IHS Markit™

TECHNOLOGY

Solar and Energy Storage trends for 2018

8 significant movements worth noting this year

What lies ahead

The solar industry continues to be an exciting and challenging place to work, keeping our role as analysts very interesting. 2017 saw annual installations grow by almost 20% from the year earlier and edge within reach of 100 GW, a milestone that the industry will reach this year.

Such remarkable expansion occurred against a backdrop of trade disputes and far-reaching policy changes on the one hand, as well as technology advances and cost improvements on the other—all of which have only served to make solar one of the most dynamic industries of our time, even as it continues to make a significant contribution to the global supply of electricity.

At the forefront in tracking and analyzing the solar and energy storage industry, our IHS Markit team of more than 20 analysts in 8 different countries is committed to providing insightful and up-to-date intelligence on this ever-evolving market. We hope you find these takeaways—thoughtfully produced on a range of compelling topics—useful in planning for the year ahead. Please feel free to get in touch to discuss any of the issues raised in this white paper or to find out more on how we can help you.

Our top solar and storage trends for 2018 include the following:

1. For the first time, 20 countries surpass 500 MW in annual PV installations.
2. Floating solar moves beyond niche applications.
3. Bifacial and half-cell technologies are the new rising module stars in 2018.
4. Full implementation of diamond wire is set for multicrystalline wafer cutting.
5. US and India trade policies seek to foster domestic manufacturing growth, but global module prices and procurement trends may be affected.
6. PV inverter suppliers are entering a new era of digitalization as they race to build new digital business models.
7. Long hailed as the solution to intermittency, utility-scale solar plus storage will take center stage in 2018, creating strong growth prospects for long-duration storage.
8. Electric vehicles will finally start realizing their potential, paving the way for new synergies with stationary energy storage.

For more information on this white paper, refer to our Solar and Energy Storage services, or contact one of our analysts.

We look forward to continuing to support you in 2018!

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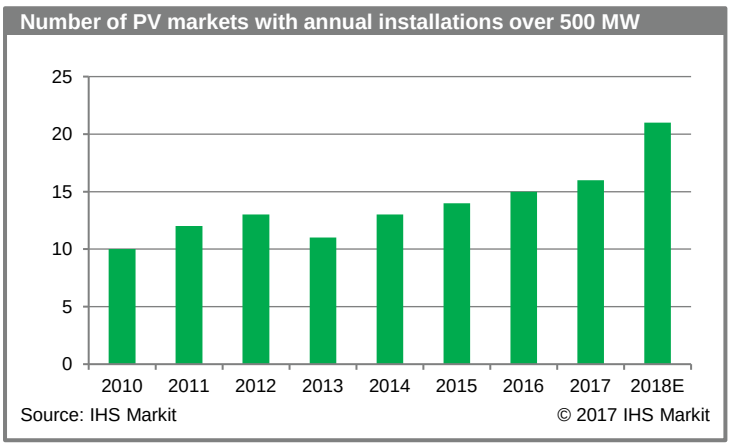
1 For the first time, 20 countries surpass 500 MW in annual PV installations.

The number of significant PV markets has been growing steadily over the past 10 years, alongside an increasing volume of installations in new markets. In 2010 there were 8 markets that passed the 500-megawatt (MW) mark for annual installations. In 2017 that number had doubled to 16, and 4 more markets are poised to join the group this year. These new markets will pop up in the shadow of the three global giants: China, India, and the United States. Combined, the top three markets will make up two-thirds of the total 108 gigawatts (GW) of new PV installations being built globally in 2018, while the next 17 markets will add up to one-quarter of the total.

With year-on-year global PV demand growth in 2018 projected at 15%, the markets outside the top three will grow 38%. Specific markets to watch in 2018 include Argentina, Spain, and Malaysia, where demand will increase more than tenfold.

Ultimately, how demand for PV in 2018 unfolds will hinge on global module prices, steered by events in the top three markets as well as by local policies and developer activity.

The trend of more new markets is set to continue in 2019 and beyond.



