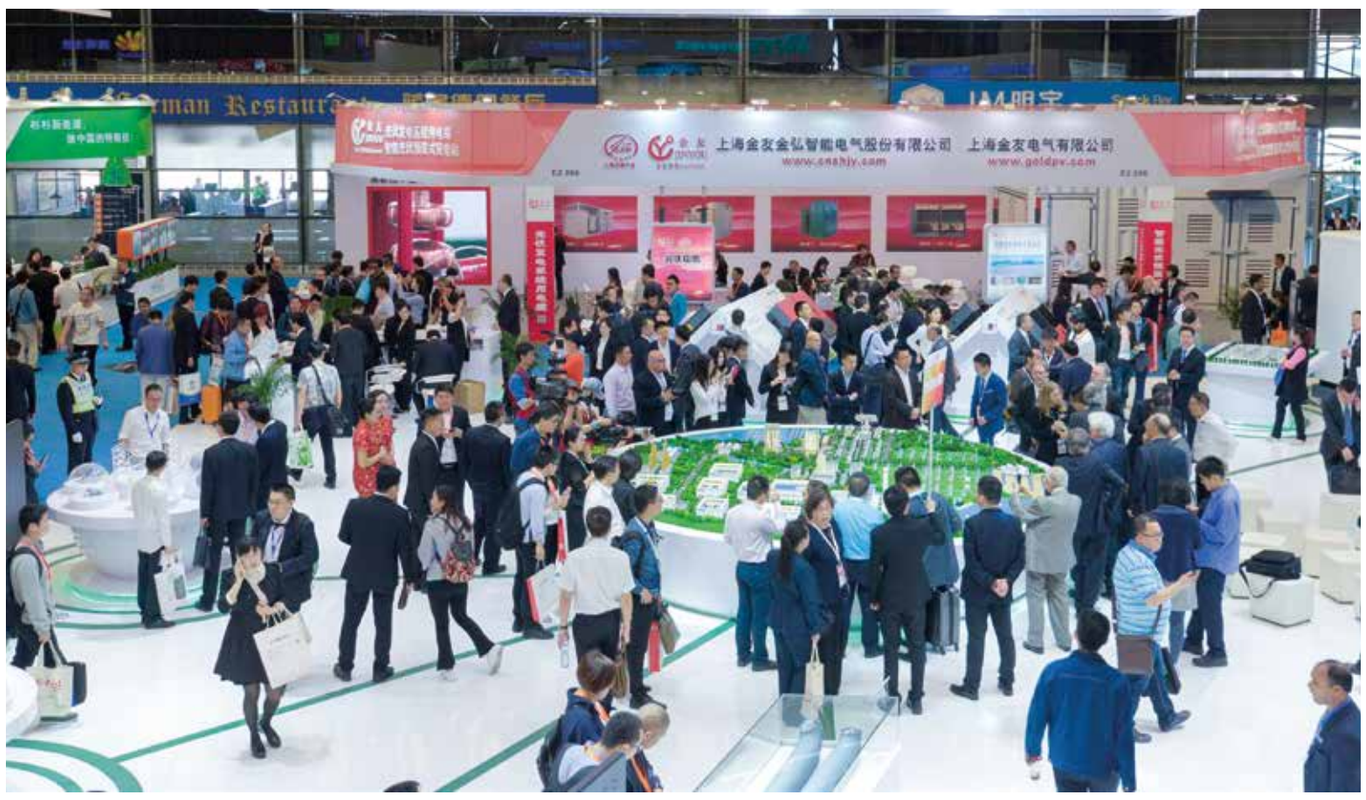
SNEC pv magazine DAILY

Day 2 – April 20, 2017 | The daily newspaper for the SNEC 2017 PV POWER EXPO | FREE COPY

SNEC exhibition begins with bang as huge crowds gather on day one



Many industry veterans were pleasantly surprised by the sheer volume of visitors to the first day of the exhibition.

The 11th annual SNEC International PV Power Exhibition began on Wednesday, drawing huge crowds at every turn.

Spread across 180,000 square meters of exhibition space, this year's show looks to be one of the biggest yet, with more than 100,000 visitors expected to attend the three-day exhibition.

Throughout the exhibition grounds the more than 1,500 exhibitors witnessed wave upon wave of engaged and enthralled visitors to their booths, with particularly packed crowds reported in Halls W1, W2 and W3, and also in halls E1, E2 and E3.

Judging by crowd size, it is the leading module companies and power electronics suppliers that have garnered the most interest, but there was also sustained footfall at the booths of upstream providers.

The tangible excitement was boosted by a series of well-choreographed dances, dazzling technical displays and engaging presentations ringing out from all four corners of the halls. Earlier in the week, the SNEC Conference had kicked off proceedings in a more muted manner, with talk even of a slightly contracted first half (H1) of the year for China's solar landscape.

The reality on the show floor, however, was one of heightened confidence in China's ability to continue to build upon its global market lead, and a notably eager embrace of new technologies – from cell and module advances through to cutting-edge upstream solutions and smarter inverter products.

In conversations with SNEC Daily, many industry experts said that in 2017 China's solar market will likely once again buck expectations.

"Nobody is complaining," said Heraeus Photovoltaics President Andreas Liebheit, adding that manufacturers are upbeat about the current market. "The manufacturers I have been speaking with are running at 100% utilization. It was a little bit different six weeks ago, but now I don't hear that manufacturers are underutilized. It really is positive." Market forecasts for China's installations in 2017 are also tending towards an end market equallying or even exceeding 2016's stellar performance. Clean Energy Associates' (CEA) Andy Klum said that he expects the distributed generation (DG) market in China will surprise many.

"The common expectation is that the market is going to be less and there have been some announcements for a 20 or 25 GW market," said Klum. "But we still feel very bullish on the China market and think it will be just as large if not slightly larger than last year. I think you have to understand there is a lot more movement towards DG and there will be a lot of activity in H1, the same as last year. And some of the DG portfolio will surprise people on the upside."

"I am not surprised by some optimistic forecasts," said Heraeus' Liebheit. "The production capacity is larger than this time next year and everyone is fully utilized, so the mathematical logic is that for the first half year in China is stronger than last year."

WHAT'S ON?

Exhibition schedule for days 2 & 3

Thursday April 20

09:00-17:30 Exhibition
Shanghai New International Expo Center, Halls W1-W5, E1-E7, N1-N3

09:00-12:30 SNEC (2017) International Solar Energy and Green Building Conference
Pudong Ballroom 1-3, Kerry Hotel

08:45-12:30 Symposium on "Internet+" Smart Energy and Smart O&M Technologies of PV Plants
Pudong Ballroom 4, Kerry Hotel

09:00-12:30 Jolywood • Industry Workshop on "Top Runner" High Efficiency Solar Cells, Auxiliary Materials and Technologies Related
Pudong Ballroom 5-7, Kerry Hotel

09:00-12:30 Industry Workshop on PV Production Technology
Function Room 3, Kerry Hotel

12:15-13:30 Delegate Lunch
Plum Blossom Room+Orchid Room, 2/F, Kerry Hotel

13:30-17:30 Industry Workshop on Global PV Market – Outlook and Development Strategies
Pudong Ballroom 4, Kerry Hotel

13:30-17:30 Jolywood • Industry Workshop on "Top Runner" High Efficiency Solar Cells, Auxiliary Materials and Technologies Related
Pudong Ballroom 5-7, Kerry Hotel

Friday April 21

09:00-15:00 Exhibition (closes earlier, at 3pm)
Shanghai New International Expo Center, Halls W1-W5, E1-E7, N1-N3

09:30-11:00 Top 10 Highlights Awards Ceremony
Booth No. 560 in Hall E7

Manz receives green light for Shenhua, Shanghai Electric deal

Germany production equipment supplier Manz announced yesterday that it has received the "necessary official approvals" required for its €263 million CIGS equipment supply deal, and that it will receive a €50 million down payment as a part of the deal, in May.

