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A PV Management Magazine

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David Ridsdale
Editor-in-Chief

An industry in denial

The industry is gearing up for the mid year conference timetable but all eyes will be on Europe for the next few weeks as the European Commission announces the results of its investigation into dumping allegations against Chinese manufacturers. With more than half of EU countries against any punitive damages it appears the EC commissioner has a hard task convincing the Union of the strong measures they would prefer to be implemented. With fear of reprisals going much further than the solar and PV industries there is no clear understanding of what will happen despite all the rumours and assumptions being made. Even if tariffs are agreed there will be six months of appeals before any real implementation occurs.

The entire situation has revealed how divided the solar industry has become in terms of goals and directions. It has also distracted from other potentially more serious issues the industry must face up to. There are growing reports that some PV modules are failing within a few years of operation and achieving nothing like the planned quarter century that clients assumed they had to return their investments. The initial culprit appears to be failing coatings designed to protect the working life of modules. This is a growing concern and some brands are faring worse than others. Without a transparent line of identification of manufacturer to some PV products it is not an easy task identifying where the problems lie. Some installations are revealing failures rates of 12 % and more. If the industry does not deal with this issue then rest assured they will forced to do so as some of the faults are causing life threatening fires, although this level of fault remains minute in comparison to installations.

The industry also has to come to terms with diminishing public support for solar and other renewable energies. To initiate public fervour in the first place and to encourage financial support, solar was inappropriately positioned as a saviour of all energy woes and represented as environmentally benign. This is not true and the public are being fed horror stories of failing product and a lack of financial returns due to diminishing capacity in government supported subsidies. The industry has to get on with the business of selling solar as part of a longer term energy solution. Despite the massive growth solar only accounts for a miniscule amount of energy produced around the world.

The energy source may be environmentally friendly but manufacturing methods and eventual waste issues means that solar is far from environmentally benign. This is another issue for the industry to get serious about before authorities force measures that may not be so business friendly. There are plenty of benchmarks in other industries if you wonder what could happen to ensure solar energy improves its own footprint while helping reduce everyone else's footprint.

The dumping issue has shown an industry divided facing real concerns that require the industry to collectively seek solutions. The industry should not wait for the China issue to resolve before actively taking on other industry concerns together. Left alone these are the issues that will come back and haunt the industry in the future.

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Wafer production returns to 2011 levels

AFTER FALLING 15% in 2012, solar photovoltaic wafer production is forecast to grow 19% in 2013, passing 30 GW and recovering to the 2011 level, according to the latest NPD Solarbuzz Polysilicon and Wafer Supply Chain Quarterly. However, industry utilization is expected to remain below 60%, and while prices have stopped falling, no significant increases are expected, so profitability for wafer makers will remain challenging.

Multicrystalline silicon (multi c-Si) technology is forecast to continue its dominance of the wafer market in the short to mid-term. However, the higher efficiency solar cells that can be produced using monocrystalline silicon (mono c-Si) wafers continue to be in demand for applications where space is restricted. The higher efficiencies enable pricing at a premium over standard multi c-Si modules. In particular, rapid growth in the Japanese market is creating demand for premium efficiency modules that use mono c-Si wafers.

"Supported by attractive solar PV incentive rates, Japan will account for more than 10% of global PV demand in 2013," stated Charles Annis, Vice President at NPD Solarbuzz. "With a strong rooftop segment and limitations on the availability of land for large-scale ground-mount installations, Japan has now become a key driver for mono c-Si based modules."

For mono c-Si wafers to increase market share compared to multi c-Si wafers, improvements in mono ingot production and module efficiencies will be required.

Annis added: "Multi c-Si wafer manufacturers are constantly improving casting approaches and developing new high-efficiency multi-wafers. Leading wafer manufacturers are now selling high-efficiency multi c-Si wafers with efficiencies as high as 18%, which is in the range of low end mono c-Si wafers, and thus helps maintain the competitiveness of multi c-Si based products."

In the long term, n-type mono c-Si wafers and enhanced mono performance supported by advanced cell designs and manufacturing have the potential to lower total costs per watt and enable faster growth of the mono c-Si wafer market. Assuming the success of these technologies, NPD Solarbuzz forecasts that mono c-Si cell production will grow at a faster rate than multi c-Si cells beginning in 2015, expanding into more applications and increasing market share.

Lux looks to powerful solar growth with 60GW

THE SOLAR PHOTOVOLTAIC (PV) market is poised to rise from the ashes of its 2011 crisis to grow to $155 billion in 2018, as market forces engineer a turnaround to a healthy 10.5% compound annual growth rate (CAGR), says Lux Research.

In the most likely scenario, the PV market will grow at a modest clip to 35 GW in 2013 before rapidly ramping up to 61.7 GW in 2018.

"Manufacturers' nightmare is turning into a long-term boon for the industry. Record low prices pushed gross margins to near zero or below, but they've made solar installations competitive in more markets," said Ed Cahill, Lux Research Associate and the lead author of the report titled, "Market Size Update 2013: Return to Equilibrium."

"Supply and demand will come back into balance in 2015, easing price pressure, returning manufacturers to profitability and restoring the industry to equilibrium," he added.

Lux Research analysts used a detailed levelized cost of energy (LCOE) analysis in 156 separate geographies, accounting for 82% of the world's population, to determine the viability and competitiveness of solar in each market. Among their findings:

- U.S., China, Japan, and India will take over where Germany and Italy left off. With an 18% CAGR to 10.8 GW of installations in 2018, the United States will emerge the world's second-largest market. But China will leapfrog it, growing over 15% annually to 12.4 GW in 2018.
- Utility-scale installations to grow the fastest; commercial the largest. Utility-scale solar, the smallest segment in 2012 at 8.6 GW, will grow the fastest to 19.9 GW in 2018 as developing markets turn to PV. Globally, commercial applications reign supreme as markets like the U.S. and Japan move to large rooftop installations.
- Opportunities abound for cheap IP. Struggling start-ups present opportunities to acquire intellectual property at record low prices. A case in point: Hanergy acquired Miasolé – which in 2012 announced the leading CIGS module efficiency at 15.5% – for only $30 million after investors had pumped $500 million into the firm.

Top 20 suppliers hold 70% of the market

THE TOP 20 solar photovoltaic (PV) module suppliers accounted for almost 70% of global PV shipments in Q1'13, according to the latest NPD Solarbuzz Module Tracker Quarterly report.

"The continued consolidation of solar PV manufacturers is creating opportunities for the leading tier 1 module suppliers," explained Ray Lian, Senior Analyst at NPD Solarbuzz. "The market share of the top 20 suppliers increased significantly in Q1'13 to 70%, up from 58% in Q1'12."

As the solar PV industry continues to show increasing globalization of end-market demand, tier 1 PV module suppliers are implementing overseas marketing strategies to increase share. This is most evident among the top 10 Chinese tier 1 PV module suppliers.

Chinese solar PV module suppliers continue to dominate the global supply landscape, with 41% of module shipments over the past four quarters. Emerging Chinese tier 1 suppliers that had previously been focused on PV cell manufacturing, such as JA Solar and Hareon Solar, also gained market share.

"The top 10 Chinese suppliers have been less successful in countries where there is strong competition from domestic module suppliers or attractive solar PV policy incentives," added Lian. "In the US and Japanese solar PV markets, for example, local manufacturers still rank at the top for domestic PV module shipments."

Over the last four quarters, US based manufacturers First Solar and SunPower were the leaders in module shipments to the US market. In Japan, leading domestic PV module suppliers Sharp, Kyocera, Panasonic, and Solar Frontier also outperformed Chinese competitors during the same time period. Solar PV module supply to the US and Japan is contrasted by the dominance of tier 1 Chinese module suppliers in European countries, emerging solar PV regions, and in China and Australia. Over the past four quarters, for example, almost 50% of modules shipped to the Australian PV market have been supplied by a small group of tier 1 Chinese manufacturers led by Trina Solar, Renesola, Suntech, China Sunergy, and Canadian Solar.

Leading European tier 1 PV module suppliers, such as Conergy and SolarWorld, continue to target European and North American PV markets that are characterized by brand recognition and higher pricing levels. However, this strategy comes at the expense of global penetration, as their market share within the top 20 module suppliers declined from 10% in Q1'12 to 7.5% in Q1'13. While solar PV module pricing levels continue to vary across the key solar PV end-markets, the average sales price for the top 20 tier 1 suppliers showed signs that it was stabilizing at $0.76/Watt in Q1'13. This compares to $1.03/Watt in Q1'12.

"The stabilization of module prices during Q1'13 was driven mainly by a geographic shift in demand from end markets during the quarter, with strong demand from higher price countries such as Japan and others preventing further global declines," added Lian.

Trade disputes and domestic manufacturing incentives are creating import restrictions across a range of PV end markets, so supplier market share and country specific pricing levels will increasingly dominate the global strategies being rolled out by leading tier 1 module suppliers for the remainder of the year 2013.

LDK solar reports loss but announces new contract

LDK SOLAR has announced that its Annual Report on Form 20-F, which includes audited financial statements for its fiscal year ended December 31, 2012. During the course of the preparation of LDK Solar's 2012 annual report, LDK Solar's management determined that an additional provision for warranty and long-term contract termination penalty of approximately $14.8 million and a reversal of previously recognized gain on restructuring of payables of approximately $21.0 million were required to properly adjust previously announced preliminary unaudited financial results for the fourth quarter ended December 31, 2012.

The additional provision for warranty and long-term contract termination penalty was based on updates in LDK Solar's negotiation with relevant counterparties. The reversal of previously recognized gain on restructuring of payables was adjusted to reflect the increased risk of reversal of previously agreed discount.

LDK has also announced that it has signed a wafer supply contract with Realforce Power a PV company located in China. Under the terms of the agreement, LDK Solar will provide 120 million 6-inch wafers, totaling approximately 500 megawatts (MW), with shipments commencing in May 2013 through December 2014.

"We are pleased to enhance our market position in the China region through this new wafer sales agreement," stated Xingxue Tong, President and CEO of LDK Solar. "We believe the China region, which is expected to reach 10 GW in 2013, represents the strongest global growth opportunity. This contract demonstrates the continued demand for our solar wafers."

Patent given for solar wind hybrid technology

SOLAR WIND ENERGY TOWER, the inventor of a large Solar Wind Downdraft Tower structure capable of producing abundant, inexpensive electricity, has announced the allowance of Patent Application Number 13/098,476, titled "Atmospheric Energy Extraction Devices and Methods", by the United States Patent and Trademark Office.

The patent covers a structure for producing electricity, specifically a tower capable of adding moisture at the top of the structure to hot-dry air so as to generate a downdraft of wind within the interior of the Tower, vanes coupled to the exterior of the Tower that at least partially define a plurality of elongated pockets at the exterior of the Tower, flaps located within the pockets configured to redirect incident wind downwards, and at least a first wind tunnel configured to receive the redirected wind so as to convert such wind to electricity.

Ronald W. Pickett, President, Chief Executive Officer of SWET, stated, "We are pleased to have received notice that our patent application for the Tower structure design has been allowed, and that a patent will be issued shortly. The patent application incorporates the entire core Tower structure, including the injection of moisture as a catalyst to generate the downdraft wind, and the additional exterior dual wind capture vanes.

In the future, as we expand our geographic footprint, the dual wind technology will provide us with the ability to construct our power plant in locations with potentially more variable weather conditions, since we can now incorporate the power created by the ambient wind captured along the outer surface of the Tower structure with the power generated internally.

This external wind capture boosts the overall power output. This patent allowance, along with our previously issued patent titled 'Efficient Energy Conversion Devices and Methods', encompasses our overall basic system architecture. We intend to continue to protect our technology as we develop enhancements to it. Our business plan has always been to efficiently extract the maximum energy generated by the captured wind, with the least loss of power while compensating for the normal differentials in atmospheric conditions."

Vdl joins solliance in OPV project

VDL BECOMES A PARTNER IN Solliance for the development of a new, completely integrated roll-to-roll (R2R) manufacturing line for the research and pilot production of organic photovoltaic (OPV) modules.

The development will take place within a consortium of several companies, among which Smit Ovens, supplying the drying furnaces for the R2R equipment and Bosch Rexroth, responsible for the drive components.

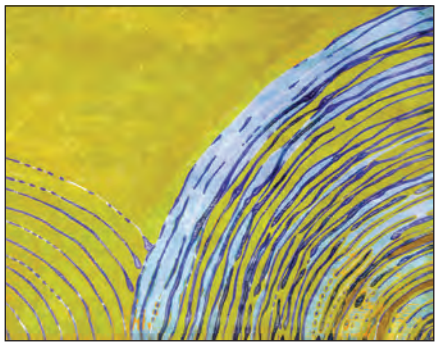
The partners will define and improve the specifications based on the experience gained during their cooperation. The pilot line will be built within the coming year. It will become operational at the new Solliance facility located at the High Tech Campus in Eindhoven. VDL will assume business responsibilities in the commercialization of the manufacturing.

OPVs are flexible solar cells made of light-active plastics and can be manufactured by cost-effective processes suitable for large-scale production. They may be less efficient than previous rigid solar cells based on silicon, but they offer the potential to be manufactured in large quantities, at low cost, and with low material quantities.

They offer therefore advantages when used on large surfaces, for example on roofs and facades of industrial buildings.

Flexible solar cells are especially useful as building-integrated photovoltaics (BIPV). The growing trend in the construction industry is to reduce the amount of energy used by buildings over their lifetime. The aim is to create energy-neutral and energy self-sufficient buildings.

One way is to integrate renewable energy-generating technologies such as solar cells into the building envelope. In contrast to PV systems fitted to a building afterwards, BIPV completely merges the intrinsic function of the construction with the power generating function.



To further develop this innovative technology, new production processes have to be investigated. These new processes will lead to high-efficiency, low-cost and highly-stable OPV modules for a wide range of applications.

Huib van den Heuvel, general manager of VDL's new unit VDL FLOW said, "VDL looks forward to team up with Solliance for this project. We are convinced that this cooperation will accelerate the market readiness of large area printed electronics through synergy between world class organizations in research, process development, equipment design, and manufacturing."

