

# The next PV capacity expansion phase is under way

Mark Osborne, senior news editor, Photovoltaics International

## ABSTRACT

Two years of overcapacity in the global PV supply chain have led to investment in new manufacturing capacity grinding to a halt. However, booming global end-market demand has brought the supply–demand imbalance under control and as a result the world’s leading equipment suppliers have begun looking at serious capacity expenditure. On the basis of recent announcements and annual report publications by some of the leading manufacturers, this article examines where, when and by whom capacity expansions are now planned.

## Introduction

It is hard to believe that after more than two years of chronic overcapacity up and down the supply chain, the PV industry has entered a new capacity expansion phase. The industry became burdened with a nameplate capacity of over 60GW by 2011, while global end-market demand was just over 30GW in that year, according to European Photovoltaics Industry Association data.

Saddled with such a significant level of overcapacity, and end-market demand that barely expanded (to just 31GW) in 2012, the industry suffered dramatic consequences: plummeting prices across the supply chain resulted in very low production utilization rates

at best, and closures, bankruptcies and exits from the industry at worst. Since then the industry has experienced over two years of profitless prosperity, and capital expenditure (capex) budgets were slashed to facility and equipment maintenance levels only.

Strong growth recovery in global end markets in 2013, however, meant installations topped over 36GW, according to NPD Solarbuzz. The market research firm’s latest PV Equipment Quarterly predicts that the freeze in spending by equipment suppliers over the past two years will finally thaw by early 2015 as a rebalancing of supply and demand took effect. Solarbuzz has said that

the overcapacity in the sector led to PV equipment spending falling to an eight-year low of US\$1.73bn in 2013, down from US\$13bn in 2011. This means equipment suppliers in 2013 saw bookings of less than US\$1bn.

But Solarbuzz predicts that over the next six months PV end-market demand will catch up with the 45GW of ‘effective capacity’ within the industry. The market research firm expects that 49GW of end-market demand in 2014 will push production utilization rates well above 90% for Tier 1 manufacturers, while prompting many to increase production outsourcing, from wafers and cells through to modules.



Source: Solibro

PV manufacturers have begun announcing plans to expand production capacity later this year and into 2015. Source: Applied Materials.

Fab & Facilities

Materials

Cell Processing

Thin Film

PV Modules

Power Generation

The new real growth phase for equipment manufacturers, however, will be driven primarily by a small number of Tier 1 manufacturers – a reflection of how the recent shakeout has consolidated the supply chain. But a key will be technology-driven spending, as China-based manufacturers are being pressured by government policies to push cell/module efficiencies beyond 20%.

Market research firm IHS recently tweaked its capex forecast up US\$430m in 2014 to a total of

US\$3.8bn. The firm had previously said that spending would increase by 42% from the lows of 2013 and reach US\$3.37bn in 2014.