The deal between Shanghai Electric and Shenhua will see Manz supply production equipment for both production and R&D CIGS lines to China. At the SNEC exhibition, Manz unveiled the two joint venture companies that will be formed in China under the equipment supply deal. The three parties have now formed Suzhou Manz New Energy Equipment and NICE PV Research Ltd. The New Energy Equipment JV company will produce Manz CIGSfab tooling in China under an exclusive license for supply to China. Manz AG will continue to fulfill CIGSfab orders, if there are forthcoming, to other parts of the world.

The NICE PV Research JV will pursue technological development of the CIGS technology, with a goal to push efficiencies higher. The former Manz CIGS research operations will be transferred to the NICE PV Research company.

Manz AG has a majority holding in Suzhou Manz New Energy Equipment, which comes in at a 56% stake.

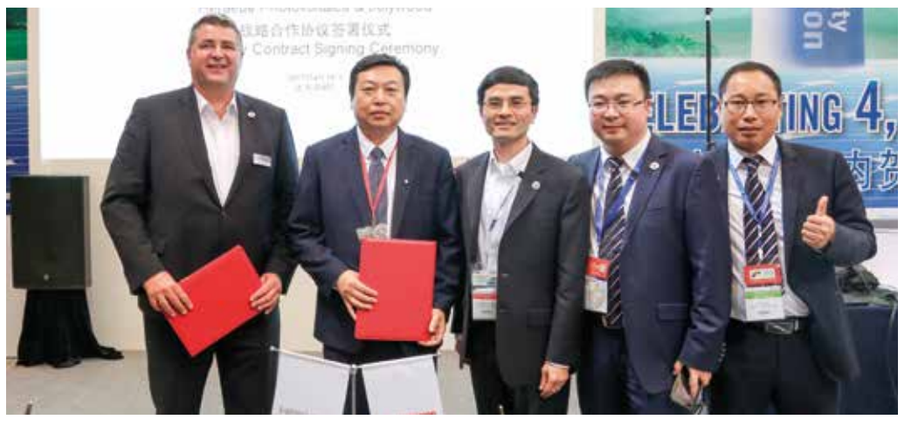
NEWS FROM SNEC

GOT A STORY?
If you've got some news for us, get in touch!
gifford@pv-magazine.com

Jolywood and Heraeus Photovoltaics form new R&D cooperation

Germany's Heraeus Photovoltaics and Chinese solar cell manufacturer Jolywood have signed a strategic R&D cooperation agreement to develop next generation metallization solutions for n-type mono bifacial solar cells to significantly improve performance and costs efficiencies.

Jolywood is a leading player in high efficient n-type mono solar cells for bifacial glass/glass-module applications. Last year it chose Heraeus Photovoltaics as its preferred paste supplier because the company focuses on high efficiency mono solar cell architectures. Heraeus' n-type paste solutions for frontside and backside metallization enable 21% frontside and 19% backside cell efficiencies in mass production. Under the agreement, both companies will share close cooperation regarding the development of silver pastes and work towards further enhancing the efficiencies of bifacial n-type mono cells, which are becoming an industry trend.



Industry analyst Corrine Lin told SNEC Daily that the wind seems to be behind bifacial cells in 2017. "New bifacial modules are offering an average of 10% to 20% increases in power output from the rearside," Lin said. "This is proving good for developers' IR, and because the technology is not too difficult to incorporate into the production process, costs will also not increase too much."

Dow takes first steps into China

For the first time, Dow Chemical Company has formally participated at the SNEC show to promote one of its key businesses, the Dow elastomer, which is an advanced PV module encapsulant film that provides better protection for the cell once placed in the PV module.

With an introduction from Andrew Yen, marketing manager of Dow Elastomer, Asia Pacific, the Dow elastomer product was unveiled on the first day of the exhibition. Yen demonstrated how a module equipped with the elastomer (called ENGAGE POE) could provide better protection and extend the lifetime of the module. The elastomer is also adept at delivering an extended period of better performance across the module's working lifetime, Dow claimed, adding that because the film accounts for only a small proportion of the total module cost, profitability can also be improved.

Dow has chemical plants in Saudi Arabia and Thailand to fulfill the market needs of Asia and especially the most demanding and largest market in the region, China. New plants are planned for more capacity, increasing to 1.4 billion pounds by the end of 2020.

The current market penetration for POE is low at less than 10%; with the majority of the backsheet market still reliant on EVA. Nevertheless, Dow is expecting a very promising market in China, Yen added.

Huawei signs 700 MW supply deal with Kong Sun Holdings

Chinese fnverter giant Huawei signed a supply deal worth 700 MW at its packed booth yesterday for inverters for both distributed and utility scale projects to be built out during 2018. As a part of the deal, Huawei will take a minority stake.

In announcing the deal, Huawei representatives spoke of the fast-emerging distributed market in China and the trend towards major project developers in the country deploying Huawei inverters.

Huawei unveiled a series of new products on the first day of the SNEC. These included the fifth generation of its Smart Fusion PV power plant monitoring and O&M system. The company claims that Fusion 5.0 can deliver a 3 – 4% yield increase to park owners and a dramatic decrease in down time. Huawei also released its new 70 kWp Smart PV Controller unit, which includes an integrated inverter and monitoring system. Huawei says that the new unit collects and delivers detailed data on PV plant performance, down to the row and even module level. This, it reported, can alert O&M providers to potential problems before they arise. The Smart PV Controller is anti PID, employs 6 MPPT, and does not deploy fans for cooling.

ET Solar, Royal DSM tie up on backsheets

The two companies have signed a strategic partnership to supply backsheets for PV modules.

Nanjing-based ET Solar will use DSM's backsheets to increase power gain in its PV modules. The companies claim the backsheets will play a "significant" role in reducing the levelized cost of energy (LCOE).

Under the terms of the agreement, they will also jointly develop new environmentally friendly backsheets, according to a statement.

"DSM has a strong position in materials, which are vital to create the best module components," said Zhenhai Guo, president of ET Solar.

DSM claims its backsheets are fluoride-free, contributing to a 30% reduction in their carbon footprint compared with fluoride-based backsheets.

"New materials and technologies will clearly play a crucial role in solar PV innovation," said Oscar Goddijn, vice president of DSM Advanced Solar.

Separately, DSM revealed a new anti-soiling coating for PV glass.

The Dutch company said the new anti-reflective coating is designed for solar panels deployed in arid, desert environments.

"In extensive testing at the TÜV SÜD desert test site in Dunhuang in China, we have shown that this new anti-soiling coating consistently outperforms our own industry leading anti-reflective coating in terms of power – each month more than 1% extra on average," said Jan Grimberg, global business director for DSM Advanced Solar.

Photo: DSM

Miss Mongolia attends SNEC to support PV in her homeland

Former Miss Mongolia Britta Battogtokh attended the SNEC Exhibition yesterday, in an attempt to encourage greater solar deployment in her home country. The glamorous, friendly and articulate solar advocate said that solar energy had made a profound impact in rural areas in Mongolia, and also has the potential to alleviate the high levels of pollution found in many Mongolian cities.

"The main goal is to connect solar companies to Mongolian officials," said Battogtokh. She went on to explain that her work in advocating for solar had allowed her to travel widely, and added that it seamlessly links to her personal life experience. Battogtokh has enjoyed a run of beauty success in her home country, and was the winner of Miss Mongolia competitions in 2013, 2014 and 2016. She has also be crowned Miss Grand Mongolia in 2014, and won the coveted Miss Supranational gong in 2016.

