities were expanded in 2015, including a further 220MW of solar cell capacity, bringing the total to 520MW, and a further 300MW of module assembly capacity to give a total nameplate capacity of 800MW per annum.

At the beginning of 2015, GCL Group, the private parent company to GCL Systems, had separately planned to set up two 1GW module assembly lines in Zhangjiagang and Chenguang, China in 2015. The plants were legally registered entities in January 2015.

Reports indicate that the Zhangjiagang facility officially opened in late May 2015 with the Chenguang facility cited to be operational later in the year. However, GCL Systems had informed us that the Zhangjiagang plant had a planned capacity of 2.35GW, which included the former Topoint nameplate capacity with further expansions in 2015.

GCL Systems has said that it would be expanding in-house module production beyond 6GW in 2016.

It should be noted that GCL Group and India's Essel Infra announced joint plans to invest US$2 billion in developing 5GW of module manufacturing capacity by 2020 in the Indian state of Andhra Pradesh.

Conclusion

The SMSL members are notable on several levels as not only are they expected to supply almost half of all end-market global PV module demand in 2016, they also demonstrate the most reliable effective capacity expansions. Since our analysis started at the beginning of 2014, SMSL members have consistently taken announced expansions to effective capacity additions within the expected timeframes. Indeed, their expansions of nameplate capacity have not met shipment guidance through the period due to demand.