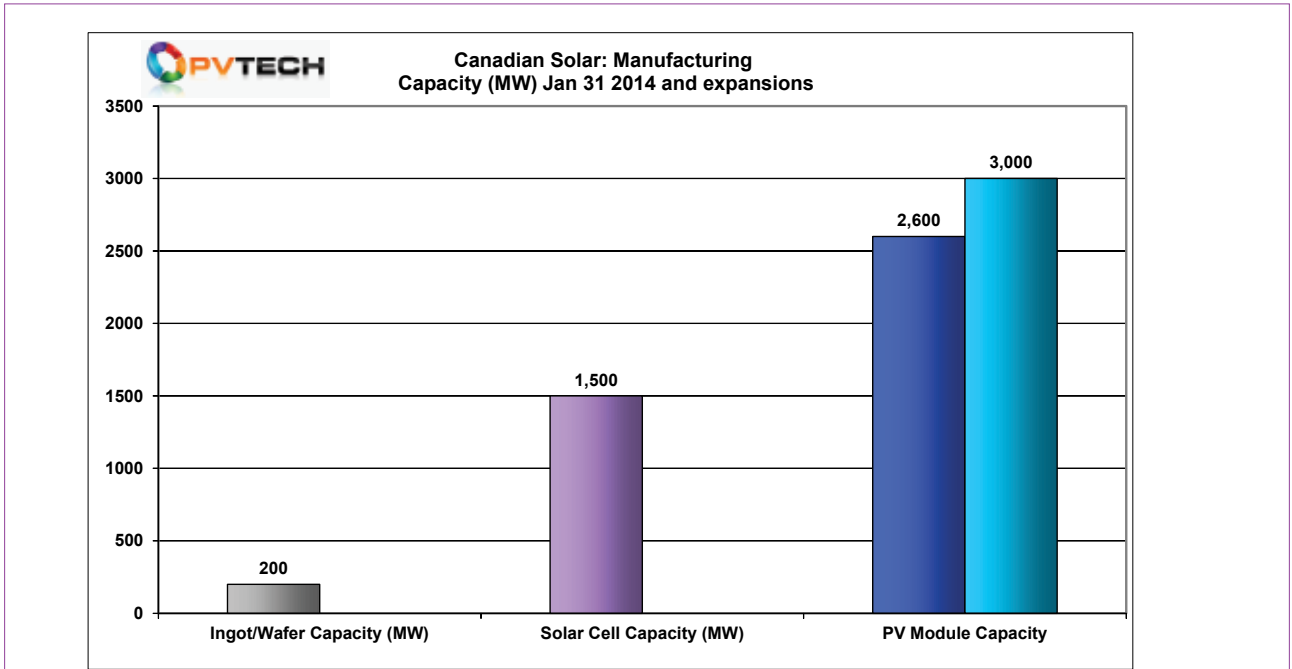
“The new real growth phase for equipment manufacturers will be driven primarily by a small number of Tier 1 manufacturers.”

### Major c-Si capacity expansion plans

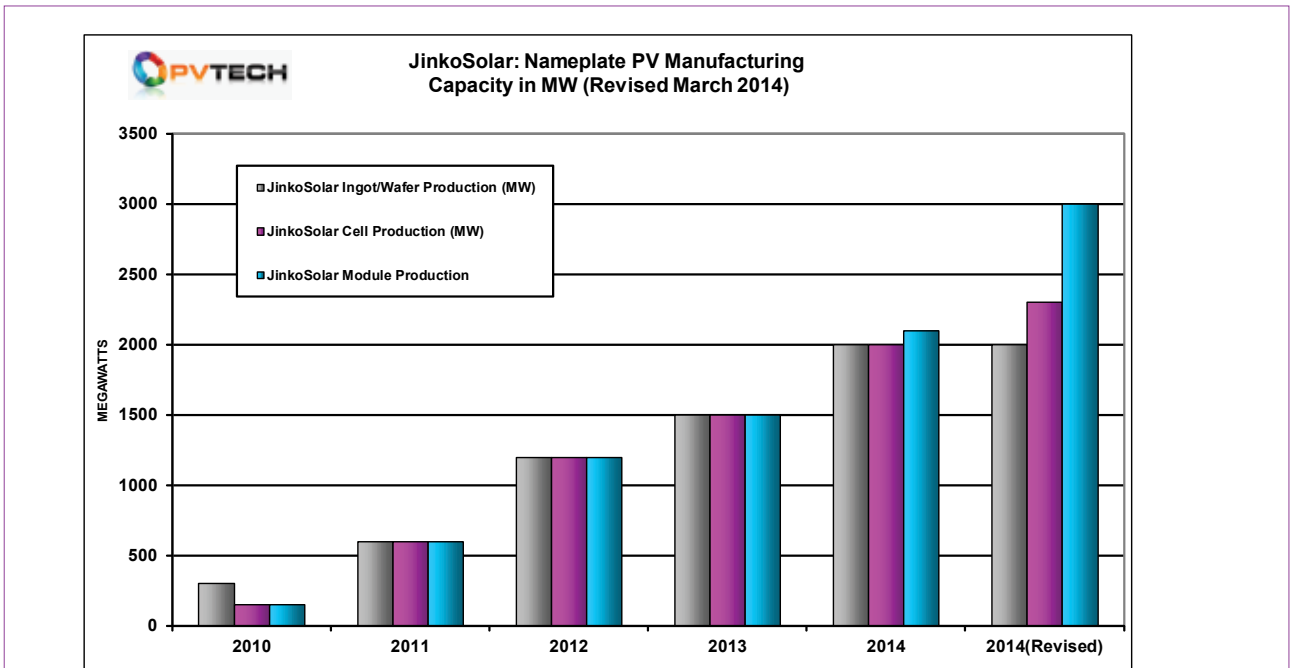
Since the fourth quarter of 2013, there has been a growing number of planned capacity expansions, some which are at the gigawatt level.