"In Mongolia there is a lot of pollution in the winter, for three or four months," said Battogtokh. "That is why the government is pushing towards solar power plants. I grew up in the countryside and we didn't have electricity. We lived in a yurt and had one PV panel and a small battery, and so my work with solar is connected to my background."

Battogtokh only attended SNEC on the first day yesterday, but had a clear message for both government officials in Mongolia and the global industry: "It's clear, solar is the future."

Heraeus

Supporting diverse pathways to higher efficiency

Materials and technology: Black silicon, n-type, heterojunction and PERC: there is a level of diversity within mainstream silicon cell manufacturing today that would have only been dreamed about just a few years ago. Weiming Zhang, Chief Technology Officer for Heraeus Photovoltaics speaks to SNEC Daily about the growth of these various technology approaches, and how the paste and service provider is supporting multiple routes to higher efficiency.

Dr. Weiming Zhang is CTO for Heraeus Photovoltaics and he spoke SNEC Daily on Day 2 of the SNEC conference.

SNEC Daily: How would you describe the new announcements and innovations coming from Heraeus at this year's SNEC?

This year is very exciting! Heraeus is offering a range of innovative products for metallization. Each year we build on our history to deliver for our customers new improvements for efficiency and performance, but also to decrease costs.

In 2017, Heraeus is extending its product offering to go beyond paste and beyond metallization. HeraGlaze is our new product that enables multicrystalline wafer production to have a 4% yield and also a higher efficiency. This is an outstanding improvement.

We are also launching our diffusion consultancy service, to really help our customers with their process optimization and thus to enable them to further improve their efficiencies. And on top of this we have also begun to market additional Heraeus products like IR emitters for different process steps in cell manufacturing, which also takes advantage of Heraeus' broader technological expertise.

I think Heraeus' strategy today is to really push beyond our traditional business to these new 'beyond metallization' suite of products.

In terms of the service and 'beyond paste' offerings, why do you feel Heraeus is well positioned to bring these to the market?

Heraeus has a broad business portfolio with state-of-the-art technologies. Each business is leading the market in its segment. We, in photovoltaics, have a longevity in the industry and can strongly leverage on this expertise and can really help our customers to further increase their performance and reduce production costs.

Just an example: By providing the Heraeus consulting service, we are basically building on our many years of working expertise and our accumulated efforts. We can work together with our customers to provide a full solution package, rather than just a product.

"Working together with customers has proven to be very successful. With our new product and service offerings we can now even further enhance the results."

How is it you can identify precisely in which areas you should be working to provide solutions for your customers?

We have more than 150 experts that meet with our customers all over the world, every day. And we are currently hiring 100 more staff. So, we have a deep understanding of our customers' processes and their needs. By working together along the value chain, we know precisely where we can bring in our knowledge and enhance the processes along that chain. We have proven that working together adds real value, which is clearly measurable

Through our diffusion consultancy service, we can offer the expertise of our excellent capabilities. For instance, we can perform analysis on state-of-the art cell structures and individual customer's current cell structures to identify where the potential for improvement is, whether that is frontside, backside, or even underneath the metallization or passivation.

By bringing together our products and the customer's knowledge, we can make better use our products, and fully maximize the potential for our customers.

Of course, the largest investment cycle in terms of cell production at the moment is PERC. What role is Heraeus playing there?

We are looking at industry development from the metallization product and technology point of view. During the SNEC we will launch a new generation of products specifically designed for PERC frontside metallization, which enables efficiency gains through better contacts, finer lines and a wider processing window on the frontside. On the backside, Heraeus has a new generation of products to protect the passivation layer, and to improve the adhesion.

In 2017 we see further improvements. We will help our customers, through these diffusion consultancy services for instance, with PERC further development upgrades, to find where the potential for further improvements will come from, and it can be either backside passivation or better frontside passivation.

With PERC deployed, the attention then falls to the frontside. Is it true that you are seeing more work on the selective emitter (SE) front?

We have identified the increasing attraction for PERC. The reason is that PERC addresses the backside passivation quality, which it improves significantly. And then there is much greater need to go back to the frontside passivation. It is getting more and more beneficial to use selective emitter in the PERC technology upgrade.

LID in multi and mono PERC is a big challenge. Heraeus is benefiting from having developed specialized PERC pastes some years ago. Do you believe this issue is effecting whether manufacturers increase mono capacities?

I think mono is for sure growing. Mono is becoming increasingly important in the market, and is also a technology that is being quickly adopted in the industry. There are a few reasons behind this. Mono, certainly costs-wise, has improved dramatically in the last few years. The costs have dropped thanks to a big mono wafer manufacturing effort, and also through quality improvements.

More importantly, mono wafers have a better emitter for the high efficiency technology like PERC, n-type, bifacial, and HJT, and Heraeus has helped to enable better high efficiency gains. However, I should also say that at the end of last year and Q1 this year, the price gap between mono and multi wafers widened. Mono wafers are around the $0.81 – $0.82/wafer range, and multi is at $0.41 – $0.42/wafer. Because of this gap, there will be a big impact for the end user when they evaluate their product cost structure. Mono wafer and mono PERC cell is price stable, while multi PERC keeps dropping. If this trend continues and the price gap between these two cannot be closed then multi will maybe have another chance to try to secure its market share.

Heraeus also supplies a specialized product for black silicon, including a new product here at SNEC. As a high efficiency multi product, what do you see as its potential in the market?

Black silicon technology is the most critical technology for multi cell manufacturers in order for them to continue to compete in the market. The efficiency gains are definitely there on a cell level, and progress has been made transferring these gains to the module level – previously a problem for black silicon. Our discussions with many of customers have confirmed this.

Challenges relating to both the dry etching process and the wet chemistry process have also been overcome. Both Tier-1 and Tier-2 manufacturers here in China are adopting it in mass production.

Black Silicon will become mainstream for multi technology, together with diamond wire cutting, which multi has to adopt if it wishes to remain competitive.

Heraeus has recognized this and worked quite early with customers specifically for black silicon's unique texturing and surface structure. It really is quite different to traditional multi, and is a good demonstration of how we work with customers on their technology pathways.

NEWS FROM HERAEUS

Heraeus Photovoltaics achieves milestone with delivery of 4,000th ton of silver pastes and confirms market and quality leadership

Heraeus Photovoltaics has set a milestone in the industry by delivering its 4,000th ton of metallization pastes to its customers. 4,000 tons of silver pastes technically translates into solar panels able to produce around 133 GW power, which is equal to more than 51 million modules or around three billion solar cells.

"The delivery our 4,000th ton of silver pastes demonstrates our leading expertise and unmatched reliability. We partner with our customers to achieve the common goal to constantly increase efficiency and lower costs. By providing them with cutting-edge technologies we have been able to set milestones in the industry. Milestones that set benchmarks regarding output, efficiency and reliability," says Andreas Liebheit, President of Heraeus Photovoltaics.

The key to Heraeus Photovoltaics market leadership relies on five pillars. The company operates R&D and Application centers all around the world, able to provide 24hrs research for higher efficiencies. From the first samples it takes only two to three months to produce a full size batch. Every 12 months, the company offers 0.2% efficiency increase on cell level through its silver paste. Up to 1% additional increase is possible by customization work. The full process perspective on further steps of the PV-production chain such as wafer production, diffusion and drying processes provides higher production yields and additional efficiency gains. Heraeus Photovoltaics also owns one of the most reliable and stable supply chain and production network to provide unmatched flexibility to its customers.

Efficiency met fun at The Brew

As is tradition at the SNEC exhibition, the end of day one was met with a mass loosening of ties, hailing of cabs and shuffling off to various dinners and formal gatherings. But those in the know knew that there was only one party in town last night – the Heraeus and pv magazine after work party at The Brew @ The Kerry Hotel. Those lucky enough to have secured a ticket to the party enjoyed an evening of excellent food and drink, an awards ceremony, a live performance from the Solar Superheroes and – of course – a chance to recap with colleagues and new friends on the day's events.