First four junction solar cell revealed

SOITEC has announced the industry's first four-junction solar cell device, which works under concentrated sunlight, putting the company on the solar-energy industry's technology roadmap at a world-class level of an outstanding 43.6 percent efficiency.

This technology development - made possible through strong collaboration between solar cell device and epitaxial growth centers of expertise combined with Soitec's substrate-bonding and layer-transfer technologies - validates the unique roadmap enabling, thanks to the four junctions structure to target the 50-percent efficiency level. This roadmap marks a major competitiveness breakthrough in the photovoltaic industry.

Soitec's four-junction solar cell has achieved today a peak efficiency of 43.6 percent, as confirmed by the Fraunhofer ISE Calibration Laboratory. This measurement was achieved at a concentration level of 319 (319 suns). The new cell has demonstrated more than 43 percent energy-generating efficiency over a concentration range between 250 and 500.

Today's triple-junction solar cells used in commercial concentrator photovoltaic (CPV) modules in real-world applications are approaching their physical limits in converting sunlight into renewable energy. Soitec's four- junction cell is designed to increase the conversion efficiency of

commercial CPV systems to the highest level ever achieved by any photovoltaic technology. Based on the initial results obtained using very few integration runs, Soitec is well positioned at the front of the efficiency race.

The four-junction cell uses two new, highly sophisticated dual-junction sub cells grown on different III-V compound materials, which allows optimal band-gap combinations tailored to capture a broader range of the solar spectrum.

This maximizes energy-generating efficiency. Soitec leverages its proprietary semiconductor-bonding (Smart Stacking) and layer-transfer (Smart Cut) technologies, which have been used in volume production by the global semiconductor industry for decades, to successfully stack non-lattice-matched materials while also raising the possibility of re-using expensive materials.

The new cell was developed in collaboration with the Fraunhofer Institute for Solar Energy Systems (ISE) in Freiburg, Germany, and the Helmholtz-Zentrum für Materialien und Energie in Berlin, which developed and deposited III-V epitaxial layers on new base materials as well as fabricating and characterizing the device.

CEA-Leti, France's research institute for electronics and information technologies, also actively participated in the project and contributed its expertise in mechanically strong, electrically conductive and optically transparent bonding interfaces as well as layer-transfer engineering of III-V compound materials.

"Boosting efficiency levels is a key step in outperforming the economics of conventional PV. This great achievement brings strong value to our solar division and validates our strategy and business model in the solar market," said André-Jacques Auberton-Hervé, CEO of Soitec. "Through our collaboration with the Fraunhofer and the Leti, two world-class R&D partners, our own leadership experience in materials and bonding technologies as well as our CPV commercial experience, we have been able to achieve this major advancement in a very short time. This represents a major proof-of-concept, on track to demonstrate a concentrated solar cell with 50% efficiency as soon as 2015."

Canadian Solar prevails over LDK

CANADIAN SOLAR has announced that the Jiangsu Suzhou Intermediate Court dismissed the request by LDK Solar to enforce the arbitration award decision by the former Shanghai branch of the China International Economic and Trade Arbitration Commission in the amount of RMB 248.9 million (approximately US$ 40.1 million).

This arbitration award relates to wafer supply contracts entered into between Canadian Solar and LDK in October of 2007 and June of 2008, and subsequently terminated. The total amount of the award includes the initial deposit of RMB 60.0 million (approximately US$ 9.7 million), but excludes approximately RMB 2.0 million to cover arbitration expenses.

Dr. Shawn Qu, Chairman and Chief Executive Officer, commented, "We are delighted with the Jiangsu Suzhou Intermediate Court's decision in our favor. We believe we have conducted our business properly at all times and we will continue to advocate cooperation rather than confrontation within the solar industry."

Conergy opens Australian power plant with no subsidy

GRID PARITY has reached Australia. In the state of Queensland, Conergy has recently commissioned a solar plant that operates without any feed-in tariff. After the numerous self-consumption plants in Spain on the roofs of an organic restaurant, several commercial enterprises and private households, which are cost-effective without any subsidies, the PV solution and service provider is now illustrating that such projects are also possible in the sun-kissed country of Australia. There, the solar experts have just connected a 100 kilowatt rooftop plant to the grid, being installed at the newly constructed retirement nursing home "Casa d'Amore" in South Brisbane.

The "Casa d'Amore" actually consumes the entire solar electricity produced itself. The around 400 Conergy PowerPlus modules on the 640 square metre roof surface are producing 146 megawatt hours of clean solar power for the seniors each year – roughly a third of the entire electricity the home requires.

The load profile of the home is perfect for solar power, because demand peaks are between 10 a.m. and 1 p.m. and between 4 p.m. and 6 p.m. In addition, the high insolation values of around 1,400 kilowatt hours per square metre per year ensure that solar power is competitive in the state of Queensland.

Due to the prevailing conditions, the levelized cost of electricity (LCOE) of the solar plant (calculated for a period of 25 years) is just under 13 Australian cents per kilowatt hour (equivalent to around 10 euro cents), while the cost that the home has to pay for electricity from the grid is around 15 Australian cents per kilowatt hour already today and not including any net charges.

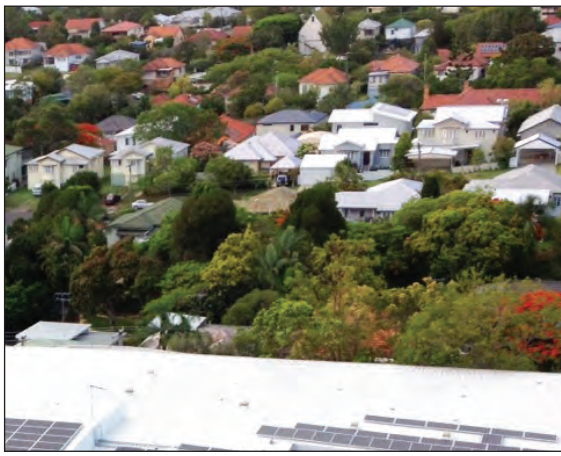
Since the system itself, the installation costs as well as maintenance expenses are all included in the LCOE calculation, the solar energy price does not change while experts expect grid energy prices to rise considerably in the next few years. In total, the operator will be saving some 16,000 Australian dollars on his electricity bills each year.

"In many cases solar electricity is already competitive, not just in Europe but also in the Asia Pacific Region, particularly when there is a high and relatively steady demand for electricity during the day," said David McCallum, Managing Director of Conergy Australia.

"In Australia, solar also represents a cost-effective and environmentally friendly alternative in remote areas, some of which have to rely on diesel generators for their power. But our project at the retirement home shows that there is also enormous potential for solar power in the cities, because by running their own plants, companies as well as end customers reduce their exposure to rising electricity prices, saving hard cash every single day."

The Australian solar market has grown rapidly over the last few years. After the country had reached its climate targets early, some states reduced their feed-in-tariffs and subsidies for solar drastically or even stopped them altogether, which actually resulted in a slowdown in growth end of 2012 and installation volume forecasts for 2013 of approximately 750 megawatts which would be 25% below the installed capacity of 2012.

Recently, the Australian government committed to maintaining its Renewable Energy Target (RET) of 41,000 gigawatt hours of renewable energy to be added to the country's electricity grids by 2020. This target is split into two parts – the Large-scale Renewable Energy Target (LRET) and the Small-scale Renewable Energy Scheme (SRES). Both create incentives for investments in renewable energy sources through "green certificates", aiming to increase the contribution of renewable energy to the nation's energy mix. Electricity retailers, utilities or energy-intensive companies are required to purchase and surrender



a certain amount of these "green certificates" each year which are currently traded at around 24 Australian dollars. The solar power plant on the "Casa d'Amore" falls under the SRES scheme and receives one Small-scale Technology Certificate per megawatt hour produced each year over the course of up to 15 years as determined in the scheme.

The excellent climatic conditions and the achievement of grid parity supported by these incentive schemes to promote the energy transition to renewable sources in the country are now opening up new opportunities for the Australian market. Experts expect a relatively consistent annual growth of around 20% between now and 2015.

Thanks to solar power becoming competitive, the Australian market will move away from being a purely investment driven market and become part of the genuine energy market, where the main criteria are electricity availability and the price per kilowatt hour.

Bearing these criteria in mind, plants no longer need to be as large as possible but instead tailored precisely to the customers and their load profile in order to optimise production and consumption behaviour.

With its global "Start it!" campaign, Conergy has developed customized system solutions and new business models for these new requirements of the solar market of the future.

Crystalox receives offer from managment

GERMAN BASED wafer manufacturer Crystalox has announced that plans to decommission assets and provide redundancies has been halted after a management buy out offer.

PV market conditions remain very difficult but spot market price declines appear to have halted and there has been some modest recovery in prices across the value chain since the beginning of the year. Wafer prices, however, remain below industry production costs.

In view of the challenging environment the Group continues to operate in cash conservation mode with reduced wafer production volumes, a continued focus on cost control and inventory management, including trading of excess polysilicon as opportunities arise.

Wafer shipments in H1 are expected to exceed production volumes and to be in the range 75-85MW, which is above the 61MW reported for the same period last year. We have successfully traded surplus polysilicon during 2013 and, as a result, our inventory levels of both wafers and polysilicon have been reduced since the year end. As referred to in the announcement of our 2012 annual results, released on 21 March 2013, production costs have been lowered as a result of the more favourable pricing and volume that has been negotiated to date with our wafering subcontractor and polysilicon suppliers.

Preparations for the deconstruction and site clearance of the Group's polysilicon facility at Bitterfeld and negotiations with employees regarding redundancy terms are both close to conclusion.

However, these have been temporarily suspended as the Group has received an offer from local management to take over the facility and the associated obligations, including those relating to grants and subsidies, in return for a cash payment from the Group. The Board believes that this transaction would be preferable to the shut down scenario as it reduces cash outflows, gives certainty over their timing and can be completed in a much shorter timescale. We have received approval from the local grant awarding authorities for such a transfer and accordingly we are pursuing this potential transaction.

The Board has reached a decision on the amount of cash to be returned to shareholders and agreed a level of 7.25p per share subject to finalisation of the process of the cash return. The Board is not yet able to confirm the timing and mechanism of the return but expects to make a further announcement on these matters shortly.

As has been widely reported, the EU is expected to announce on 6 June that provisional anti-dumping duties averaging 47% are to be levied on solar products imported from China. Such a decision should benefit non-Chinese producers and contribute towards a more favourable market environment within the EU during the second half of the year.

Solarcity announces finance deal with Goldman Sachs

SOLARCITY has announced a lease financing agreement with Goldman Sachs to fund more than $500 million in solar power projects; an estimated 110 megawatts in generation capacity for homeowners and businesses.

The financing makes it possible for homeowners, businesses, government and other non-profit organizations to install solar panels with no upfront cost and pay less for clean electricity than they currently pay for utility bills. The agreement was initiated in 2012 and expanded per its initial terms at the end of April. The combined lease financing is the largest of its kind announced in the U.S. for homeowners' rooftops. The financing has already enabled approximately 26 megawatts (MW) of new solar generation to be deployed, and the remainder is reflected in the 158 MW of available financing as of May 10, 2013 reported in SolarCity's announcement of financial results earlier this week.

"We are excited about the opportunity in distributed solar, which has the potential to both lower energy costs and create jobs," said Stuart Bernstein, Global Head of Clean Technology and Renewables at Goldman Sachs. "Our firm has set a target of $40 billion in financings and investments in renewable energy over the next decade, and we believe SolarCity's range of distributed solar solutions targeting a wider customer base will help us move toward a low carbon energy future."

As more investors have become familiar with the reliability and quality of solar as a technology and an asset class, it has become possible to expand the pool of available financing and offer options to a broader range of potential customers, including those with lower credit profiles. SolarCity and Goldman Sachs have created an attractive financing structure to further lower the cost of capital of financing solar. The financing can make it easier to fund projects for schools, municipalities and other organizations that are not publicly rated.

"The Goldman lease financing will make affordable solar electricity available to more types of homeowners and organizations," said Jimmy Chuang, SolarCity's vice president of structured finance. "We expect to be able to expand our offering to a broader customer base by lowering the credit requirements even further in future financings."

Beleaguered Suntech announces new forbearance deal

In an attempt to stave off further financial problems Suntech Power Holdings has agreed on a new forbearance agreement with the majority of the holders of the Company's 3% Convertible Notes for which a principal payment of US$541 million was due on March 15, 2013.

Under the new forbearance agreement, the signing bondholders agree not to exercise their rights under the Notes and the related indenture until June 28, 2013, subject to certain market-standard early termination events. David King, Suntech's CEO, said, "This new forbearance agreement demonstrates bondholders' continued support for Suntech. The agreement will enable Suntech to continue to work with bondholders towards achieving a consensual restructuring."

Inverter company sputnik opens in US

THE SWISS INVERTER manufacturer Sputnik Engineering launched with its SolarMax brand into the United States market and celebrated its Atlanta, Georgia area office opening. The operational expansion will allow SolarMax to deliver its portfolio of Swiss-quality grid-connected PV inverters to the rapidly growing U.S. solar market. To support growth, the company recently staffed up the facility, which houses sales and research & development, for the new U.S. arm of the company.

SolarMax's first U.S. office is headed by technology and PV solar industry veteran, Alan Beale, who will head sales efforts in the U.S. market. Beale comes to SolarMax from REFUsol, where he was Vice President of Sales and Marketing. Prior to that, Alan held executive leadership roles at Canesta, Immersion Corporation, Clarity LLC, SGI and General Electric.

The U.S. solar market experienced record-breaking 76% growth in 2012 and is the fastest growing energy source in the U.S., according to recent research from GTM Research and the Solar Energy Industries Association (SEIA).

"We firmly believe that the growth in the U.S. market is just getting underway and there is enormous opportunity for SolarMax. The generation of electricity from the sun has reached grid parity in some states today with more to follow shortly. Residential and commercial customers alike are realizing that solar now makes sound economic sense," said Alan Beale, General Manager, SolarMax.

SolarMax local presence will enable them to grow and build up new customer relationships. SolarMax will complete testing and certification of its PV inverters according to UL standards for use in the U.S. market.