#### Canadian Solar

Canadian Solar has already increased module assembly capacity at its plant in Ontario, Canada, from 330MW at the end of 2013 to 530MW as of January 31st 2014. Total nameplate capacity at module production plants in China and



Canadian Solar's ingot, wafer and cell capacities remain modest, but it is planning to expand module output to 3GW.



JinkoSolar is planning further capacity expansions in 2014, which will take its nameplate capacity to 2GW.

Canada currently stands at 2.6GW, up from 2.4GW in 2013.

Canadian Solar has typically used a flexible, vertically integrated manufacturing model but has significantly smaller capacity in ingot/wafers (200MW) and solar cells (1500MW) than in module assembly (2.6GW). However, the company recently raised around US\$200m for further expansion of manufacturing capacity to 3GW in order to meet growing demand.

#### JinkoSolar

JinkoSolar added several hundred megawatts of module capacity in 2013. The company had 1.5GW of annual nameplate capacity for silicon ingots, wafers and solar cells, and approximately 2.0GW for solar modules.

This year, however, JinkoSolar recently announced it was acquiring Topoint, which would provide the company with 500MW of cell and 500MW of wafer capacity as well as 100MW of module capacity, bringing its total nameplate module capacity to 2GW-plus.

#### Trina Solar

Trina Solar has also followed the acquisition route to gaining new capacity with the purchase of a majority shareholding in Hubei Hongyuan PV Science and Technology, a small solar cell producer, as well as taking over operations of Tier 2 module manufacturer NESL Solartech.

The operations takeover deal was struck with Chinese conglomerate Yabang Investment Holding Group, owners of NESL Solartech. The new joint venture will be called Changzhou Trina Yabang Solar Energy Co., Ltd., with Trina Solar holding a 51% stake and Yabang Group having a 49% interest. The facility will be managed by Trina Solar management, according to a statement. Trina Solar said that the total investment by both companies would be approximately US\$45m, a sum that will be used for capital expenditure and working capital requirements. NESL Solartech had a PV module nameplate capacity of 400MW, which under the JV investment is expected to be increased to 500MW before the end of 2014.

Trina Solar will also form a joint venture with Shenzhen S.C. New Energy Technology Corporation, the owner of Hubei Hongyuan PV Science and Technology, taking a 51% stake in the solar cell producer; the operations will be renamed Hubei Trina Solar Co., Ltd. The partners said that the existing production facilities would be expanded to a capacity of 420MW by mid-2014.

Having recently detailed its module

capacity levels after line upgrades and throughput improvements that effectively took annual nameplate capacity from 2.4GW to 2.8GW, Trina Solar now has a module capacity standing at 3.3GW, or 900MW higher than mid-2013. Solar cell nameplate capacity increased to 2.6GW, providing the potential need for 600MW of outsourced cell production in 2014.

Trina Solar is expecting capital expenditure to reach US\$213m in 2014 as it targets expansion of capacity from ingot/wafer through to 1GW of extra module capacity.

#### SunPower

SunPower has guided capex plans for 2014 that are nearly double the spending in 2013. The company reported in its 2013 annual report that its capex would be in the range US\$150m to US\$170m in 2014, a possible increase of 88.8% from its 2013 guidance range of US\$70m to US\$90m.