EXPERIENCE SNEC WITH HERAEUS

German metallization paste specialists Heraeus is presenting a busy SNEC schedule packed with presentations, product launches, scientific workshops and industry milestones. Here is a selection of upcoming Heraeus highlights…

Ribbon-cutting and booth party

When? Today at 11am
Where? The Heraeus booth, W3, 310

Heraeus has a milestone to celebrate: 4,000 tons of silver paste delivered in just eight years. To mark this achievement, visitors to SNEC are invited to join Hereaus and a select group of VIPs at the Heraeus booth. Following the ribbon cutting ceremony will be a booth party beginning at 11:40am that is open to all visitors.

Presentation at the Industry Workshop

When? Today at 2pm
Where? Kerry Hotel, Ballroom 1-3

As part of the SNEC Conference Industry Workshop, Heraeus will deliver a presentation on Screen Printing and Metallization Paste 2017 and Beyond.

Throughout the day @ the Heraeus booth there will be hourly presentations in both English and Chinese on alternating topics: Heraeus Photovoltaics – Leading the Future of PV, and Heraeus – Architects of Sustainable Growth.

Visitors to the booth can also enjoy trivia quiz games, a virtual reality experience and participate in raffle draws throughout the day.
Feeling hot? Cool down at the Heraeus ice cream corner!

TECH CORNER

NEW PRODUCT? If you have a new product or service, let us know! clover@pv-magazine.com

MacDermid Enthone Helios PoSi

MacDermid Enthone introduces its Helios PoSi, an inline laser > plate > anneal process, as a direct replacement for front side screen printing and firing methods.

Helios PoSi utilizes an innovative laser ablation process to expose silicon, then deposits nickel, copper and thin silver into the opening. The material then undergoes a thermal annealing process in an inert environment at a low temperature. U.S. based MacDermid claims a number of benefits to its process, not least of which is the price. "Typical overall cost of ownership for the process is about $0.03/cell," states a MacDermid Enthone press release. This is far below the company's estimate of $0.07-$0.085/cell for production using silver paste. The cost benefit arises from a dramatic reduction in the amount of silver used, something which the industry has sought to achieve for many years. MacDermid's process could reduce silver use by a factor of 40-80. Copper plating processes for cell metallization are by no means a new idea, however, adhesion of the plated materials to the silicon cell has been a major hurdle for the technology.

MacDermid claim to have overcome this issue, and says that it is now producing plated layers with strengths that exceed industry requirements. The claimed robustness has been achieved through two innovations. First, the use of picosecond lasers, supplied by Innolas, rather than nanosecond lasers. The company says that these make thermal degradation of the silicon surface far easier to control, and also that the lasers create a 'nano-texture' on the surface of the silicon, which enhances bonding of the plating material. Second, MacDermid experimented to optimize the plating formula to allow fast, ductile, low stress deposits using light induced plating (LIP).

High performance anti-soiling coating

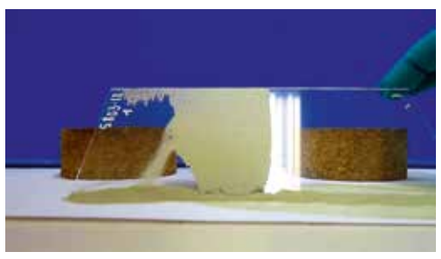
Dutch company DSM is launching its new anti-soiling coating for PV glass. With the release, DSM is particularly targeting modules installed in dry, dusty climates where dust and dirt can badly affect a module's performance.

The coating combines anti-soiling and anti-reflective properties to secure a higher module output, as well reducing the need for regular cleaning and maintenance. DSM says that this new coating builds on its range of anti-reflective coatings, which have shown a 3% energy gain in flash tests.

"In extensive testing we have shown that this new anti-soiling coating consistently outperforms our own anti-reflective coating in terms of power," states Jan Grimberg, Global Business Director at DSM Advanced Solar. "We are convinced that by using this coating, the financial performance of PV parks in arid climates can be improved by higher energy output due to less soiling and reduced cleaning costs."

Having conducted extensive testing both in labs and in outdoor settings, DSM is now scaling up its anti-soiling coating and making the product available for pilot scale testing. The company is also working with Chinese glass manufacturer the Flat Glass Group to supply coated glass to module manufacturers.

"DSM and Flat have been cooperation partners for several years now," says Edwin Zhao, General Manager at FGG Solar PV. "We are extremely proud to bring solar modules coated with the innovative DSM anti-soiling coating to the market for the first time, fulfilling an unmet need for our customers."



Indeotec Octopus III PECVD tool

Swiss supplier Indeotec is continuing to make sales of its Octopus II PECVD platform to PV research bodies. The original Octopus II system was first released last year and is for the deposition of amorphous silicon onto a crystalline silicon substrate. Now the company is developing the next stage in its development, the Octopus III, set to be released later in 2017.

The Octopus III is a PECVD coating system targeting mass production of the next generation of PV modules, specifically heterojunction cell devices. The tool utilizes Indeotec's 'Mirror Reactor' concept, whereby the deposition is carried on both sides of the cell with no need for cell flipping or for breaking the vacuum.

As well as simplifying the process and increasing throughput, the concept inherently reduces the risk of contamination during the deposition stage. Indeotec says that the patented concept, present in the previous Octopus II tool, has received strongly positive feedback from the industry.

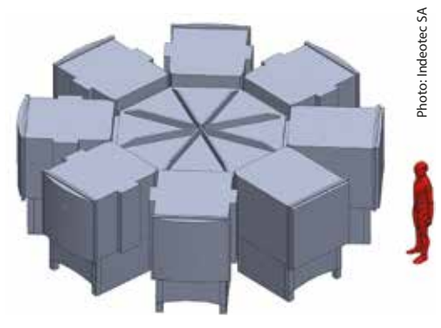


Photo: Indeotec SA

Alpha Assembly unveils flux for high throughout tabbing/stringing

U.S. based materials provider Alpha Assembly Solutions has introduced its new ALPHA PV-38i Liquid Flux, a liquid spray flux material which it says is specifically designed for use in automated tabbing/stringing processes and suitable for both dip and spray on cell flux applications.

According to Alpha, the material is designed to work in high throughput production lines, and addresses issues of bottleneck at the bussing and interconnect stage, as the number of busbars in a module increases, as well the pollution of tabber/stringer machinery during operations. The company claims that its flux material features the lowest level of solids in the industry, reducing pollution inside the machines and instances requiring a production line to shut down for cleaning.

"Most liquid spray fluxes currently in use have been taken directly from the electronics assembly industry and are not specifically designed or suitable for newer, advanced busbar modules. Higher solids in their formulas pollute the current generation of high volume tabbing/stringing machines, as well as clog the spray nozzles, requiring the line to shut down for cleaning," says Global Product Manager for Liquid Flux and Chemicals Michael Previti.

INDUSTRY VIEW

Monocrystalline to gain share, but keep an eye out for multicrystalline

By Edurne Zoco, Director – IHS Markit

Monocrystalline technology has been gaining share rapidly since 2015 due to a sharp decrease in its price. Last year, monocrystalline represented 29% of total wafer production. IHS Markit latest report predicts it will account for 37% by 2020.

The growing traction of monocrystalline does not mean the demise of multicrystalline. Multicrystalline players are expected to keep up the battle and will continue to represent the majority of the market. Once it is fully implemented, the use of diamond wire saws in multicrystalline wafer production will increase wafer efficiency, and reduce kerf and production costs, which will contribute to making multicrystalline attractive again in the next couple of years. The use of diamond wire sawing remains relatively immature within the multicrystalline segment but IHS Markit predicts that this will rapidly change in the coming quarters.