Heraeus increases investment in PV lab in China

THE HERAEUS Photovoltaics Business Unit will be holding an event on Monday, May 13th, to celebrate their increased research and development capabilities at their PV facility in Shanghai. Heraeus has upgraded their laboratory to increase their local support to Chinese cell manufacturers.

In a statement Tobias Caspari, General Manager of Asia for the Photovoltaics Business Unit, says, "China represents the largest market for solar cell production and is vital for the success of the PV industry. We have been present in China since 2009 with a local PV facility, providing technical support to the Chinese market.

We value our customer relationships in this region very much and will continue to invest in technology at our Shanghai facility in order to serve our customers even better. The investments we make in this lab will support our efforts to work closely with our Chinese customers and launch new products that maximize the performance and value of their solar cells."

The event at Heraeus hosted many of the PV Business Units' customers located in China. "Since Heraeus' entry into the PV market as a metallization paste supplier, we have developed strong relationships with many of the major cell manufacturers in China. We appreciate their confidence in our products and capabilities and we are committed to their success," states Bill Gao , Business Unit Manager of the China Region.

Energised success

The goldrush mentality is slipping away for the solar industry and companies wishing to be in it for the long term are sighing with relief. The fallout continues as the industry rights itself from an over abundance of supply of offerings. While many companies quietly moved away one company was just beginning and the success of Enphase with their micro-inverters has an industry watching closely. David Ridsdale discovered a company that used its semiconductor knowledge to plot success in a changing solar industry.

The people at Enphase are a confident group of people. Every time I have spoken with this company I am struck with the belief that radiates in the company and in its products. This confidence is not just what Europeans call an American thing as I have met the same level of enthusiasm in their European operations.

I can not say it is the first time I have come across such confidence in a company but two things set Enphase apart from the usual excitement in a new venture. Firstly they are convinced their technology is disruptive but not unique. And secondly their growth rate in what is supposed to be a slow period backs their sense of purpose.

Enphase manufacturers micro-inverters and like other manufacturers of the ilk they package the inverters with a monitoring system that provides high level control of the energy functioning of PV systems. They market themselves as energy experts rather than electricity inverter manufacturers and spend a great deal of time training the people that will eventually use their products.

The system approach that the company has developed is not unique but is designed to help home owners maintain their own energy behaviours to move towards zero carbon footprints. Enphase is one of the first companies to actively remind energy users that the long term goal of sustainability

has as much to do with consumer behaviour as it has to do with the latest technology. Combining both provides a strong story rather than just a hard sell.

Convincing the price is worth it

The main reason the company has a hard sell on their technology alone is the simple fact that they cost more than their competitors. String inverters have been the early adopted technology from a simple economic perspective. In the early days of solar where grid parity was the early carrot driving the industry, cost was the only factor in technology decisions. A string inverter can be used on a group of solar panels whereas micro-inverters need to be attached to each panel to achieve the technological advantage. I remember interviewing some early adopters of micro technology and the general consensus was they would not succeed as installers would not be prepared to raise the cost to customers at the time.

Many things have changed since then and with margins now tighter than ever before and a global industry going through massive changes, there is a desire to achieve technological advantage in the energy market. The solar industry of the last few years has rightly been accused of selling financial packages instead of energy solutions and the manner Enphase presents itself shows an awareness of this discrepancy. Since its inception in 2006 the company has discussed technology above all else and early press releases speak of paradigm shifts and a changing industry ripe for change. The company went on to have successful investment rounds over the next couple of years as they developed a product that was designed to unseat the incumbent string inverter.

Strong leadership

For a company to have such positive outlook you would expect them to be led by a charismatic character and Paul Nahi, Chief Executive Officer of Enphase Energy does not disappoint. Nahi is a positive force and is happy to talk all day about how his company's micro-inverter technology will change the potential of solar energy.

Nahi has over 20 years experience in both entrepreneurial and multinational high technology companies. Prior to his position at Enpahse, Nahi was the CEO of Crimson Microsystems, a fabless semiconductor company specializing in large scale SONET ICs for the telecommunications industry. He is articulate when it comes to the industry and is well aware of the global trends of the industry and is well aware of the struggle he would face in introducing disruptive technology to a value chain already decided on the best path to profit.

Nahi's vision is based on consolidation in current markets with a continuous roll out into new markets. He has the process down pat and the company sets up the equivalent of a small satellite outposts in new markets and leaves the operations for the locals to set up and develop. This method is working and the company has steadily moved up the list of the most successful solar companies. Initial investments have enabled them to establish in France, Italy and the UK to serve those local markets. The growth in Europe has been so successful that Enphase recently appointed a Managing Director for the European operations as they scale up. Each European operation I have visited to or spoken with has caught Nahi's enthusiasm for the company inverters and are very positive for future growth.

Nahi also has his finger on the pulse of policy outcomes and was one of the first individuals who connected the USA trade disagreement with China to the current EU trade dispute. Nahi told me some time ago to watch what happens after the hors d'oeuvre of the American process. He rightly tipped the real issue to be the European trade dispute and believed that it would be settled outside of any arbitration as the fall out for both sides would be detrimental.

The company ethos is to stick to the original plan, which has been to build intelligent data rich microinverter systems while applying a high-tech semiconductor business model. This is Nahi's background and the results are ensuring other companies and investors are keeping an eye on progress. Whatever metrics you use, the outcomes show that the plan is working. With over 3.3 million units in the field around the world the company is not just showing off to encourage financial investment.

The market potential for solar in enormous despite the current reorganising blip in market growth. In the U.S. alone there are approximately 250,000 solar homes, yet there are over 70 million owner occupied homes in total with projections of roughly 1 million new homes to be built in 2013. With the costs of solar coming down and new financing tools available to consumers, the proposition for installing solar is increasingly compelling and this is not just a US phenomena but a global one.

Escalating energy prices along with an increasing awareness of the environmental impact of burning fossil fuels will result in increasing global demand for alternative energy solutions including solar.

These are the markets and dynamics that Nahi intends to tap into and the success of the company efforts so far has definitely made Enphase one of the company stocks to watch in the financial circles.

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The Enphase system also boasts a high technology interface system that allows the user to closely monitor their energy output and energy creation. They call their system Envoy and it boasts a number of remote accessibility possibilities. One in particular allows the company to access the health of the inverter and energy activity remotely

Local growth

A key element to the global growth of Enphase has been the way it has entered new markets and developed local networks and growth potential. When Enphase sets an office up there is an expectation that the new company will involve themselves with the local solar community and participate in industry gatherings. This is not simply a set up and leave them to it mentality with US support provided to local areas along the way.

Networking is a key factor of the company success and Enphase seems to understand that they need to be well known along the entire value chain to achieve success. At a recent visit to the UK offices in Milton Keynes I was impressed with the knowledge of the staff and the method they go about achieving their goals.

Paul Nightingale is the man who was picked to lead the UK operations in the middle of 2012. He brought over two decades of management experience to his role as country manager. With a strong background in strategic sales, marketing and business development, Nightingale was previously a UK country manager for a multi-national solar inverter company where he successfully launched the brand into the UK market. This competitive background was perfect for taking the new venture straight out of the blocks to join the UK race for a piece of the growing market.

The UK is a sizeable and growing photovoltaic market. Installations are forecast to grow 27.8 percent annually, reaching a yearly installation of 1.6GW by 2016. With a bewildering array of changing government support for solar, Nightingale has had to keep on top of local policies in order to best serve his team and their customers.

“The installers are the key to success for a company like ours,” Nightingale explained. “They are the first line of contact to potential users of our technology and how they present opportunities will impact on our success.”

Enphase UK takes this information seriously and Nightingale pointed out that he spends time with installers and the company provides training that demonstrates why their inverters are the better in the long run. This is not an easy task when you have to acknowledge that your competitors are generally cheaper. It is the clever technology and safety that becomes the two major points of success. Both Pauls agree that the solar industry has been selling financial packages and to combat this the company offers training on how to sell solar. In the short space of time the company has been in the UK it is already making waves and has signed a number of exclusive contracts with module suppliers who will now only supply Enphase inverters with their product.

Technological advantage

Micro-inverters ensure that the end user receives energy from every solar module on the roof. With a string inverter connecting the modules it is easy to see why micro-inverters are a more expensive opportunity. The problem with string inverters is they are impacted badly by shade and an entire array can function poorly if only a part of the array is shaded. Micro-inverters avoid this as each panel is controlled independently. This means that micro-inverters will function much better in shaded areas as well as increasing possibilities in West and East facing roofs increasing the potential market possibilities.

The Enphase system also boasts a high technology interface system that allows the user to closely monitor their energy output and energy creation. They call their system Envoy and it boasts a number of remote accessibility possibilities. One in particular allows the company to access the health of the inverter and energy activity remotely. This reduces costs with engineers only needed to be sent out when there is an issue that cannot be dealt with via remote methods.

The Envoy system is not unique but the company claims the proprietary knowledge and purpose built device easily outstrips the competition in terms of ease of use and knowledge that can be gained. The company is always thinking of the next evolution in the marketplace and feel confident what they have built up will fit into the energy needs of the markets they are in. The hard part of their sell is encouraging installers that there is a

return on investment for both the installer and their customer. The initial cost may be more but the superior technology means more energy produced over time ensuring more profitable returns in the long run. Nightingale tells the story of one installer who realised the technology of micro-inverters afforded him cost savings in unexpected places. By reducing the overall costs they could improve the offer to their customer who was more than happy to invest in technology that would improve their solar goals. One of the key savings for installers came from increased safety of the micro-inverters.

Safe as houses

Electricity is converted in a solar cell into direct current (DC) voltage and the key role of an inverter is to change the high voltage energy into a more usable alternating current (AC) that is in general household use. With a string converter the electricity leaves the solar module at around 600 volts of DC energy that travels along wires to the string inverter where it is converted to 230-240 volt AC which is used in domestic settings.

Any problems that are likely to occur in a solar panel is more likely going to happen along the transmission wire from device to end usage. 600 volts of DC energy is not just unsafe. It is deadly and prior to solar installations very few electricians would have come across DC energy in such a dangerous amount. With DC energy there is also a danger of arcing occurring at a number of points along the transmission of the energy and such an arc will cause fires. It is the main reason that fire fighters will not turn their hoses on when they come to a burning house fitted with solar panels.

With a micro-inverter the process is very different and energy is converted at a more manageable 45 volts DC and only travels a short distance to the in situ micro converters which then convert the energy to the AC voltage. This means that the electricity entering the establishment is already converted whereas string inverters do that at one point. Often under the roof. This safety element is fast becoming a key selling point for the Enphase product. Installers realise that the micro-inverter system is plug and play whereas the string inverter requires electricians skilled and trained in working with DC energy. Some installers are able to reduce their need for electricians with a micro-inverter installation programme able to have a floating electrician rather than one per installation. This reduction in installation costs helps improve margins along the value chain.

“The powerful combination of increased performance and safety benefits that Enphase technology offers and lifetime monitoring included creates an ideal solution for the UK solar market’s needs,” says Nightingale. “My focus is on creating a sustainable business for Enphase in the UK that is recognized for quality, innovation, service and reliability.”

This is where Enphase is going to be successful as they educate their local industry and help improve opportunities for solar and PV end users. The competencies they set themselves up for are now the very issues the industry is seeking as companies differentiate with technology rather than price.

System control

The system consists of Enphase M215 Micro-inverters that work in combination with the Envoy Communications Gateway and Enlighten monitoring and analysis software. The micro-inverter system enables intelligent maintenance and operations for solar installers and system owners. Remote diagnostic capabilities and system alerts via the web, coupled with Enphase’s expert technical support staff, helps installers provide their customers superior system uptime and a better return on investment. The global demand for solar continues to grow. In 2012, 30 gigawatts were installed worldwide up approximately 10% from 2011. The industry continues to benefit from a decrease in module prices. The excess capacity in the industry has resulted in module prices declining from approximately $3 per watt only a couple of years ago to around $0.75 per watt today.

Enphase recently announced its first-quarter 2013 earnings and they show a growing company. Enphase’s growth is undeniable with 315,000 units shipped in Q1, amounting to approximately 68 megawatts. Revenue was $45.6 million for the quarter which was 7 percent up from the previous while most companies were reporting losses. The company still gets around $0.67 per watt for the micro-inverter which is significantly more than a string inverter. Recent figures show Enphase is now the 6th largest inverter company in the world but they have only started showing any global presence. In the USA they are easily the fastest growing and are the number one micro-inverter supplier in the United States. Despite all the success there is still some way to go before the company reaches the goal of being cash friendly and out of the debt accrued from setting up the venture.
I would expect the company to continue to run flat with costs until margins improve and they will then scale up to the next level for global running.

With such growth the company will begin to consider where they may expand operations. With USA under their belt there are many markets for them to move towards and this appears to be a company worth watching for their growth and as a benchmark for others not used to working with the rollercoaster high and lows associated with high technology markets.

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Averting the war

The rapid growth of the solar and PV industries around the world was initiated by a huge increase in the number of companies attempting to take a piece of the growing pie. China contributed a disproportionate amount of that growth and was soon taking out incumbent manufactures around the world. German based SolarWorld initiated a trade dispute and the European Union's investigation is about to be completed. David Ridsdale looks at how the industry dispute has potentially become a world wide trade concern.

You know that things are awry when people start to behave as if rumours are fact and begin to change business plans to fit into the impact of said rumours. It would be fair to say that things are fairly awry as the international solar community is already reacting to rumours of what the European Commission outcome will be in the first week of June.

Of course the cynical amongst us will suggest that any information was leaked to force the parties involved to come to the negotiating table and clean up what could potentially be a very big mess. I am of course referring to the European Union's investigation into alleged dumping practise by Chinese manufacturers of solar and PV cells and modules. It has been intriguing to watch the media and industry response in treating rumours as fact. Early in May I attended a large scale solar conference in Cornwall and an eminent UK industry person got up and had the audience all excited that he had inside information that the EC trade dispute against the Chinese manufacturers and informed us all that the dispute would be settled out of session and would soon go away. This created a flurry of excitement from a number of companies with one of the biggest installers in the UK speaking to the individual later

seeking confirmation due to the impact it would have on their business.