The company had noted in its recent fourth quarter 2013 conference call that spending in the first quarter of 2014 would be in the range US\$25m to US\$30m as it started to ramp the construction of its 350MW facility in the Philippines, Fab 4.

The company is expected to be capacity constrained throughout 2014, unless further expansion is made at its JV Fab 3 in Malaysia, which was reported to have a production capacity of 800MW but a nameplate capacity over 1GW. No plans have been announced to expand Fab 3 production in 2014, and no further clues were revealed by SunPower on any planned expansion in its recent management conference call with analysts.

SunPower has revealed it is prepping plans for its next-generation 'Fab 5' manufacturing facility, which would be on a larger scale than existing facilities. The plant will be built as part of a major capacity expansion planned for 2015, once the new plant in the Philippines has been completed.

#### Hanwha Q CELLS

In December 2013 Hanwha Q CELLS started building a new solar cell plant at its manufacturing complex in Cyberjaya, Malaysia, which will house a 204MW solar cell production line. The new line will focus on producing high-efficiency solar cells for its Q.PRO G3 multicrystalline PV modules, which will be in production by early autumn 2014.

With the addition of the 204MW solar cell production line, Hanwha Q CELLS said the nameplate capacity of its Malaysian facilities would surpass 1GW, with 1.1GW of integrated

production capacity and a total production capacity of 1.3GW.

#### Wuxi Suntech

Wuxi Suntech is currently upgrading cell and module production lines in China ahead of plans to increase in-house module capacity in 2014. Line upgrades relate to improved conversion efficiencies and take module production to between 2.4GW and 2.5GW, a 20% increase from official production levels at the end of 2011. The intention is to expand in-house capacity by the end of 2014 to between 3GW and 3.5GW.

According to the last published annual report of Suntech Power Holdings in 2011, Wuxi Suntech's wafer and ingot production capacity stood at 1.6GW, while its cell and module capacity was 2.4GW.

#### SunEdison

Potentially the biggest planned expansion relates to SunEdison. The company said a few months ago that it was undertaking a feasibility study on establishing a fully integrated PV manufacturing complex, including FBR polysilicon production in partnership with the Saudi Arabian government. The plans call for an investment of US\$6.4bn in a major complex that could potentially be commenced later in 2014. As yet the company has not publicly provided further details.

#### JA Solar

JA Solar has plans to add capacity at existing production plants but has also ventured outside China for the first time, with a recent announcement to join forces in operating a module assembly plant in South Africa.

JA Solar and Powerway have formed a joint venture to establish a PV module assembly plant in Port Elizabeth, South Africa, with an initial nameplate capacity of 150MW. The JV partners said that production would start as early as the second quarter of 2014. The plant will be located in the Port Elizabeth's COEGA Industrial Development Zone, and the partners have the option to ramp capacity to 600MW to meet expected demand in the country.

**“Several major plans have been announced that are expected to trigger something of a renaissance in thin-film manufacturing.”**

At home, JA Solar is keeping ingot/wafer production steady at 1GW each,

but said that cell production would increase 300MW to 2.8GW in 2014. The big step function, however, is module capacity, with the company planning to add 1GW of capacity to reach parity with its planned cell expansion.

**Major thin-film capacity expansion plans**

The manufacturing sector that has suffered the most significant bankruptcies and plant closures in the last two years has been thin film.