"Price sensitivity" will be another major factor to consider that will shape the relationship between monocrystalline and multicrystalline cells. In order for demand for monocrystalline products to remain strong, there is a limit to how big a gap there can be between its price and the price of multicrystalline products, otherwise it loses its competitiveness. In order words, monocrystalline pricing must closely follow muticrystalline price trends in order to remain in strong demand.

In addition to a clear trend towards monocrystalline technology as suppliers seek higher efficiencies in order to differentiate, module manufacturers continue to look for innovative ways to reduce their costs. What we saw today at the show at the module level is aligned with a forecast that we made back in 2015 that suppliers would become increasingly focused on improving their cell to module conversion rate, in order to improve module efficiency independently of cell efficiency improvements. This is now a big trend within the module manufacturing industry. In this vein, most leading and tier-2 Chinese companies are exhibiting half-cell monocrystalline modules (both p-type and PERC) as well as showing modules with an increased number of busbars and shingling modules that can increase module output by 10-15 watts in comparison to standard modules, without incurring higher production costs on a per watt basis.

DON'T MISS!

Webinar in association with Dow

Discover how to extend module lifetimes beyond current expectations with the use of POE-based encapsulant film.

As PV module manufacturers and end users strive to reduce the cost of electricity and improve the long-term reliability of components, the use of high efficiency, cost-effective components become more important. The choice of encapsulant materials used to protect photovoltaic cells has a significant impact on component power output, reliability, service life and overall system cost.

In this webinar, we will share how polyolefin (POE) encapsulant films help module manufacturers reduce module and system lifetime costs. We will focus on the advantages of Dow ENGAGE™ PV polyolefin elastomers in PV encapsulant films and how it helps modules achieve excellent resistance to potential induced attenuation (PID) and better power retention.

When: Tuesday, May 9 at 3 pm SGT – Singapore, 9 am CEST – Berlin
Visit the homepage of www.pv-magazine.com for information on how to register and participate!

FROM THE CONFERENCE FLOOR

Junfeng Li, former director general of the National Center for Climate Strategy and International Cooperation (NCSC), opened the Global PV Financial Summit by urging the Chinese solar industry to look to the country's automotive industry as a model for long-term development.

"We're developing quickly, with lots of investment, but to remain sustainable as an industry, we need to look to the auto sector," said Li, without elaborating.

He believes that China could surpass the government's target of 110 GW of capacity by 2020, to as much as 200 GW. However, he lamented that even that level would mean that PV would still only account for 5% of the national energy mix. And future growth can only be ensured by facilitating the provision of much-needed finance across the solar value chain, he argued.

"Chinese solar faces a number of issues, including difficulties related to finance. Suppliers of parts and materials, as well as developers, struggle to secure financing," said Li."We need to help the PV industry go the distance or solar will remain a marginal resource."

Turning point for distributed generation

Although distributed-generation (DG) solar has been a key development priority for the Chinese government for several years, build-out has thus far fallen short of expectations. Annual installations hit 34.5 GW in 2016, with DG projects accounting for just 4.23 GW of the total, according to statistics from the National Energy Administration (NEA). However, many industry participants believe that 2017 could mark a turning point.

"In 2017, 'distribution' will be the keyword," said Lengen Shu, GCL Finance (Group) Holdings.

Numerous issues have held discouraged banks from financing for DG projects, including concerns over the stability of the incentives that provincial and municipal authorities offer on top of the central government's subsidies. While developers have successfully installed arrays on factory rooftops in recent years, growth in the residential segment remains stalled by a dearth of suitable rooftops, concerns about the structural integrity of buildings, a lack of clarity over long-term building ownership and the weakness of contracts.

But Shu believes that the biggest barrier to financing for DG solar is public awareness. "How can we build an ecosystem to support DG?" he asked, arguing that the weakening of the Chinese currency is a risk that continues to complicate the outlook for financing in 2017. "We need to promote DG as something that's good for the public."

Hong Li, chief financial officer of United PV, believes that sliding power prices have further discouraged investment in DG and utility-scale projects. While he said that the cost of capital is a concern, he also bemoaned the tendency for provincial authorities to push developers to use local suppliers to win projects. "Different kinds of subsidies can change returns on investment," he said.

Curtailment of PV from the grid – particularly in northwestern China – also discourages lenders from investing in projects, although Li noted that the expected completion of an ultra-high voltage DC transmission line from Gansu province this year could provide some relief. However, grid operators will likely continue to favour coal-fired capacity over solar in heavily-curtailed locations such as the Xinjiang region, he said.

"We need to limit our investment in such areas," he added. "We're looking to strengthen investment in central China."

Alex Sun, general manager of Apollo Solar, said that third-party energy-management service providers can play an important role in reducing finance-related risks. The company – affiliated with wind-turbine supplier Envision Energy – currently manages more than 60 GW of solar, wind and storage capacity worldwide. In 2016, it worked with financial institutions such as China Development Bank and China CITIC Bank.

"The don't understand PV-related risks, so they come to us," Sun said, adding that he has seen growing investor interest in DG projects in recent months. "Finance is all about risk… if we can help companies to manage risk, it will help the industry."

Risk awareness

Non-Chinese industry observers contend that awareness of project-related risks in the country remains low.

"Risks are maybe underestimated. Cash flows that are assumed to be completely stable, over 25 years are maybe not so stable," said Ronald Sastrawan, senior risk analyst for green technology at Munich Re.

Many Chinese financial institutions also remain concerned about the long-term durability of key solar components. "The guaranteed performance of modules is an essential point in gaining the confidence of investors," said Sastrawan.

Eric Wang, global commercial director for DuPont Photovoltaic Solutions, said that awareness of such issues still needs to improve.

"We see challenges. Customers think that low cost is everything. But we need to consider quality and the longevity of components," Wang said. "We need to look at costs, but also at quality, because that's the basis of growth."

However, Kyumin Lee – chief engineer at U.S.-based CFV Solar Test Laboratory – argued that technological advancements in recent years are increasingly providing a basis for investor confidence.

"Module quality is a significant risk factor for how sound a PV project is financially," he said. "But PV modules made nowadays – like, this year – are actually much better… For modules made three years ago, you usually see 2% to 5% degradation after 600 cycles. So definitely module quality has improved."

Policy uncertainty

Michael Lu, chief financial officer of Asia Clean Capital, said that "policy uncertainty" is another factor that discourages investors from financing PV projects. He said that financial institutions want a clearer sense of subsidy levels a decade in advance, rather than just several years of visibility.

"If policy is not consistent, it increases risk," he said.

Delays in payments of government subsidies to developers – a longstanding issue – also continues to weigh on investor interest in solar projects, while making it more difficult for companies to raise fresh funds through share placements.

Aa a result, many Chinese financial institutions are seeking PV investments outside of their home market. Charles Yeung, chief financial officer of GCL-Poly Energy Holdings, likes the opportunities on offer in newer markets such as India, but says returns in mature, stable markets such as the U.S. are often too low to consider. "We need to find a balance between risk and returns," he said.

New instruments

But more than ever, Chinese companies have a wide range of financing options to consider in the domestic market, including industrial funds, financial leasing models and convertible bonds.

In addition, China has emerged as one of the world's most important markets for green bonds over the past year, with total issuance hitting about 230 billion yuan in 2016.

Yvonne Liu, China solar analyst for Bloomberg New Energy Finance, argued that the range of financial instruments available to Chinese developers expanded in 2016.

"More and more investors are becoming familiar with the PV industry," Liu said.

But Lian Guo – an official at policy lender China Development Bank – said that much more work remains to be done. In particular, project monitoring needs to become more commonplace to lower investor perceptions of risk, while the central government needs to update its standards and regulations.

"We need to become more open to green finance," Guo said. "We need to become more risk-tolerant."