Only one week later and a new rumour had surfaced. This time the rumour came from within the European Commission and suggested that European trade commissioner Karel De Gucht was pushing for punitive tariffs of at least 47% and had the backing of the commission. Shares moved around the world based on the new rumour and the media reported it as a fait accompli. Subsequent rumours and announcements suggest that this 'fact' was not a sure thing as divisions appeared in the commission and different EU countries began to actively lobby the EU to not levy trade tariffs against the Chinese citing the potential impact on the growing solar and PV industries across the continent.

The solar and PV industries have remained constant in their unequivocal split down the centre as to how the EC should progress with the AFASE group against any tariffs and EU Pro Sun calling for the highest possible fiscal punishment the EU can offer. The lack of unity in the industry has been a key factor that has allowed the process to continue as it has and now the entire outcome has become but the tip of a much larger iceberg involving all trade between China and the EU countries. The solar industry finds itself at the centre of a much larger storm. Only days away from the expected decision there has been a lobbying tsunami as all parties try and ensure their needs are met without causing a full blown trade war.

Everybody has an opinion

The reaction to the EC rumour of stringent punitive tariffs has seen such a flurry of reaction that it is easy to believe it was deliberately leaked. One thing it has done is make people realise how big an issue is at stake and how far beyond the solar and PV industries the impact will be felt. We have had all sorts of stories in the media suggesting the USA has actively discussed the issue with the EU and China in trying to broker a deal. All parties have subsequently denied such meetings occurred. We have had suggestions that the Chinese will retaliate in industries that will hurt the EU member countries. Of course all parties deny such rumours.

What we have seen is division in the EU with government leaders from all countries making their voices heard. The majority of countries have sent high level delegations to call for a more reasonable response or no response at all. The call is for all parties to reach a conclusion but the conclusions tend to be for the Chinese to agree to limiting the amount of solar they can sell or an agreed cost to sell new product to. For many Chinese players this seems another form of protectionism and has not being met kindly in that part of the world. This has caused EU ProSun to request the EU define what protectionism is and have helpfully provided their own definition that they request the EU take on board.

A number of companies have chosen to release press releases expressing their opinion on the matter and one thing that becomes obvious is there is no middle ground on the topic. It is a for-or-against scenario that has certainly got people talking and offering opinion. The real fear is what any such tariff will do to an industry that has grown in leaps and bounds over the last few years. The group for tariffs argue that international laws have been broken and European companies are struggling due to the excessive and cheap Chinese products that flooded the European markets. The concerns are all about jobs and failures rather than even concern themselves with whether the influx of so many products was of a high enough quality. Not that jobs and company survival are not important matters it just began to appear that the issues concerning some people had little to do with the industry as they claimed and more to with their personal situation.

The other side of the argument is that punitive tariffs will have a great negative impact on the local industry than any dumping of products ever had. Many companies and regions took advantage of the reduced prices that came from the excessive product supply and governments were more than happy to align their subsidy packages to the reduced prices. If tariffs are imposed there would be a dramatic increase in panel and module prices and the impact on an industry balancing cost and profit so precariously may be more negative than the dumping was in the first place.

Of course no one knows for sure what the outcomes will be and both AFASE and EU ProSun have commissioned top analysts to provide reports on the potential outcomes. Both reports are so diametrically opposed that all the process did was cast doubt on the veracity of both of the report authors who came up with the results they were commissioned to find.

It will be interesting to see how individual governments in Europe react to any outcomes as almost everyone of them provided subsidies for renewable energies have reduced their exposure and costs completely on the declining costs of solar products. If there is a price increase will they be prepared to increase subsidies based on the same equations? The decisions will also have a great impact on the future of the industry in Europe.

Strong opinions for tariffs

An issue that has caused such division in the industry will undoubtedly not end with the EC decision. It appears most likely that there will be a challenge to whatever the decision may be. The tone of commentary indicates that individuals will only be happy if their concerns are met with little room for compromise.

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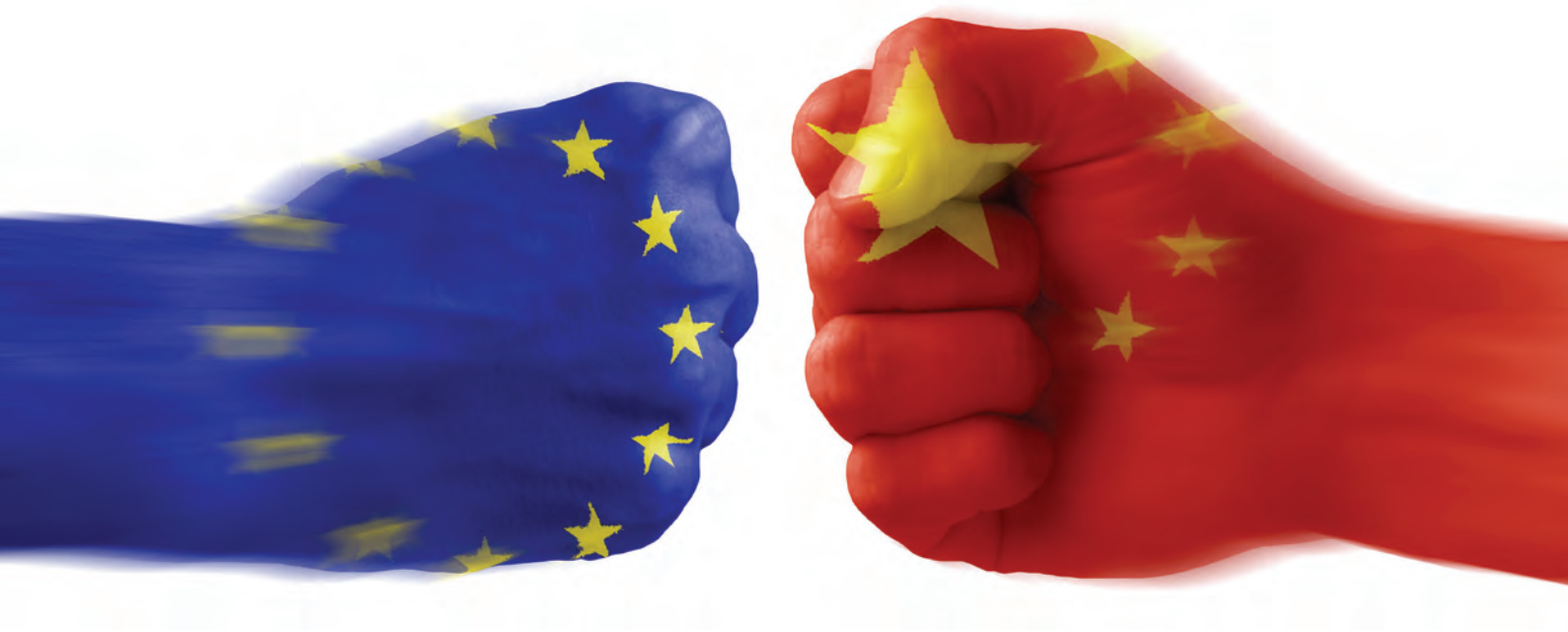


The recent reports of back door deals in the EC demonstrate that anything may still happen. We know that most countries, led by Germany and the UK, are against trade sanctions and the bigger world picture of the potential back lash has seen strong words between the EU and member countries.

This stand off between the EU and member countries is another key element to the overall picture. It is strange that a relatively new industry has become the flashpoint for so many larger concerns.

Many companies have felt the need to have a say on this topic and only their obstinate stances demonstrate any connection to the idea of sitting down and seeking resolution. The Scandinavian-German manufacturer Innotech Solar (ITS) demanded the enforcement of anti-dumping duties for Chinese solar modules in their statement.

“A glance at the annual financial statements of Chinese suppliers shows that instead of economizing, these companies are simply selling their PV modules below manufacturing costs. In some instances, their losses are just as high as their sales,” explained Dr. Thomas Hillig, Vice President Module Sales & Marketing at Innotech Solar. “If Chinese manufacturers were not selling their modules at levels that distort the competition, their prices would actually be up to double as high.”

According to Hillig, as soon as Europe loses its own photovoltaics industry, Chinese manufacturers would no longer provide their solar modules at unprofitable prices but offers no substance to such a claim.

“Fair competition is only possible if all market players follow the same set of game rules. We are in no doubt that China is distorting the market for PV modules by dumping its products in a targeted manner and this unfair competition must not remain unpunished by the EU,” continues Hillig. “If we do not act now to enforce anti-dumping duties that bring about a discernible increase in prices, Chinese suppliers will dramatically increase their module prices once the European competition has collapsed.”

EU ProSun calls on the EU to impose urgent anti-dumping duties on Chinese solar products to save European industry, innovation and jobs. EU ProSun believes a lack of duties will allow a Chinese monopoly which would be the sole beneficiary of future market growth in the EU. According to the group an unpunished Chinese industry will see major EU investments in R&D, innovation and production completely wiped out by illegal trade practices, while the imposition of measures would allow the industry to recover and flourish like in the United States.

In response to the idea that any such trade tariffs would be essentially another form of trade protectionism the group state that the use of trade defence measures is not illegal. On the contrary, they believe it is a rightful measure to combat illegal trade practices of other countries and ensure a level playing field. The group were quick to provide further commentary following new rumours that an agreement was being reached.

“According to press reports, the EU is proposing relatively moderate duties of around 47% on imports of Chinese solar products while dumping of up to nearly 90% is taking place in Europe,” said Milan Nitzschke President of EU ProSun. “We call on the EU to impose tariffs urgently that reflect the illegal practices of subsidized Chinese producers in the European market, where they sell far below their own production costs,”

Strong opinions against tariffs

Those against the idea of tariffs and the impact on the local industry are just as strong in their opinions. Following reports, read rumours,that a large number of member states including Germany have rejected the Commission’s proposal to impose provisional duties. AFASE was as quick out of the blocks as their counterparts and welcomed the news and called on the European Commission to not impose duties on solar products

"The proposed levy would deal a severe blow to both our domestic and commercial solar businesses by making it harder and more expensive for potential customers to invest in solar energy, not only could it lead to significant job losses across the UK solar industry, but it would make it virtually impossible for the UK to meet its climate obligations."

from China as any form of tariffs will cause severe harm to the wider European PV industry. They claim this will protect companies that represent more than 8,000 jobs and 33% of total production of EU solar products in the EU.

"I am very glad that the German government has listened to the concerns voiced by the German solar industry and other businesses. The European Commission's plans to impose preliminary duties are very dangerous all the more that duties would be levied not only on imports of solar products originating in China but also on imports of solar products originating in other countries but shipped from China". says Thorsten Preugschas, CEO of Soventix and one of the AFASE spokespersons.

AFASE further cautioned the commission not to follow EU ProSun's suggestion of dragging products originating in Taiwan or Malaysia or other unsuspecting countries into this dispute claiming this defies logic. They caution that the Commission proposal risks turning a major bilateral trade dispute into a global trade conflagration. The group informs the Commission that to have a trade investigation on multiple countries would require a new investigation. Expanding the inquiry nine months into an investigation is simply not permissible according to AFASE.

Other companies were just as quick to release personal statements to encourage the EC to take stock of its decisions. SolarTech, a UK supplier of renewable energy solutions, is strongly opposed to a EU trade levy, and claim it could have devastating effects on the UK solar industry.

According to Shaun Taylor, managing Director of SolarTech, the provisional anti-dumping duties, which could come in by June 6th, could potentially add 30% to 60% to the cost of panels imported from China. Although a duty on the practice of 'dumping', which is where countries sell their products abroad at prices below normal market values, could potentially benefit European manufacturers, it is expected to have an adverse effect on the UK solar industry as whole by massively increasing the cost of installing panels.

"The proposed levy would deal a severe blow to both our domestic and commercial solar businesses by making it harder and more expensive for potential customers to invest in solar energy," said Shaun Taylor. "Not only could it lead to significant job losses across the UK solar industry, but it would make it virtually impossible for the UK to meet its climate obligations."

The issue in the UK is receiving the highest level attention with the Minister for Energy, Greg Barker personally leading a delegation to the EU to attempt to sway the EC in their decision making process.

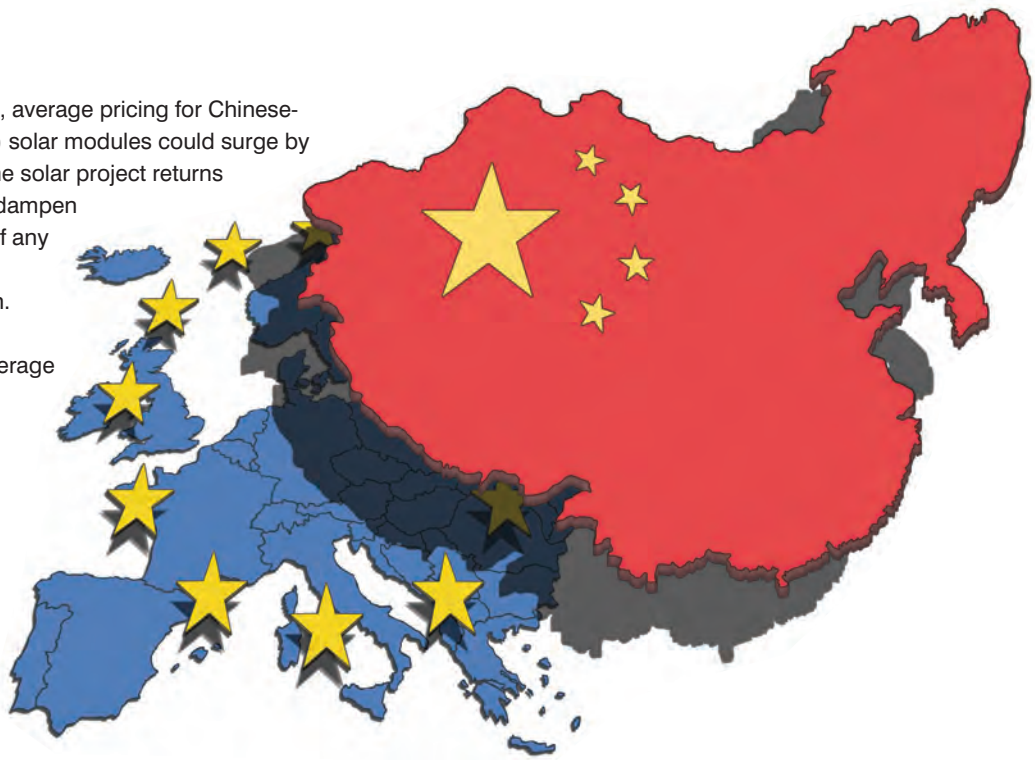
Chinese companies have also being uncharacteristically chatty on the topic with most saying they would not be able to run a profitable business in Europe if sanctions were to go ahead.