2 Floating solar moves beyond niche applications.

Floating PV systems are increasingly deployed on dams, reservoirs, lakes, and other water bodies across the world. In 2018, the technology for floating PV systems will move from niche applications to steady market uptake.

Floating PV systems have the advantage of saving land use, reducing evaporation from reservoirs, and generating more electricity—all thanks to the cooling effect of water. To date China, Japan, and South Korea have deployed the bulk of the more than 450 MW of installed floating photovoltaic (PV) panels. China will consolidate its position as the world leader in 2018, having already completed the world's largest floating PV system of 40 MW, alongside plans to continue with 70 MW and 150 MW projects in Q1.

While China is set to stay at the forefront, new potential markets are also emerging, such as India with a 10 GW tender, and the Netherlands with a 2.3 GW plan by 2023. This rapid growth of market opportunities will increase the number of companies with floating solar initiatives and give the current market leader, French-based Ciel et Terre, new competition.

As more announcements of floating PV systems and tenders continue through 2018, noticeable is how many so-called floating PV projects being mounted on pillars are ground-mount projects in disguise. Such misleading announcements risk distorting the market's perception of floating PV.

3 Bifacial and half-cell technologies are the new rising module stars in 2018.

To achieve higher efficiency, technologies for new solar cells, such as N-type HJT and IBC, may be good solutions but not the best, due to their complex production process and current high cost. Most manufacturers are leaning toward using other ways to improve module output based on existing cell technologies, since such a move requires much lower investments. To this end, some of the key module technology improvements that players are prioritizing now are bifacial and half-cell.

Bifacial promises all the advantages of glass-glass, such as lower LID, higher resistance, and higher tolerance for harsh environments. Moreover, bifacial can potentially generate 10-15% more electricity from the rear side, accompanied by only a limited increase in costs.

For its part, half-cell technology aims to reduce cell-to-module losses by optimizing ribbon thickness. This new module design allows more cells to be placed into a module of a given size and increasing power output by 5-10 watts, potentially at a lower cost per watt.

For both technologies, the increased output from one single module will also contribute to system cost reductions (on a per-watt basis). This applies to balance-of-system components (BoS), land, and transportation, among other factors, compared to a standard module for a similar-sized project.

One of the biggest barriers for these “new technologies” is recognition from buyers. Another hurdle is the limit to the number of cells obtainable, imposed by the current method of glass production. Production volume remains small compared to that from mass production, which means slower development and higher costs for these new technologies.

For now, bifacial is also awaiting a unified testing standard for bankability. Meanwhile, half-cell requires improvement in some equipment to reduce the higher breakage rate compared to that of standard cells.

4 Full implementation of diamond wire is set for multicrystalline wafer cutting.

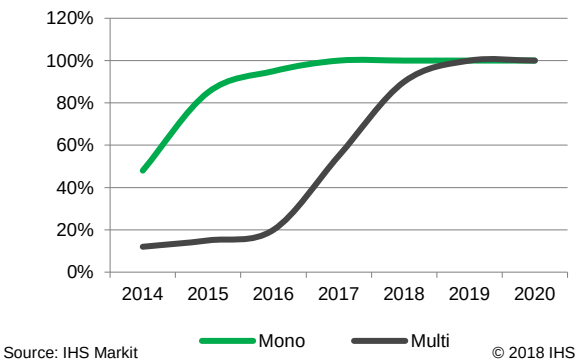
In the last couple of years, most announcements on new wafer capacity have been on the monocrystalline side. The growing traction of monocrystalline does not mean the demise of multicrystalline, as multicrystalline suppliers are expected to keep up the battle and will continue to account for about 50% of the market in 2021.

The main cause of the resurgence of multicrystalline is the implementation of diamond wire sawing. IHS Markit forecasts that the use of diamond wire saws for cutting multicrystalline wafers will reach significant penetration rates in 2018, with major players entering mass production.

Once fully implemented, the use of diamond wire saws will increase wafer efficiency as well as reduce kerf and production costs, helping make multicrystalline costs competitive again in the next couple of years.

The successful implementation of diamond wire saw could reduce the cost of each multicrystalline wafer piece by up to 15%.