INDUSTRY VIEW

SNEC 2017: Major product trends at China's largest solar PV exhibition

By solar industry expert Corrine Lin

This year at SNEC, it has become clear that China continues to maintain its advantage as the world's largest vertically-integrated supply chain, taking the lead in manufacturing efficiency, technology, and cost. In the PV industry forum for cutting-edge technology, many experts and scholars from different countries reported the progress of technology development for all sectors of the supply chain. Because it is more vital than ever in PV to reduce cost and increase efficiency through cell technology improvement. This requires a lot of research time and capital investment. Hence, the development of downstream module sector is also a major highlight at SNEC. It's not difficult to see from the exhibited products this year that module technology has become the competition highlight for manufacturers. Some of the most important highlights are the bifacial modules – which have been emphasized repeatedly in recent years; half-cut technology that slowly matures, and overlapped modules that have started to garner a lot of attention since last year.

Bifacial modules

Problems like rear side power output standardization and insurance confirmation have always existed in bifacial module products. However, from last year certain manufacturers have begun to promote bifacial modules through making them the same prices as single-sided modules. Therefore, power plant developers now have a higher acceptance of double-sided modules. A number of Chinese companies have now developed bifacial technology, including Jolywood (which has received orders for 600 MW of its N-type bi-facial modules), JA Solar, Lerri Solar, and Trina Solar, which unveiled its P-type PERC bifacial products at SNEC. Bifacial modules provide high efficiency and more power with just a small increase in cost.

Half-cut cell modules

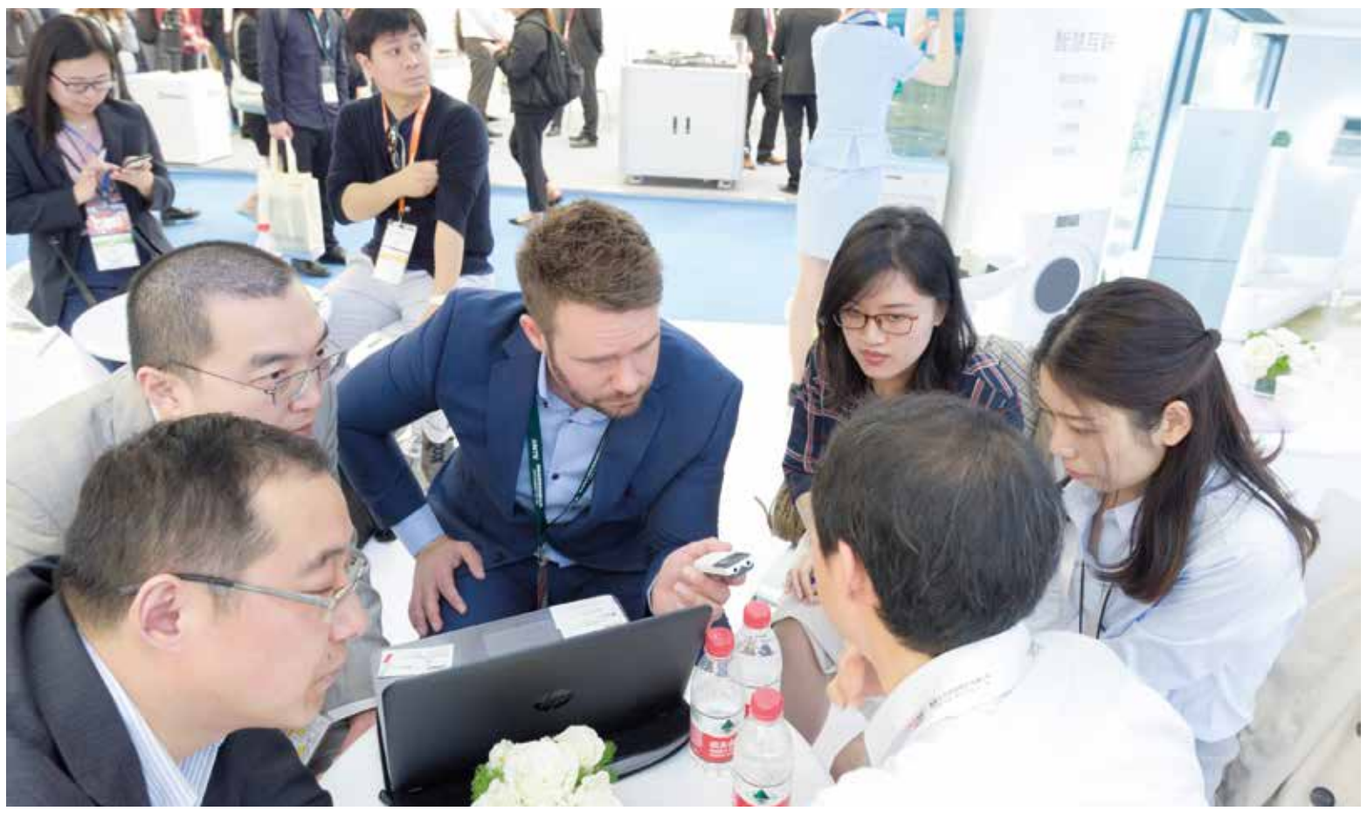
When a conventional cell module is processed by half-cut cell technology, module power output can increase by around 2-3%, which has made many manufacturers eager to try their hand at such technology this year. REC Solar has always been a leader in half-cut cells technology and now they are joined in the half-cut field by JinkoSolar, JA Solar, Hanwha Q Cells, ReneSola, Linuo and Linyang. Many of these companies are exhibiting their new half-cut cell modules at SNEC. More manufacturers are expected to follow suit and begin to mass produce half-cut cell modules.

Overlapped modules

China's Seraphim first showcased its overlapped modules at the PV Expo in Tokyo last year, and more and more Asian manufacturers have poured their energies into overlapped technology research & development (R&D). This year, in addition to Seraphim, DZS Solar, Jolywood, and DMEGC will reveal their overlapped modules at SNEC. However, the fragmentation rate and cost control of overlapped modules still has to be improved, leading to fewer opportunities for mass production this year.

Although the increase in conversion efficiency or module power output remains the focus of SNEC, the biggest impact on the industry this year is cost reduction. The promotion of multi-Si wafers using diamond wire cut will bring down costs further. The bottleneck of diamond wire cut has always been the cell texturing process, which requires special and difficult handling. The capacity of diamond wire-cut multi-Si wafers will increase significantly once this year's show ends. Cell makers can also use the additive method to collocate with diamond wire-cut multi-Si wafers. As a result, many slurry capacities will be switched to diamond wire capacities in Q3 2017 to catch up with the module price downtrend in expected in the second half of the year.

Mono marches on



The Lerri Solar and Longi team discuss mono with SNEC Daily's Ian Clover.

BIG Interview: Hongbin Fang, director of technical marketing at LONGi Solar, and Longi's strategy director Max Aimin Xia discuss the growth and cost reduction potential of monocrystalline cells, and explain how a new hydrogenation process may well have solved the problem of light-induced degradation in mono PERC cells.

SNEC Daily: What is LONGi Solar's main technological focus in 2017 and into 2018?

Hongbin Fang (HF): Last year we introduced our PERC product Hi-MO1 to the market, and for 2017 the main focus for LONGi Solar is to continue to refine our PERC process to improve the efficiency and power output of our cells. In addition to that we are continually working on module improvement to bring higher power gains to the market. We are looking at a 10 Watt (W) power gain every year going forward. There is a lot of technology that we are developing on the module side, including our half-cut cells and also our shingling modules that are poised to improve our power output significantly.

This year we have introduced our bifacial PERC module product Hi-MO2. This offers a big increase in terms of power output. On the frontside the output is equal to standard PERC, and on the backside you have an additional 8% to 25% power gain. This can help our customers to significantly lower their LCOE.