Zhang Longgen, chief financial officer at JinkoSolar Holding stated there is no way they can be profitable with the new tariffs and believes the only action would be to increase costs. This is the general consensus of the Chinese companies many of whom are looking to Asian Pacific markets like Japan or emerging areas such as India or Africa as an alternative to a potentially hostile European market. The Chinese government has also found it has had to comment on the topic, sometimes to refute a rumour but mostly to let Europe know they will not accept the top end of punitive action without a backlash. Chinese Commerce Minister Chen Deming has encouraged all partied involved to find an acceptable solution rather than increase trade frictions which can only lead to greater problems for all concerned.

"We hope to address the dispute through negotiations between Chinese and European companies and boost our industrial cooperation and seek third-party markets," Chen was reported to have said recently.

Analysing costs

According to analyst group IHS, average pricing for Chinese-manufactured photovoltaic (PV) solar modules could surge by 45 percent in June, cutting some solar project returns to below 7 percent and further dampen demand in Europe as a result of any preliminary antidumping duties imposed in the European Union.



Chinese modules carried an average price of $0.66 per watt (W) in March, and were expected to increase to $0.67/W in June, based on a forecast from the IHS Solar Module Price Index. However, with EU commissioners planning to impose import duties on solar modules from China, average pricing could surge to $0.97/W in June. They point out that a further six months of negotiations is likely before a final decision is made.

"In recent months, prices of Chinese modules have crept upwards in key European markets as a result of the additional overhead incurred from the mandatory registration of imported modules from China," said Ash Sharma, senior director of solar research for IHS. "However, when the duties go into effect, prices for Chinese modules will rise dramatically as they cannot absorb these additional costs due to the poor state of their balance sheets. This likely will force many Chinese PV module suppliers out of the European market and could spur rising costs for installations."

To make up for the European sales deficit, a large volume of modules will need to be installed domestically in China. Given the low prices and the long delays in receiving payments for installation projects in China, this may prove to be challenging. Outsourcing of module production to PV original equipment manufacturers (OEMs) outside of China may be one strategy suppliers employ to circumvent the duties.

The increase in module prices will inflate PV system prices in Europe. At the same time, installers and engineering, procurement and construction companies EPCs are likely to absorb some of the additional costs and sacrifice their margins to limit the price increases they pass on to customers. IHS predicts that both events most likely will occur simultaneously. Large installations that tend to favor low-priced modules will be most impacted, while smaller rooftop installations that gravitate to German, Korean and Japanese modules will be less affected.

"The analysis by IHS of project IRRs shows that the most price-sensitive market segments are German ground-mounted and large rooftops without self-consumption," said Dr. Henning Wicht, senior director of solar research for IHS. "A system price increase of 10 percent in Germany would reduce the return on investment to less than 7 percent, seriously dampening investor appetite for this sector. This change could eliminate nearly 2 GW of installations that would have otherwise occurred."

Outcomes

At this point it is impossible to determine the outcomes without real facts and figures from the European Commission in June. The concern remains that the actual issues are being overtaken by much larger global and European problems that could force the solar issue one way or the other.

Whatever the outcome there is no doubt that this issue will dominate the solar and PV landscape worldwide and will be the defining feature to an industry already going through a consolidation process as it develops as a mature industry. Until this issue is settled there will be nothing but uncertainty.

It does not appear that many have reflected on what this uncertainty will do for the solar industry. There is already concern amongst consumers as to how effective solar is. After years of expecting high financial returns there is a reticence to invest for many. Coupled with concerns that solar panels will not last the 25 years everyone hopes for the industry would do well to recognise that there are more fundamental concerns that need to be addressed with as much vigour as this trade dispute has seen. Whether it be safety or product integrity there is a great deal of work to be done to ensure the sustainable and reliant goals of the solar industry can be met.

EU levy puts projects at risk

The industry is waiting with baited breath to see the official outcome of the European Commission's investigation into anti-dumping accusations against Chinese manufacturers. Orta Solar is one company who believes that the outcome of punitive tariffs will force them to reconsider about £180M worth of projects.

Orta Solar is a Southern England based team that have developed one of the UK's largest Solar Farm portfolios to date. The company has had to recently announce to investors that it is being forced to consider postponing over £180M of UK Construction projects in reaction to an EU trade levy of between 40% and 70% proposed to be added to the import price of Chinese solar products.

"We're tremendously disappointed to hear this proposed news", declared Nick Pascoe, the business's Managing Director. "We invest many millions in surveying, planning, legal, financial and technical design work typically twelve months prior to constructing these projects and we no longer know whether it will be economically viable to construct UK commercial scale solar farms later in 2013 and beyond. How can we possibly continue to invest?".

Orta's team members have successfully planned for well over 20 solar farms at a construction cost of £250M creating enough CO2 free electricity to power 37,500 British homes and creating hundreds of UK professional and construction jobs. Building on this background, work on Orta's next round of projects due for commissioning before the end of March 2014 is presently going ahead in full swing.

"We're astonished that the EU has bought into the protectionist argument of 42 largely bankrupt EU based solar wafer & cell manufacturers at the expense of thousands of EU based solar

development and installation businesses who depend on easy availability of low cost solar panels for their existence. Any certainty we had on future construction costs has just been removed with the stroke of a pen. We're writing to and speaking with all of our clients, suppliers and partners explaining the impact of the proposed EU levy, suggesting how they can help by lobbying the UK's Dept. of Energy & Climate Change and explaining what we're doing to help keep their projects on track. I'm an advocate of EU harmonisation to bring down trade barriers.

This misguided EU proposal will likely impact British jobs and should be opposed strongly by David Cameron's Govt.", Pascoe commented. Avenues being explored to keep projects economically viable include striking supply deals with EU cell & panel manufacturers [but at current Chinese level pricing] or switching supply to panels not containing Chinese manufactured cells, however both options are very limited.

Regional employment

The facts in the UK speak for themselves where there are approximately 500 people working in manufacturing solar panels and approximately 25,000 directly employed installing the panels and developing larger scale projects. Ironically, 400 of those in manufacturing are based in Sharp's Wrexham plant which imports Chinese solar wafers and exports most of its manufactured solar panels to Japan. It may now face steep cost price rises whilst its sales price remains static. Within the EU the picture is similar, particularly in Germany where 6,000 are directly employed manufacturing Solar wafers & cells, and 150,000 are employed installing and developing large projects.

"Throughout Europe, the Solar Sector has become a largely value adding industry enabled by availability of low cost Solar panels and limited by sensitive Government subsidised economics that allow for minimal margins and carefully selected projects", Pascoe said."It does not take much imagination to see what will happen to the installation and commercial development sector if cost prices are hiked upwards whilst the revenues remain fixed. The EU is shutting the stable door, but the horse bolted some time ago and we've mostly now got over it."

Lack of start up investment

One of the major infrastructural challenges facing EU manufacturers of photovoltaic silicon wafers & cells is that none of the big EU companies with the financial muscle to invest the £10Bns required to develop low cost manufacturing facilities in the EU (BP Solar or Bosch for example) chose to do so. It may be fact that China supported the growth of it's Solar cell manufacturing base ($45Bn quoted in Reuters) whereas the EU Govt. did not, but inevitably Chinese manufacturers are now in pole position when it comes to lowest priced products and EU manufacturers have lost out.

That is now history. Is there any sense at all in trying to re-write the legacy of EU cell manufacturing under-investment by impacting the much larger & healthy EU based value adding Solar sector addicted to the easy availability of low cost product?

There's no doubt that renewable energy is an established part of the UK, being particularly welcomed by farmers harvesting sunshine by solar panels rather than by photosynthesis on a small part of their farm. The UK Government has a target of approximately 20 GigaWatts of Solar installed capacity in the UK by 2020 about half of which will be land based, or approximately 50,000 acres of Solar Farms spread across the UK (compares with 1,900,000 acres of rape seed (canola) oil in 2012 by way of a comparison). Orta is working hard despite the odds to keep projects on track and retain its highly skilled and experienced UK based workforce whatever EU slings & arrows are thrown.

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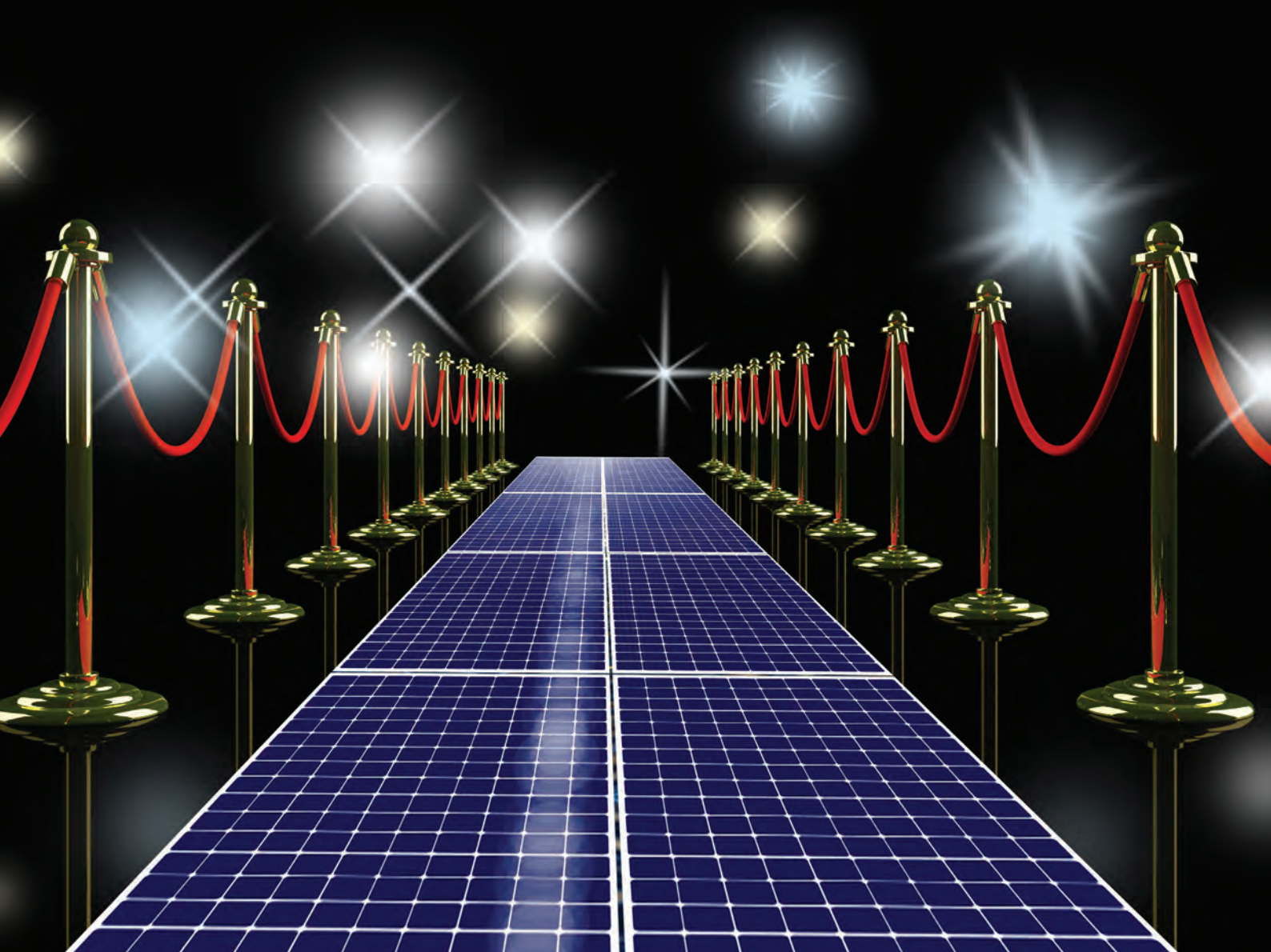

Punitive tariffs would cause dramatic job losses

The European Union inches closer to a decision on anti dumping claims against Chinese solar manufacturers. The situation has split the industry down the centre but many are coming to realise that China could just as easy retaliate for any punitive announcements. The backlash could be greater than the case itself. Thorsten Preugschas, CEO of the German project developer Soventix and AFASE spokesperson puts his groups point of view forward.

The solar industry in the EU and all over the world has had to cope with a changing and volatile market in recent years. Many new producers appeared when demand boomed and technological innovations caused solar products to increasingly become a mass-produced commodity. Then, in the wake of the financial crisis, many states lowered their feed in tariffs forcing all producers alike into accelerated cost rationalizations.

European solar manufacturers profited immensely for years from the solar boom in Europe when they almost had a technological and commercial monopoly. But when the solar industry transformed, their business models were exposed as not being competitive anymore. Some European manufacturers lay the blame for their own difficulties on solar manufacturers outside the European Union. Some decided to call on the EU to impose anti-dumping and/or countervailing duties on Chinese solar products.

This seems to be the last means to revert the necessary and inevitable market consolidation.

I have joined the Alliance for Affordable Solar Energy, AFASE, with more than four hundred other companies because I cannot watch silently as some companies are putting a whole thriving industry at risk for their own selfish interests. AFASE is fighting for open markets and free trade in the solar sector.

At the beginning of May, over 900 companies and other players in the European solar industry have signed an open letter to the EU Trade Commissioner Karel de Gucht, in which they request that the EU Commission refrain from imposing punitive duties and allow the EU PV value chain to develop and grow.