Diamond wire cutting penetration rate (%)



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5 US and India trade policies seek to foster domestic manufacturing growth, but will impact global module prices and procurement trends.

Policy and trade barriers in key markets will shape manufacturing investments and expansions in 2018 and beyond. In the same manner that cases involving anti-dumping and countervailing duties (AD/CVD) in both the United States and Europe shaped global manufacturing and were the trigger to significant capacity expansions in Southeast Asia, recent trade developments in the second- and third-largest solar markets—the United States and India, respectively—are expected to have broad implications on manufacturing investments and expansions from this year to the next few years.

US President Trump is implementing broad-based import tariffs of 30% on imported PV cells and modules. The new import tariffs extend to additional markets outside of China and Taiwan, including markets such as Malaysia and the Philippines,

While final tariffs are much softer than in the original petition, they are enough to increase interest in domestic manufacturing. Even so, tariffs alone are not seen as enough to incentivize a flood of new manufacturing expansions, because secure sales pipelines and any local government incentives are also needed.

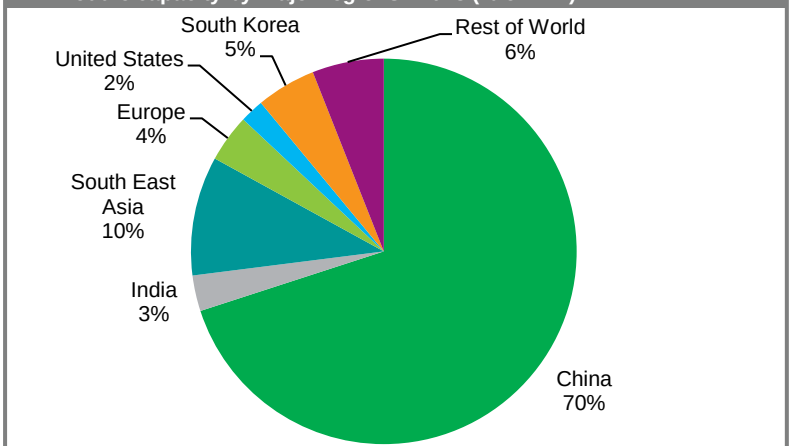
The announcement from China's Jinko Solar in Florida is a perfect example, leveraging a master supply agreement as a safety net against any sudden changes to the tariff policy. Customers can benefit as well by locking in the projected module costs for their project portfolios, thus allowing them to sign project power purchase agreements (PPAs) at secure prices with their partners.

Overall, tariff-free import quotas for PV cells are likely to influence the type of manufacturing expansions that will occur in the United States. Given the generous tariff-free quota, suppliers looking to expand in the United States will likely push for module assembly expansion first, if there is enough cushion in the quota for them to import cells tariff free.

In parallel, India's Directorate General of Anti-Dumping and Allied Duties (DGAD) in July 2017 opened an anti-dumping investigation of imports from China, Malaysia, and Taiwan; the investigation is expected to be completed by the end of 2018.

India also announced the forthcoming establishment of a safeguard provision for modules from these countries of origin to avoid a surge in imports, ahead of the anti-dumping investigation.

PV module capacity by major regions - 2018 (% of MW)



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This decision may bring about the imposition of up to 70% duties on cells and modules during the safeguard period, which can be extended up to 200 days from the day of the announcement.

The result of these two trade cases could be the closing of the second- and third-largest PV markets to cell and modules that are manufactured in China, where more than 70% of all modules were produced in 2017.

The implications of these developments—on global pricing, as well as on the worldwide supply-and-demand balance by restricting access to Chinese cells and modules in the largest PV markets—cannot be underestimated.

6 PV inverter suppliers are entering a new era of digitalization as they race to build new digital business models.

The PV inverter supplier landscape is forecast to remain extremely competitive in 2018 because of continued price pressure, volatile market demand, and an extremely crowded supplier base.

Some PV inverter suppliers will continue to find growth opportunities through a few avenues: by entering new markets, releasing higher-power-rating string and central inverters, or releasing module-level power electronic (MLPE) solutions for the residential market. Even so, many suppliers are looking to create new business models.