> *"The hydrogenation process has definitely solved the LID issue in PERC cells"*

Recent analysis by IHS Markit has suggested that monocrystalline cells will increase their share of the market from 29% last year to as much as 37% by 2020. What is LONGi Solar's view on how mono's market share can grow?

HF: Our vision is that mono is going to continue to increase its market share, yes. We are aggressively expanding our ingot and wafer capacity, while also gradually increasing our module capacity. We think that at this point our wafer costs on mono are competitive with multi, with higher power on the cell and module side for mono. This means an improved end result for the customer, and looking ahead to the future, costs for mono can be even lower. We are confident that because of these realities mono will grab a larger market share.

Max Aimin Xia (MX): Mono capacity was 7.5 GW by the end of 2016 and even with that we were largely unable to meet market demand. But our recent additional 5 GW mono ingot and wafer capacity expansion in Yinchuan and Zhongning, Ningxia Province has eased the situation, and our recent capacity expansion in Taizhou has eased the situation, taking our cell and module capacity to 5 GW. This has eased the bottleneck that was holding back mono adoption, and I believe that it will aid market growth. In two to three years many companies are going to transfer to mono, and with costs continuing to fall closer to those of multi, this growth will accelerate.

At the SNEC conference on day it was revealed that LONGi Solar has been collaborating with the University of New South Wales on advanced hydrogenation solution on LID with PERC. What have been the results on this?

HF: The results of this collaboration have been very encouraging. It used to be the case that three to five years ago one of the main obstacles for PERC adoption was high light-induced degradation (LID). Because Longi Green Energy Technology [which owns LONGi Solar] is a vertically integrated company, we have approached LID issue from both wafer and cell processing. We have production and quality control from the wafers right up to the modules. We have conducted a lot of work to reduce the oxygen concentration in the wafer. By doing this, it helps us to lower the LID.

From the cell processing side, with the collaboration with the UNSW, we have developed advanced passivation technology that can also lower the LID from the cell processing. So thanks to this collaboration research and application, we can have control of both the wafer and then the cell: this means now that our PERC product's LID performance is similar to, or even lower than, the conventional multicrystalline process. LONGi Solar has also just released its LIR technology with UNSW to minimize the LID effect.

So would you say that the hydrogenation process more or less solves the issue of LID with mono?

HF: It definitely does. Combine that with our wafer quality improvement where we can offer higher wafer purity than multi, we see that even right now the LID performance for Mono PERC is even better than multi

What is the significance of LONGi Solar's results of 22.7% efficiency on mono PERC – mentioned in Tuesday's conference? What does this say for PERC in general?

HF: Currently the industrial production efficiency for LONGi Solar's PERC cells is a little over 21.1% - 21.2%. So looking at our next generation cell technology it can help us to bring our power output to a higher level. This result of 22.17% in laboratory tests shows that PERC has not yet reached its limit. We still have a long way to go to reach even higher efficiency.

What is LONGi Solar's roadmap towards getting there?

HF: By the end of this year in terms of production we are looking at incremental increases, and we expect efficiencies of 21.4%, 21.5% for MONO PERC cells coming off the production line. Next year I am confident that we can increase that by an additional 0.3%, taking us up to that next level. Exhibiting at the SNEC show are our most advanced PERC modules: 60- and 72-cell versions, all black for residential applications, which are targeted particularly for the U.S. and Europe. The new product is our

HI-MO2 cell and module that offers additional power gain on top of PERC. Still in the development phase is our shingling modules, which is our next generation of products that we hope to introduce into the market some time next year. These offer an additional 8-10% power gain on top of PERC.

Moving on to the wider Chinese solar market, do you feel that China's Top Runner program has helped to support high efficiency solar products in the country?

HF: The Top Runner basically tries to bring advanced technology to the market, and to increase high efficiency penetration. It is a good program to demonstrate the ability for high efficiency technology to drive market evolution and deliver better value for customers. You see the end results – customers have more opportunities to purchase better quality modules.

MX: As a solar producer, China has occupied around 80% of market share globally, but for the next generation of new technologies, there was often a reluctance among Chinese companies to invest in these technologies, so NEA felt they needed to promote new technology investment.

The program, which is released by the NEA, pushes this industry to innovate and improve standards, and for Longi – being focused on high efficiency mono – this new generation total solution approach to reducing LCOE and improving the IRR is well suited to our own outlook. At the time the program was introduced, the government needed a pioneer in this area – a role that Longi has been able to play. We think that the government will also push the program to instigate even further technology upgrades. Companies that want to invest in new technology will reap the benefits – not just in China but globally. Other countries can also benefit too; they can learn from China and follow its lead, and even collaborate with China to innovate and work together.

> *"Because costs for mono are going to be lower, it will increase its market share in the near future"*

HF: This will benefit everyone, and help to bring down costs quickly while also improving standards – it's a win-win.

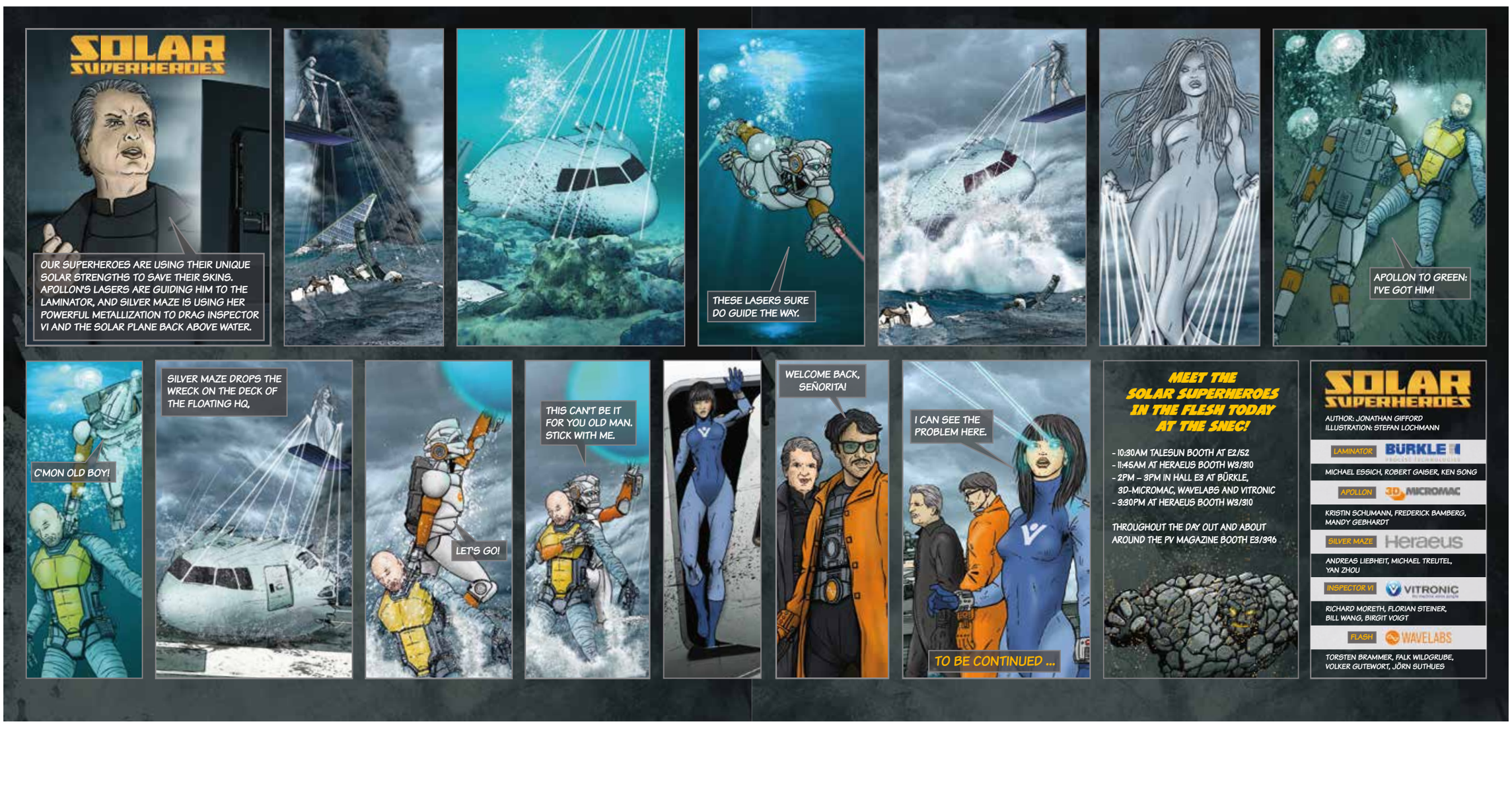
Within China, do you share the view that the first half of the year is shaping up to be disappointing in terms of installations? Or will China reach the end of June with similar levels of growth as seen in H1 2016?