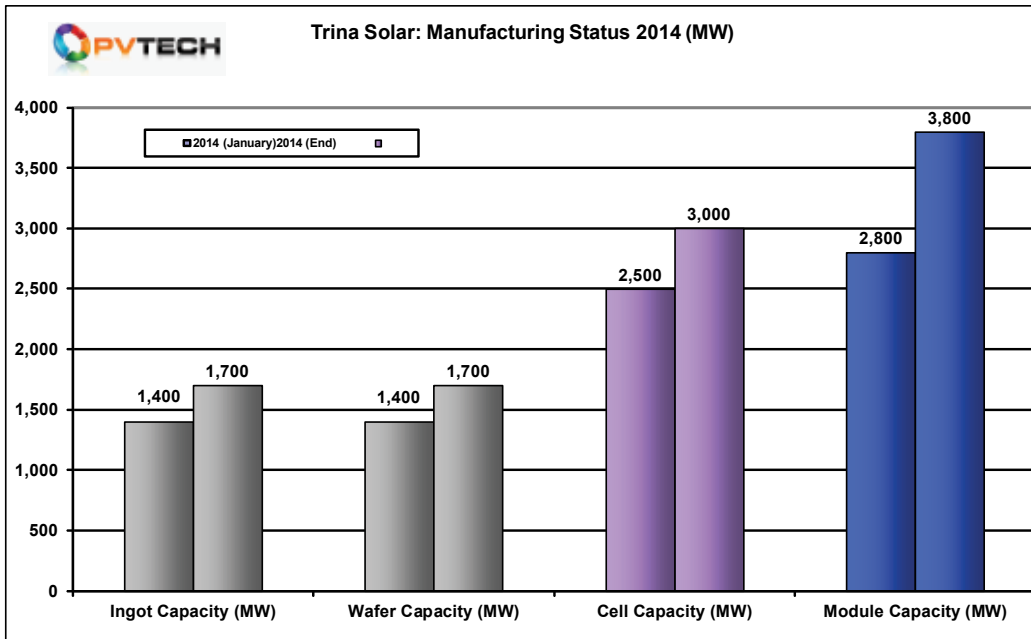
Even leading players, such as First Solar, cancelled significant capacity expansions in the USA and Vietnam during this period. However, several major plans, currently driven by CIGS-technology-based capacity expansions, have been announced that are expected to trigger something of a renaissance in thin-film manufacturing.

**Hanergy Solar**

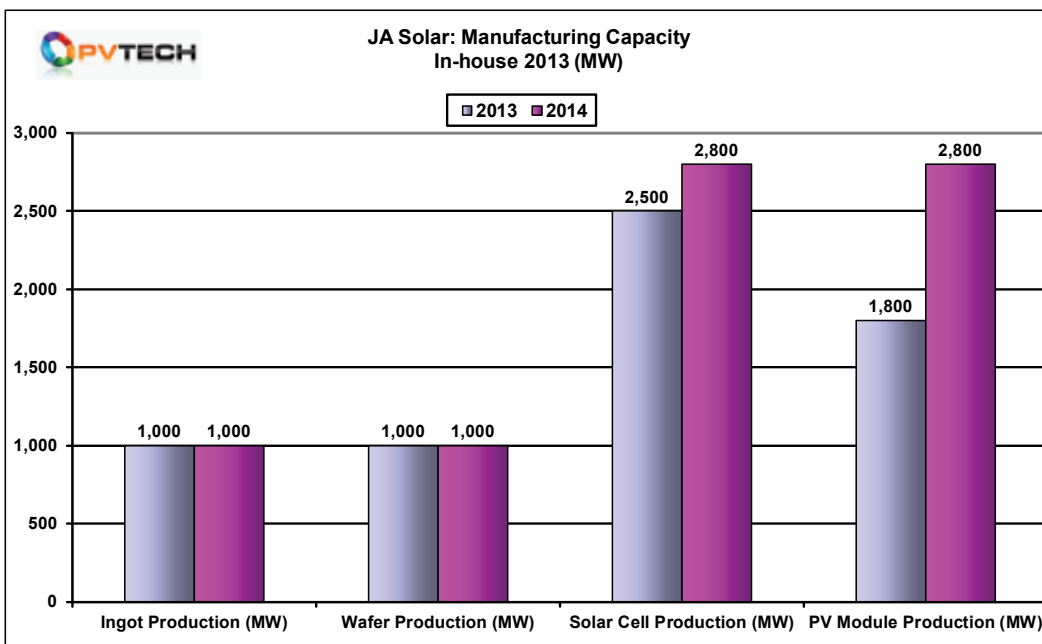
Hanergy Solar was to begin construction in March 2014 of a planned 3GW CIGS thin-film

manufacturing complex in Caofeidian, Hebei Province, China, with tool install commencing by the end of the year. The company is establishing a subsidiary, Hebei Caofeidian Hanergy Photovoltaic Co. Ltd., to own and operate the new complex. Initial plans are to build two separate production lines with a total nameplate capacity of 600MW.