Let´s be very clear: punitive tariffs would be deadly poison for the European solar industry! The extent of that damage has been brought into sharp focus by the independent economic institute Prognos that has published a comprehensive study on the effects of tariffs on the European solar industry.

The study shows that anti-dumping and/or countervailing duties at whatever level on imported Chinese solar products will lead to decreased demand for solar products immediately translating into significant job losses and less value added along the whole European photovoltaic value chain. This is because the considerable decrease in demand for solar products would result on the one hand in less demand for solar installations and services. On the other hand, the supply of intermediate inputs such as raw materials and production equipment from Europe to China would decline.

A punitive tariff of 20% would already cost more than 115,000 jobs in the European Union. Should the EU decide to levy a punitive tariff of 60%, up to 242,000 jobs and over 27 billion euros in value added would be lost within a period of three years.

But that is not all. In addition, punitive tariffs would delay or even prevent achieving grid parity between solar energy and conventional energy sources even though this is already within grasp in many European member states. Price decreases were anticipated and even required under the EU's own renewable energy policy that rests on grid parity being achieved with other sources of energy. Decreasing costs of photovoltaic installations and products are key to this. Chinese solar products contributed towards this goal as their prices decreased in line with cost rationalization.

This was as a result of research and development, their bigger scale of production and a dramatic fall in the cost of raw materials. It's no different to many other technologies; we remember the eye watering costs of the first generation of mobile phones and home computers.

Many European companies along the whole solar value chain have profited from the presence of the Chinese solar products: European producers sell their raw materials and manufacturing equipment to manufacturers of solar products based outside of Europe. Post-manufacturing, European engineers and system integrators take over the on-site planning of solar systems. Local companies ultimately install and service these solar systems. This means for example: If a solar panel is produced in China and assembled and installed in Europe, around 70% of the value added is generated inside the EU.

More and more European companies along the whole solar value chain, politicians and experts are warning of the devastating effects the introduction of tariffs would have. They underline that open markets have made solar energy more affordable and widespread as well as created a globally active, competitive European solar industry.

The warning is clear: If we want a viable solar sector that is going to help us achieve our carbon reduction targets and provide us with the desperately wanted Green jobs, we call on the Commission to oppose protectionist tendencies and allow the free market to prosper.

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EU ProSun responds to dumping case in EC

No issue has split the Solar industry like the trade cases occurring around the world, and specifically against China, for the proliferation of cheap modules. EU ProSun who have been firmly for the trade actions have commissioned PwC to provide their own facts about the impact of tariffs.

Some European solar manufactures who are represented by EU ProSun, expect EU anti-dumping duties on Chinese solar imports to have a clear positive effect on solar jobs and growth.

"The European solar industry is the global leader in technology and new innovations. If the European Commission acts now against illegal dumping by Chinese solar manufacturers, this industry can survive and prosper. If the EU does not act, EU ProSun predicts a Chinese solar monopoly with disastrous consequences for European manufacturers, suppliers and customers," said Milan Nitzschke, President of EU ProSun. EU ProSun refers in this context, among others, to a new study by Price Waterhouse Coopers (PwC).

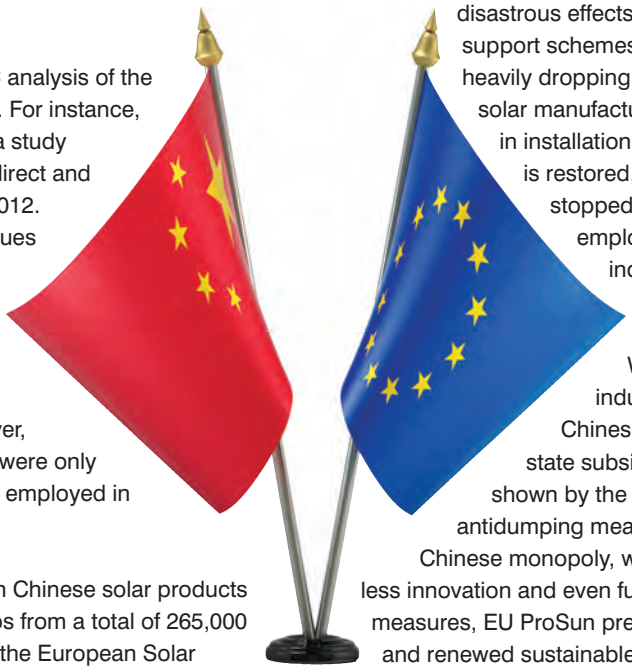
The PwC analysis refutes the claims made by the Prognos study on the supposed impact of trade measures in the EU solar market. Chinese solar manufacturers, and a European

front group of installers who use their products called AFASE, commissioned a study by Prognos which made a number of scientifically unsupported claims, for instance, estimating potential job losses exceeding the actual total number of direct and indirect solar jobs in some countries.

Author of the PwC study, Dr Wolfgang Nothhelfer said 'The Prognos study contains major flaws in methodology and content, as well as contradictory evidence. The US imposed tariffs on photovoltaic products in 2012. As in Europe, a study commissioned on the possible effects of tariffs forecast an alarming crash of demand and job losses in the US. However, after the introduction of tariffs, demand increased and 14,000 new solar jobs were created. We should not believe alarming studies which are based on vague data and questionable assumptions. Indeed it is reasonable to conclude that the introduction of tariffs will have a net positive effect on employment in Europe.'

Difference of opinion

EU ProSun fully endorses the PwC analysis of the implausibility of the Prognos study. For instance, Prognos themselves co-authored a study which estimated a total of 87,800 direct and indirect solar jobs in Germany in 2012. However, their new 2013 study argues that duties may result in the loss of up to 98,000 jobs, thus over 10,000 more jobs that actually exist in Germany. Furthermore, Prognos predicts net job losses of 38,600 in 2015 in the UK, however, according to published data there were only 10,000 people directly or indirectly employed in the PV industry in 2011.



Prognos even claims that duties on Chinese solar products would lead to a loss of 242,000 jobs from a total of 265,000 solar jobs in Europe, according to the European Solar Industry Association (EPIA). EU ProSun utterly rejects such false claims and, in line with the US experience and PwC analysis, expects jobs and growth to increase in the EU solar sector when trade measures are imposed. Currently, due to disastrous effects of Chinese dumping on European support schemes, the number of new installations is heavily dropping, which already cost 15,000 jobs in solar manufacturing as well as thousands of jobs in installation and supply. When fair competition is restored, this destructive process will be stopped leading again to creation of new employment opportunities in the solar industry.

'EU solar production and transport costs are lower than in China. We have the most advanced solar industry in the world here in Europe. Chinese prices are low because of illegal state subsidies and massive dumping as shown by the US government investigation. Only antidumping measures can prevent the creation of a Chinese monopoly, which would lead to higher prices, less innovation and even further job losses in Europe. With measures, EU ProSun predicts restoration of fair competition and renewed sustainable growth of the European solar market', commented Milan Nitzschke, President of EU ProSun.

PwC report overview

PwC was engaged in the context of the current investigation of the European Commission in the solar industry to report on the EU solar photovoltaic market and in particular on the claims made in the Prognos study with regard to the consequences of tariffs. The following provids a short summary of the main conclusions.

The results of the Prognos study are implausible

Higher job losses than total number of jobs: In the Prognos study, estimated job losses exceed in several instances the total number of existing jobs in the solar industry.

The unexplained increase of the number of allegedly lost jobs: The first results of the Prognos study, which were presented to the public in November 2012, announced considerably fewer job losses than the results made available to the public in February 2013. By then, the number of estimated job losses was suddenly several times higher than in November 2012.

The US experience - Anti-dumping tariffs and job growth: The US imposed tariffs on PV products in 2012. There was also a study commissioned in the US on the possible effects of tariffs that forecasted alarming job losses. However, after the introduction of tariffs demand increased and more jobs were created. This is a useful example to illustrate that there are good reasons not to believe alarming studies which are based on vague data and questionable assumptions.

There are major flaws with regard to methodology and content

- Central elements of the analysis like the elasticity of demand remain completely unclear
- Several offsetting factors that reduce the impact of tariffs on demand were not taken into account
- The assumption that volumes of production inputs exported from Germany to China will remain constant is highly questionable
- The Prognos study does not meet the standards for economic evidence set out by the Commission and therefore should not be taken into consideration
- Relevant aspects for a holistic assessment of the impact of tariffs on photovoltaic products

There are many factors to consider when estimating demand and employment effects of tariffs in the solar industry, and the Prognos study does not provide a transparent and objective evaluation of those factors.

A recovery of the European PV manufacturers combined with cluster effects along the PV value chain and other related sectors, as well as effects on innovation have the potential to generate a substantial amount of EU value added and employment, and depend to a large extent on the introduction of tariffs. It is reasonable to conclude that these beneficial effects of tariffs more than outweigh limited negative effects on demand, i.e. that the introduction of tariffs has a net positive effect on employment in Europe.

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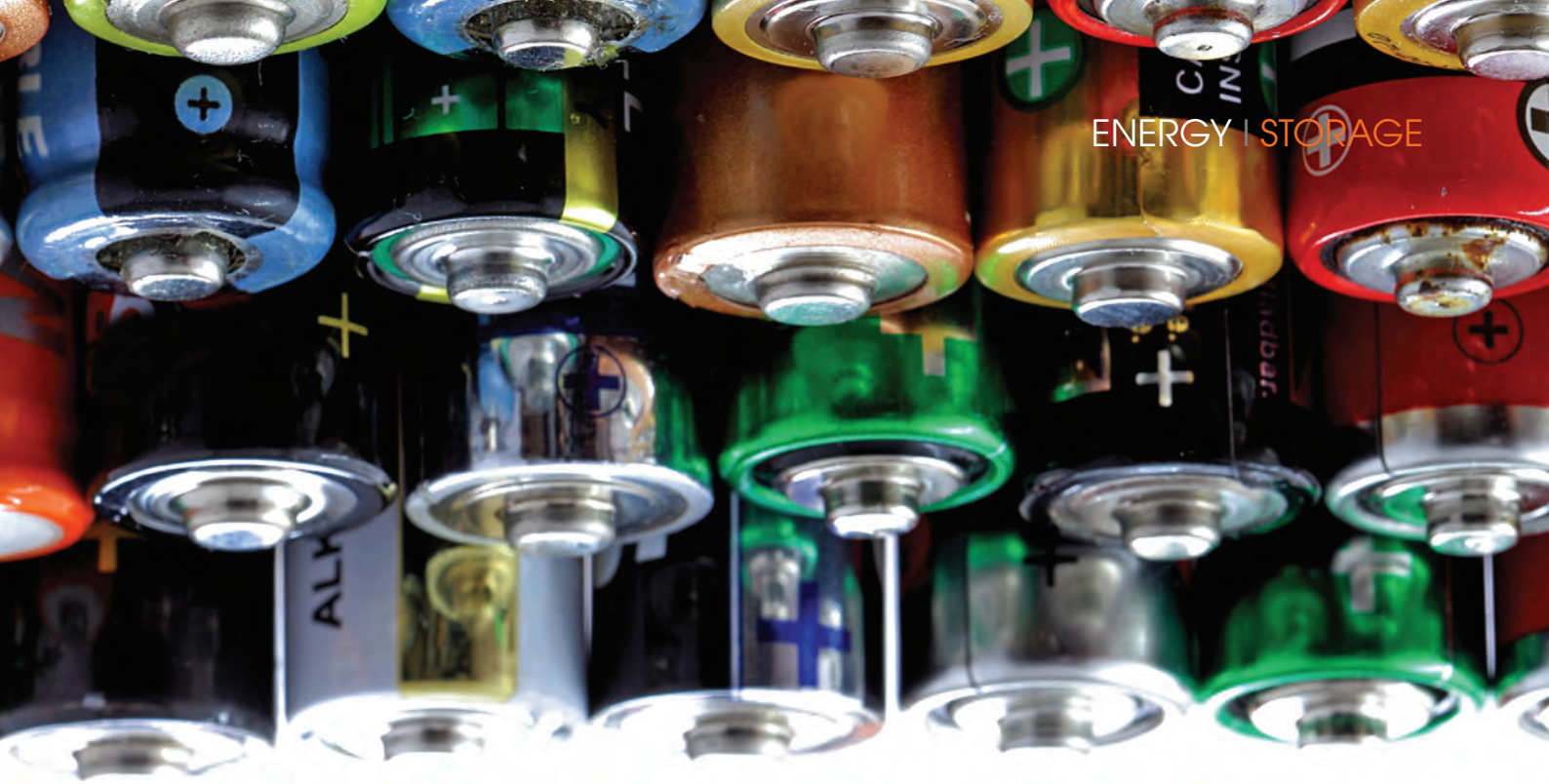
Unlocking the value of energy storage

Energy storage is not just a buzz phrase in energy creation and consumption but a necessary part of the future energy needs. Patrick Clerens, Secretary General at European Association for Storage of Energy (EASE), explains why energy storage is not a question of 'if', but 'when' and 'how' for the power industry.



Political and societal aims are driving deep transformation across the electricity and energy systems of Europe. The achievement of an internal electricity market for the European Union (EU) is the objective for the next year, decarbonisation is underway, and member states are making their own choices regarding the energy mixes, for example nuclear power phase out. Moving forward, electricity grids will have to cope with increasingly variable supplies resulting from the integration of more renewable energy sources ('renewables'), as well as rising demand and changing demand patterns.

Significant investment is needed, given that current infrastructure is ageing and poorly prepared for the fundamental changes taking place in the way electricity is generated, transported, distributed and consumed. As stated by EU Commissioner for Energy, Günther Oettinger, the energy system is the backbone of the modern society, and Europe must ensure sustainable, secure, safe and competitive access to energy in the medium to long term. Energy storage is well suited to helping meet these requirements. It will ensure a continued security of energy supply and can deliver a number of strategic services both on the regulated and deregulated parts of the power industry. It also

addresses, among others, three major challenges: balancing demand & supply; management of transmission & distribution grids; and increasing energy efficiency.

Yet some energy storage technologies remain in the early stages of development. It is not well understood outside of industry specialists, there are multiple types of technology being developed for various applications, and there is a lack of clarity concerning the economic and business case for each.