One business model that many suppliers have identified is to create a digital services platform that combines the core strength of suppliers in providing PV inverter hardware, with the addition of a software and cloud platform. This way, suppliers can work seamlessly with new partners in parallel industries, such as e-mobility, energy storage, lighting, heating, and cooling.

The benefit to providing such a platform is that it can be easier and more cost-effective for customers to analyze and manage their energy generation and consumption efficiently, with the PV inverter instrumental as the intelligence of the energy ecosystem.

In the last few years, industrial PV inverter suppliers such as ABB, Schneider Electric, and GE have developed digital platforms, particularly for microgrid applications. These companies are rapidly expanding their capabilities to work with new customers and applications.

Other companies are rapidly expanding their hardware portfolios and software/cloud capabilities so that they, too, can develop a digital services platform. These include PV inverter suppliers with a large market share in residential, such as Enphase, SolarEdge, and Panasonic; as well as suppliers that boast of a large installed base, such as SMA and Huawei.

Although this new business model of building a digital services platform is still nascent and has yet to be monetized in a significant way, early entrants have early-mover advantage to create a new revenue stream. This is true even if the market is already a crowded place.

7 Long hailed as the solution to intermittency, utility-scale solar plus storage will take center stage in 2018, creating strong growth prospects for long-duration storage.

Solar has made a huge impression in many countries, becoming a meaningful contributor to the energy-generation mix. This is mostly thanks to tremendous improvements in cost, to scale, and to advances in technology. In the last five years, the upfront cost of a utility-scale solar system has fallen on average by half.

Without a doubt, the inherent challenge with solar technology as a large-scale energy generator is intermittency. The combination of solar together with batteries has long been recognized as a solution to this problem, smoothing the variations in a plant's output and storing electricity during the day, allowing the system to provide power into the evening.

In the past, the high cost of batteries prohibited these types of systems. However, the huge drop in the price of lithium-ion batteries—nearly 70% between 2012 and 2017—has now made utility-scale solar plus storage cost-effective and a reality in some places.

Hawaii has been an early sweet spot because of its high electricity prices. Purchase power agreements (PPAs) signed for solar plus storage plants compete with other technologies, delivering power priced 10% less than that from the current diesel generators on which the state relies for large parts of its power generation.

Other regions are following close behind. These include other parts of the United States; as well as Australia, where some large planned utility-scale PV plants are now adding storage to provide firm power supply, resulting in the building of a 2.1 GW pipeline of such systems in the country.

On a global level, utility-scale solar plus storage accounts for approximately 40% of the total utility-side-of-the-meter energy storage pipeline.

8 Electric vehicles will finally start realizing their potential, paving the way for new synergies with stationary energy storage.

The growth and future promise of electric vehicles (EVs) has been a major factor in driving down the cost of batteries for energy storage, thanks to huge investments in battery technology and scale. EV growth will continue in 2018, but the various synergies between stationary energy storage and the reuse of “second-life” batteries from EVs will also be increasingly explored.

While they are charging, the batteries within EVs represent a potentially valuable flexible resource for providing grid services and for keeping the supply and demand of electricity on the grid. The concept of using batteries in EVs as they charge for providing services to the grid is of growing interest. Nonetheless, this could create a competing resource for stationary energy storage in the provision of ancillary services.

As the number of EVs on the road grows, the number of batteries that need to be recycled or reused will also quickly increase. To this end, batteries no longer able to provide an adequate range to an EV user may still be usable in the stationary energy storage segment, which means they could be a source of low-cost batteries. At present, however, the lack of an effective repurposing chain and remuneration alike creates a major barrier, even if these second-life batteries may offer in some cases a cost-competitive solution,

The growing number of EVs on the road and their need to charge—often at similar times of the day—could also present a challenge from both an electricity supply and infrastructure point of view. On this aspect, of growing interest is the use of energy storage at charging stations and nearby infrastructure, not only in terms of mitigating the impact of charging, but also on how costly investments in upgrading the grid might be reduced.

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