Hanergy Solar said one of the turnkey lines, with a nameplate capacity of 300MW, would employ MiaSolé-based CIGS sputtering process technology, while the second line, with a further



Trina Solar is planning to increase production capacity in all its main areas of business in 2014.



JA Solar is keeping ingot and wafer production at existing levels this year, but is ramping cell and module output.

300MW, would employ Solibro's co-evaporating manufacturing process technology. Both CIGS manufacturers were acquired by Hanergy Group and their technology licences transferred to Hanergy Solar and subsidiaries. The initial 600MW phase-one construction and equipment spending is estimated to be approximately US\$780m.

Hanergy had also requested a two-year extension for its expansion plans for the existing MiaSolé plant in Santa Clara, California, from the California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA). Funding for the expansion is expected to be in place by the fourth quarter of 2015.

### Solar Frontier

Leading CIS thin-film PV module manufacturer Solar Frontier began construction of a new 150MW CIGS plant in Japan's Tohoku region in March 2014. The company had previously said that its new plant will potentially become a benchmark for new production facilities in various key PV markets around the world.

Solar Frontier's main Kunitomi Plant (900MW nameplate capacity) was said to have operated at full capacity from the start of 2013, while its Miyazaki Plant, with an annual production capacity of 60MW, also resumed production in July 2013.

Very recently, the company said it was considering establishing a 150MW production plant in Buffalo, New York, after signing a memorandum of understanding (MOU) with the State University of New York College of Nanoscale Science and Engineering (SUNY CNSE).

### Ascent Solar

Although US-based flexible CIGS thin-film manufacturer Ascent Solar had previously announced a joint-venture thin-film plant in China, the company recently updated on the plans. The company noted that the joint venture would build a 100MW CIGS thin-film manufacturing plant in the Suqian Economic and Industrial Development Science Park with the Municipal City of Suqian in Jiangsu Province.

The initial production capacity, however, will be 25MW, and the plant will be fully operational in the first quarter of 2016, with the 100MW ramp-up taking place over a six-year period. Suqian was originally said to be providing cash of approximately US\$32.5m for the joint venture and retaining a minority share. Under the revised agreement, however, Suqian is expected to provide approximately US\$4.8m in cash and to have a majority interest of 75%.



Source: Solibro

Proposed CIGS-based technology expansions promise something of a renaissance for thin-film.

### TSMC Solar

The CIGS thin-film firm TSMC Solar recently told PV Tech that it was also expanding production in 2014 at its plant in Taiwan from 40MW to 120MW. The company noted that equipment purchases have been made and tool install is expected to be completed by the end of the third quarter of 2014. TSMC Solar expects to achieve the new ramped-up capacity in the fourth quarter of this year.

### First Solar

In March, during its annual analyst day event, First Solar highlighted its next major CdTe thin-film production capacity expansion phase, but this would not occur until 2015 with an additional 1GW of nameplate capacity. Nameplate capacity would remain at 1.8GW in 2014, excluding the 100MW c-Si TetraSun production plant currently under construction that was announced in 2013.

However, First Solar is planning a combination of existing manufacturing line throughput and module efficiency gains, as well

as new line capacity, to provide a nameplate capacity of around 2.8GW by the end of 2015. Effectively, First Solar is only adding approximately 200MW of new capacity in 2015, although that additional new capacity rate would steadily increase to around 400MW in 2016 and to around 700MW in 2017 and 2018.

“PV manufacturers could announce the next significant wave of capacity additions later in the year.”

### Conclusion

With end-market demand set for strong growth over the next two years, it is clear that major capacity expansions are already under way in 2014. As the 'effective' 45GW plus of capacity is expected to become exhausted in 2014, PV manufacturers could announce the next significant wave of capacity additions later in the year, with many sites having to be greenfield.