Evolving energy landscape

Decarbonisation is well underway as EU member states look to meet the '20-20-20' targets set out within the Climate and Energy Package. Agreed by the European Parliament and Council of the European Union and entered into law in mid-2009, the legislative package is composed of two binding targets for 2020: increasing the share of renewables to 20 per cent of the EU's energy production; and reducing CO2 emissions to at least 20 per cent below 1990 levels. It also includes a non-binding agreement on reducing energy consumption by 20 per cent compared to business as usual by the same date by improving energy efficiency.

In addition to these targets, some member states are seeking to phase out nuclear power. Germany's Energiewende (energy transformation) for example, mandates a shift from nuclear and fossil fuels to renewable energy sources, while Italy has placed a moratorium on nuclear energy development following the Fukushima disaster in Japan. However, nuclear energy will continue to play an important role in those member states where it is accepted, and it remains a central source of low-carbon energy in Europe.

Although it is difficult to predict what Europe's future energy mix will look like, the underlying inevitability is that energy storage will be critical to achieving a sustainable energy system. This view is widely supported, with the EC's Energy Roadmap 2050 in particular recognising the role of energy storage in overcoming the integration of greater amounts of renewable generation. According to the Roadmap, the share of renewables in energy consumption could reach about 30 per cent in 2030. About half of this increase is expected to come from variable energy sources such as wind and solar photovoltaic (solar PV).

A novel approach

Renewables are predominantly intermittent sources of generation, non-dispatchable (i.e. not available on demand) and can have a wide seasonal variation. This will inevitably lead to situations where generation will exceed demand or vice versa, placing stress on transmission and distribution networks in particular. All types of flexibility sources will therefore be crucial, including dispatchable power plants, demand-side response via smart grid, and energy storage, as well as interconnection with adjacent markets. While each flexibility source addresses a specific separate issue, storage systems have the advantage of providing the solution to a combination of problems. Such options include (but are not limited to):

- Flexible generation systems
- Grid (transmission/distribution) flexibility upgrades
- Demand side management
- Interconnection improvement

The main functionalities of energy storage include the ability to time-shift electrical energy, to inject energy to the electrical grid (technically acting as a generator) and to extract energy from the electrical grid (technically acting as a demand). Energy storage technology is not a new concept and has been used successfully for many decades to match the variation in demand with generation and to provide ancillary services.

Pumped Hydro Storage (PHS) today represents almost 99 per cent of the worldwide electrical energy storage capacity. Even if PHS is attractive and essential in Europe, it cannot answer all necessary applications on its own, and expansion plans are usually limited by geographical and financial limits. The changing energy landscape entails a large number storage applications, requiring short term (minutes to hours) or long term (days to weeks) storage capacities, centralized or decentralized implementation patterns, etc. This implies the use of a variety of storage technologies, or a combination of different technologies. In this context research and development of energy storage technologies is crucial.

Systemic solution

Energy storage technology has the potential to provide valuable services throughout the energy chain – from power generation, transportation and distribution, to the final consumer. However, it is clear that not one solution will fit all and there is currently limited storage in the EU energy system. The installed storage

The main functionalities of energy storage include the ability to time-shift electrical energy, to inject energy to the electrical grid (technically acting as a generator) and to extract energy from the electrical grid (technically acting as a demand)

capacity is mostly PHS; other forms of storage – chemical, electrical, thermal, electrochemical (batteries) and other forms of mechanical energy storage – are either minimal, or at a very early stage of development.

Decisions to invest in development and deployment of storage technologies and adequate capacity depend on the evolution of the whole energy system. Here, a number of uncertainties exist, including regulation and market design, integration with the grid, and the potential to develop new and innovative business models to make storage schemes cost effective. A key challenge for storage technology is the realisation of ideally several value streams from one single storage system. For this there are several reasons:

- No compensation schemes for storage exist among stakeholders: because of the unbundled European Energy System it is difficult to foresee where the revenues of energy storage will be allocated.
- No clear ownership and operating models
- No models for fully capturing different value streams

A further challenge relates to how the economic and business case for storage varies according to application and where it is needed: Generation (arbitrage, capacity firming, curtailment reduction); Transmission (frequency and voltage control, investment deferral, curtailment reduction, black starting); Distribution (voltage control, capacity support, curtailment reduction); Customer (peak shaving, time of use cost management, off-grid supply).

These different locations in the power system will involve different stakeholders and will have an impact on the associations of services to be provided. Moreover, each location may provide a specific share of deregulated and regulated income streams. To make matters more complex, the nature of the renewable energy resource varies across Europe. For example, southern member states have a greater reliance on PV generation, whereas northern states have a greater reliance on wind.

European coordination

How European member states integrate renewables within their boundaries lies in their own hands. However, it is essential to work towards a coordinated approach between the different member states for energy storage research and development efforts, as well as for funding. This is in line with the aspired internal electricity market and necessary to avoid overlaps or contradictory developments.

Likewise, member states must work together to optimise the different technologies, drive the necessary investments and to harmonise the different rules within the European energy market if a fragmentation of the European Internal Market is to be avoided.

As such, energy storage is the subject of shared interest among several existing initiatives. European energy players including manufacturers, utilities and academic bodies have come together under the European Association for Storage of Energy (EASE), to provide a consensual vision of the roles, technologies and potential applications of energy storage and to actively promote its use. pEASE is coordinating with relevant stakeholders as well as national, European and international associations, to build a European platform for sharing and disseminating energy storage related information. For instance, EASE and EERA (European Energy Research Alliance) the alliance of leading organisations in the field of energy research, including the input of all EU-stakeholders, have published in April 2013 a roadmap and recommendations to 2030, which describes the future European needs for energy storage and provides recommendations for R&D actions within the timeframe of Horizon2020 (the financial instrument implementing the 'Innovation Union', a Europe 2020 flagship initiative) and in line with the wider EU Energy & Climate Framework.

Ultimately, the European industry has the potential to bring to market a large number of innovative storage technologies within just a few years, enabling the region to take a significant stride towards achieving its goal of a low-carbon and sustainable energy system.

EASE general recommendations regarding market design include:

- A legal framework for energy storage at EU level to allow grasping all the added value energy storage can deliver, bearing in mind that the completion of the European single market for energy is crucial. A leeway for national approaches should be incorporated, as long as they do not create market distortion.
- Energy storage constitutes a special and important asset of the complete energy value chain. Therefore the current levy structures (grid fees, taxes or similar) may not hinder the integration of energy storage.
- Storage devices can render services to the regulated and non-regulated part of the energy system. In providing such services, market based solutions should be preferred whenever possible.
- Energy storage gives an added value on different levels in the energy system. Therefore the operator of such devices may differ. The market design could also allow specialised storage operators to emerge, as long as this does not trigger market distortion.
- Potential future capacity markets/payments must be shaped in such a way that without discrimination every energy storage technology should be eligible to participate, if able to fulfil the requirements.
- Storage technologies must be considered comprising its capabilities in sector export (e.g. power to gas, hybrid electric vehicles, heat storage…). Given the important consequences for the markets involved, EASE reminds that an integrated approach is advisable.
- Adequate financial support for Research, Development and Demonstration must be made available on EU level to allow grasping the full benefit that energy storage technologies can bring to the energy system.

Thermal awareness

As the solar industry enters a phase of differing dynamics companies have to learn to differentiate their products to different markets with different needs. To achieve this there is a need for greater understanding of solar panels and what can potentially go wrong. Thermal imaging is a non-invasive method of inspecting solar panels in situ and Andy Baker, UK & Ireland Sales Manager at FLIR Systems discusses the potential benefits.

Picture of a Flir P660 thermal imaging camera Visual image of solar panels

It stands to reason that for maximum power generation, system life and the best return on investment every solar cell on a solar panel must be working. To provide this assurance, both post production, and once the panel is operating in the field, the industry is increasing employing thermal imaging as its preferred method for locating defects.

Thermal imaging allows anomalies to be seen clearly and, unlike other methods, can be used to scan installed solar panels during normal operation. It is also a highly time efficient process as a large area can be scanned in minutes.

Cooled thermal imaging cameras have been used in the research and development of solar panel technology for many years but it is the commercial uncooled cameras that are typically fulfilling the post-production, quality control and maintenance applications. These cameras are handheld, lightweight and inexpensive. They can also be used for a range of applications and with every new task added to the list the payback on the camera is even quicker.

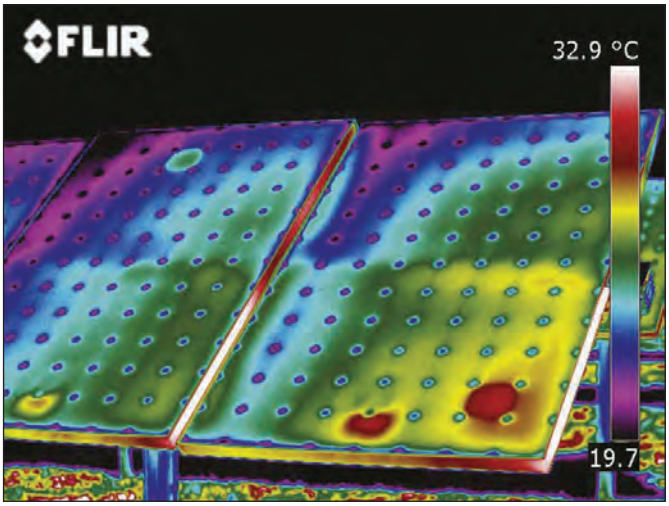
Ambient and measurement conditions

A few guidelines need to be observed when using thermal imaging to determine the working efficiency of photovoltaic modules with crystalline solar cells or thin-film modules in the field. Fundamentally it is necessary to ensure there is sufficient energy from the sun to achieve good a thermal contrast for accurate thermographic measurement; a solar irradiance of 500W/m^2 or higher is needed and optimally, 700W/m^2.

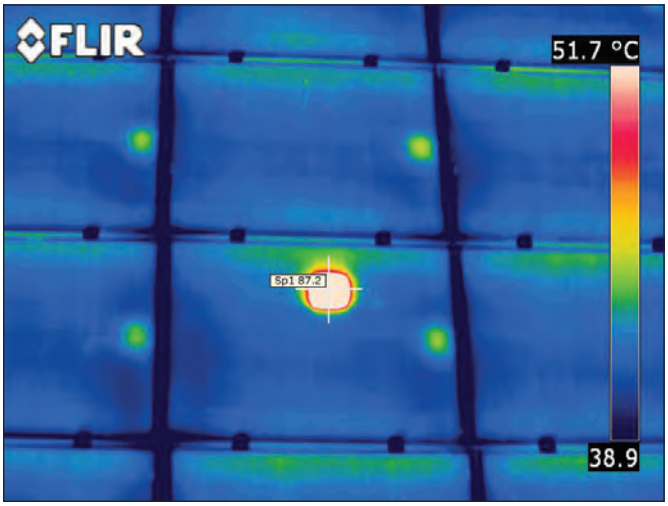
Ideally the sky should be clear as clouds reduce solar irradiance and also produce interference through reflections. However, informative images can still be obtained with an overcast sky provided the chosen camera has sufficient thermal sensitivity. Calm conditions are also desirable as airflow on the surface of the module will cause convective cooling, reducing the thermal gradient. The cooler the air temperature the higher the potential thermal contrast, so early morning inspection is certainly the best option.

Choosing the right camera

Handheld thermal imaging cameras typically have an uncooled microbolometer detector that is sensitive in the 8 – 14 μm waveband. However, glass is not transparent in this region. So when solar cells are inspected from the front, a thermal imaging



ID-15 Red spots indicate modules that are consistently hotter than the rest, indicating faulty connections



ID-16 Hot spot within one solar cell indicates physical damage within the cell

camera sees the heat distribution on the glass surface but only indirectly the thermal performance of the underlying cells.

As a result, the temperature differences that can be measured and seen on the solar panel's glass surface are small. In order for these differences to be visible, the thermal imaging camera chosen needs a thermal sensitivity of <80mK. It should also allow manual adjustment of the level and span function to optimise visual contrast.

Photovoltaic modules are generally mounted on highly reflective aluminium framework which shows up as a cold area on a thermal image. This is because it reflects the thermal radiation emitted by the sky. In practice this will mean a thermal imaging camera will record the framework temperature as being well below 0°C.

As the camera's histogram equalisation automatically adapts to the maximum and minimum measured temperatures, many small thermal anomalies will not be immediately visual. With manual correction of level and span however, clear contrast can be achieved. Digital Detail Enhancement (DDE) is also an extremely helpful function in this regard as it automatically optimises image contrast in high dynamic range scenes. A thermal imaging camera with this feature is therefore particularly well suited to fast and accurate solar panel inspection.

Some thermal imaging cameras now have in-built GPS and this is particularly useful for tagging faulty modules in large areas, a solar farm for example. An in-built digital camera is also beneficial as it allows a visual image to be saved with its thermal counterpart. Fusion is another relevant feature as it allows the thermal and visual images to be superimposed to give even greater clarity to resultant reports. Voice and text comments can also be added in the field.

Another feature that should be considered is Multi Spectral Dynamic Imaging - MSX technology. This technology takes

detail from the visual image to improve the thermal image. It makes it easier for the operator to see the problem in even greater detail. Solar panel inspection with MSX is therefore quicker and more effective, reducing time and cost.

On site considerations

The emissivity of a material is the relative ability of its surface to emit energy by radiation. It is therefore vital that this value is factored in to any thermal measurement and professional thermal imaging cameras will allow this to be pre-programmed.

As with all highly reflective material, the glass on a solar panel requires particular attention as any thermal image of its surface will also pick up the radiated temperature of surrounding objects including the camera and its operator! In the worst case, this results in false hotspots and measurement errors.