MX: We are seeing that in 2017 it is not quite as strong as last year, so far. The amount of installed capacity for ground mount is a bit lower. The Chinese government has released a new policy to promote distributed solar energy in some regions, particularly in the east and the north of the country. These areas are the most developed and consume the most energy, and so also have the highest levels of pollution. So the government is urgently promoting distributed generation (DG) solar in these regions. The FIT cut for grid-connected power stations in June will be around 15%, after which the support for DG solar will be around 50% higher compared to ground mount. To me, the policy direction is certainly now in support of distributed solar energy.

Hongbin Fang, left, and Max Aimin Xia, right, pose before one of Lerri Solar's new modules.

PHOTO FINISH

Day one of any solar exhibition is alway a slightly dizzying assault on the senses, and SNEC certainly didn't disappoint, offering up a kaleidoscope of color, a cacophony of noise and a plethora of things to see, do, touch and experience. The Solar Superheroes certainly made their presence felt as they prowled the halls doing battle with Coal and offering visitors the chance for a memorable selfie. At seemingly every booth, crowds gathered, and the mood was most definitely upbeat. Here is a selection of the finest images from Day 1, and we expect there to be more of the same on the second day of the show!



TODAY'S HIGHLIGHTS

08:45 - 12:45, Kerry Hotel Pudong Shanghai, Pudong Ballroom 4

Internet+Smart Energy Symposium

The "Internet of Energy" — the catch-all phrase used to describe the way in which sensors and data analysis is driving the decentralization of energy assets — has been a hot topic in Chinese renewables for several years. Topics of discussion will range from smart design to the construction and remote management of solar plants. The session will be moderated by NDRC researcher Sicheng Wang, with guest speakers to include representatives from Trina Solar and Huawei Technologies.

09:00 - 12:00, Kerry Hotel Pudong Shanghai

Sino-Africa Clean Energy Workshop

Africa offers enormous potential to develop solar projects. However, due to a range of issues — including grid-related problems and limited access to low-cost finance — PV build-out remains limited. The China-Cooperation Clean Energy Seminar will explore how industry leaders in China can engage with stakeholders in Africa to facilitate the development of more PV capacity throughout the continent. Following opening remarks from Chinese renewables expert Li Junfeng, this workshop will focus on opportunities for African and Chinese stakeholders to collaborate on projects.

Head on over to Bürkle

Bürkle claims reduced lamination times

If you want to learn more about lamination, head on over to visit German lamination supplier Bürkle, which yesterday announced results that demonstrate a dramatic reduction in lamination times. The company has said that it can reduce process times by 26.7%, a result achieved on its easy-lam an Ypsator platforms. In the fast-growing glass-glass market, Bürkle also says that it can achieve a reduction in lamination time of 30.1%. During testing, Lamination times for glass-glass backsheet were reduced from 7.5 minutes to 5.5 minutes, with 6.5 to 4.5 glass-glass. Looking towards costs, on a 72-cell module the reducion in lamination time can deliver savings of 10.2% on glass-backsheet modules, and 9.9% on glass-glass. Bürkle engineers stipulate the results are dependent on materials. "These results can deliver flexibility," said Bürkle's Sraisth when presenting the development yesterday, adding that he had worked for nine months to develop the process innovations required to bring down the lamination times.

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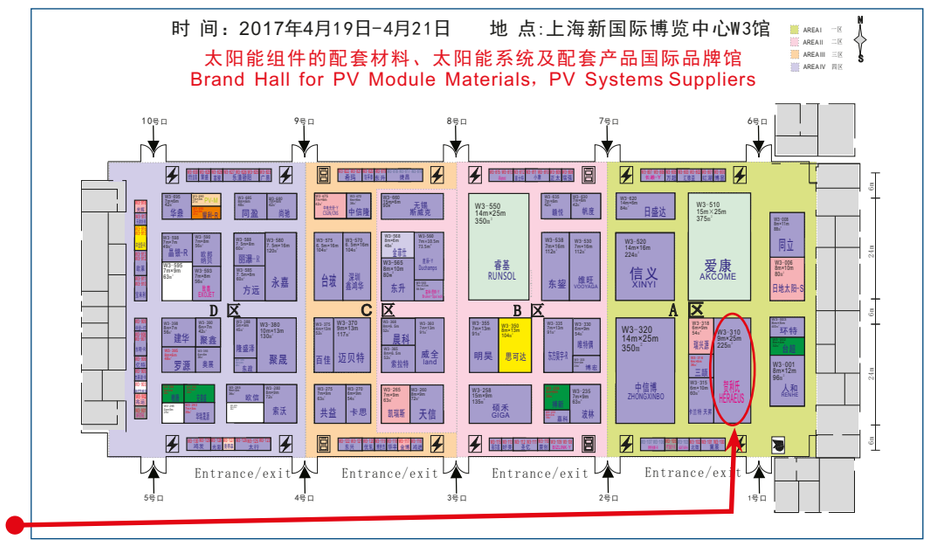

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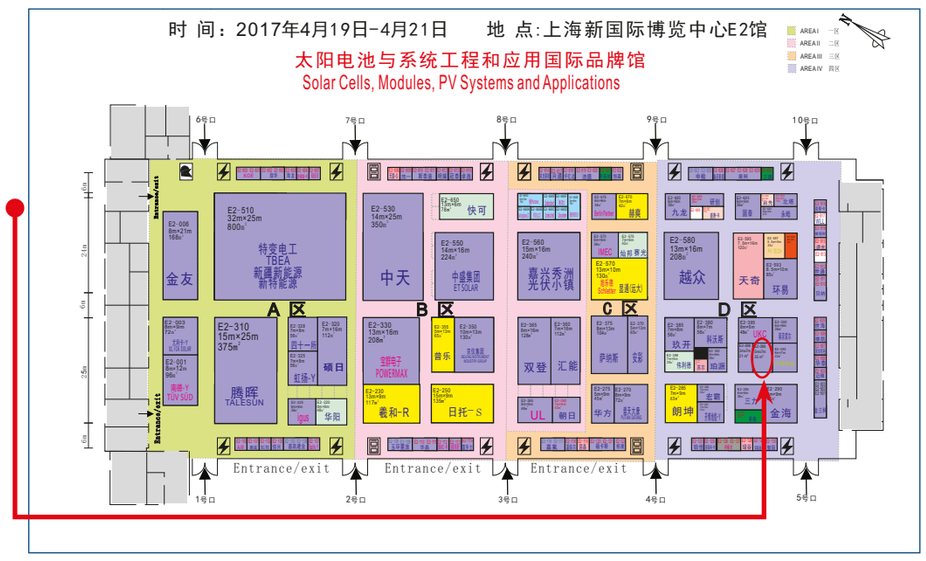

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