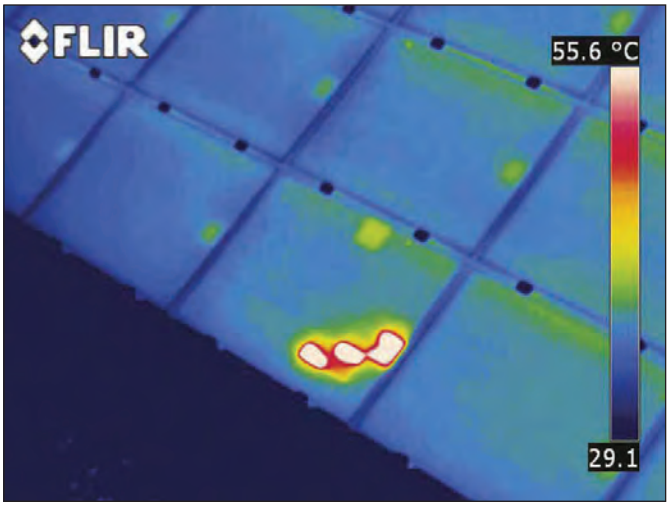
By adjusting the viewing angle these problems can be minimised or avoided and for this purpose a tripod will prove a useful accessory.

For some applications longer distance measurement can be advantageous as larger areas can be inspected in a single camera pass. To safeguard the clarity of the thermal image over a distance a thermal imaging camera with a minimal image resolution of 320 x 240 pixels is needed and better still one with 640 x 480 pixels.

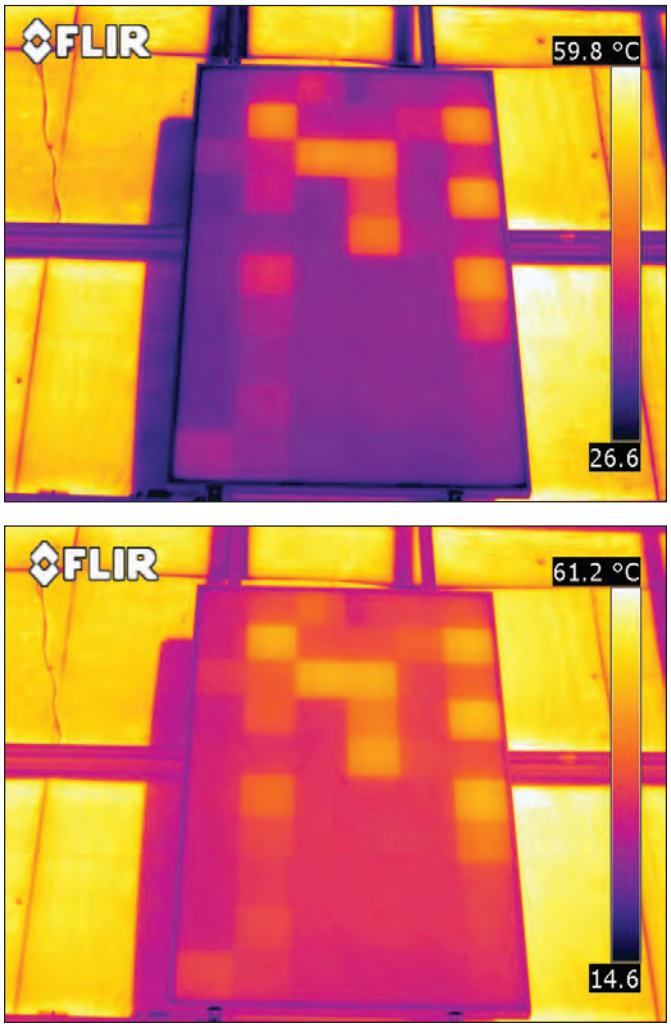
The high resolution camera should also have an interchangeable lens so the operator can switch to a telephoto lens for long distance observations.

Image analysis

The shape and location of hotspots on the thermal image will indicate a variety of faults. If an entire module is warmer than usual interconnection problems should be suspected. When individual cells or strings of cells are abnormally hot or shown as a warmer patchwork pattern, the cause can usually be found either in defective bypass diodes, internal short circuits or a cell mismatch. Shadowing and cracks in cells are evidenced by hotspots or polygonal patches in the thermal image. And the temperature rise of a cell or of part of a cell may indicate a defective cell or shadowing.



ID-19 Thermal image shows an example of 'patchwork pattern' indicating that this panel has a defective bypass diode



Thermogram with level and span in automatic mode (ID-20, top) and in manual mode (IR solar image, above)

Thermal images obtained under load, no-load and short circuit condition should be compared. And if the front and rear faces of the module have been both inspected, these should be associated too, although temperatures obtained from the back may be higher as the cell is not covered by a glass surface.

It should also be emphasised that classification and assessment of the thermal anomalies require a sound understanding of solar technology, the system under inspection and additional electrical measurements.

Future direction

This year's European Intersolar is occurring at a key time in the global solar industry as trade disputes are finally settled and the industry moves to the next stage of evolution following a year of upheaval. David Ridsdale looks at what the show has to offer.

AS the first major conference following the expected announcement of the EU anti-dumping trade case there is no doubt that this year's Intersolar Europe in Munich will be full of conversation about the impact the eventual result may be. Meanwhile the rest of the conference and trade show will offer the latest in technology and policies for the international solar and PV community.

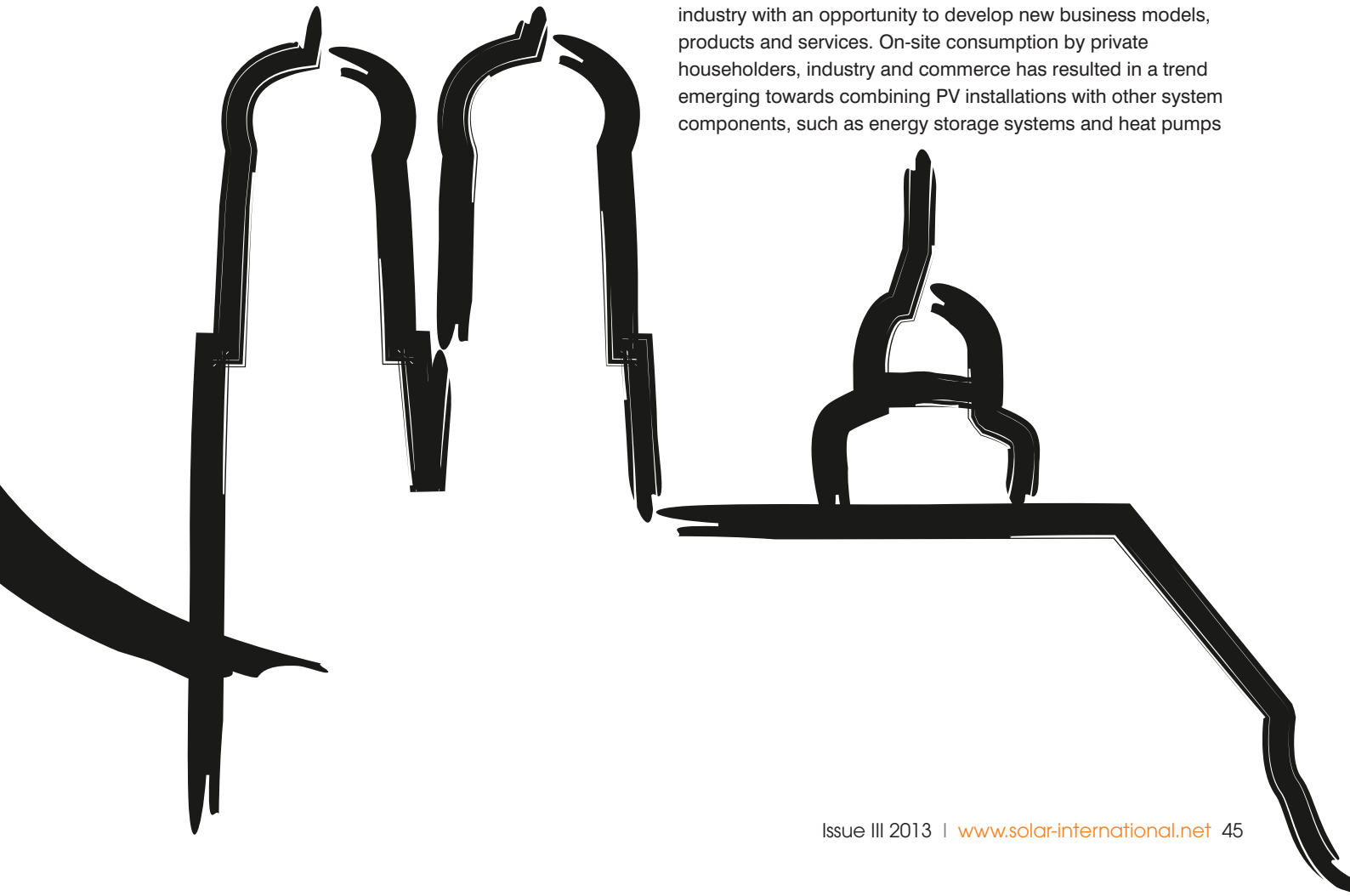
The photovoltaics market is undergoing a rapid transformation. Legislation and price developments are changing the conditions faced by the industry, with small and medium enterprises (SMEs) especially reaping the rewards. While reasonable rates of return were once predominantly guaranteed by feed-in tariffs, new business models are now emerging, with on-site consumption and direct marketing becoming increasingly attractive. New possibilities are even being created for plant financing in the form of plant leasing schemes and community energy cooperatives. At Intersolar Europe 2013, which takes place at Messe München, numerous exhibitors will showcase a variety of new PV system solutions and investment opportunities. Exhibition tours, workshops and presentations will shed light on topics from a variety of perspectives and a specially dedicated set of presentations at the Intersolar Europe Conference rounds off the range of information available at the exhibition on new business models for the photovoltaics (PV) industry.

Feed-in tariffs have provided the greatest incentive for investing in solar power. However, increasing electricity prices, tumbling feed-in tariffs and falling module prices are resulting in the on-site consumption of self-generated solar power becoming increasingly attractive. According to an electricity price analysis conducted by the Berlin-based German Association of Energy and Water Industries (BDEW), the electricity price paid by private householders in Germany has risen over the last five years from an average of 20.64 euro cents per kilowatt hour (kWh) in 2007 to 25.89 euro cents per kWh in 2012, and a further price increase is expected. It is a similar scenario in other regions.

Small and medium businesses (SMEs) are unable to escape the effects of rising electricity prices. Against this backdrop, the on-site consumption of solar power represents an attractive economic and reliable alternative to power generated using conventional methods. Additionally, low PV system prices mean that solar power can already be generated in Germany for between 12 and 15 euro cents per kWh. The desire for independence and electricity prices that remain calculable in the long term is exerting an ever greater influence on the purchasing decisions of private and commercial investors and companies.

From product manufacturers to systems providers

These changing demands are providing the photovoltaics industry with an opportunity to develop new business models, products and services. On-site consumption by private householders, industry and commerce has resulted in a trend emerging towards combining PV installations with other system components, such as energy storage systems and heat pumps



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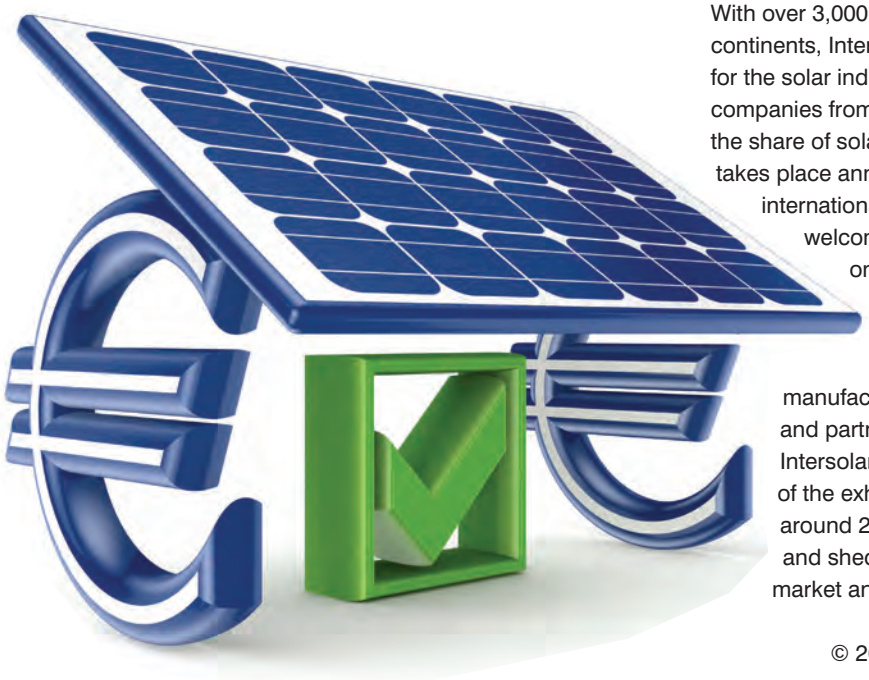
that work alongside energy management systems. Energy storage systems allow surplus electricity to be stored for times at which it is needed, while solar power can be used to drive heat pumps, and intelligent control systems allow solar power production and consumption to be synchronized with the use of domestic appliances. Installation engineers, planners and developers are also benefiting from these developments, as the on-site consumption market requires specialist expert knowledge and greater levels of consultation in order to meet consumers' individual requirements. Wholesalers and manufacturers are able to support their trading partners by providing documentation and use this distribution of targeted knowledge to tap new market potential.

German experience

Financial incentives for the direct marketing of solar power have provided PV plant operators with a worthwhile alternative to feed-in tariffs since the revised version of the Renewable Energy Sources Act (EEG) came into force in Germany on January 1, 2012. Operators are able to sell their power directly on the European Energy Exchange in Leipzig (EEX). The revenues generated from doing so are supported by market and management premiums, meaning that if the power is marketed appropriately, the overall revenue produced is able to exceed that provided by feed-in tariffs. Specialist power traders are combining the outputs generated by several operators into virtual power plants, minimizing costs and risks for individual operators. Added to this is the option of concluding private supply agreements, in which plant operators are able to make direct arrangements with consumers.

New avenues for financing PV plants are also being explored. In addition to selling their systems, manufacturers are also able to offer customers leasing opportunities, transforming themselves into electricity suppliers. Customers make a monthly advance payment for the electricity, while the manufacturers continue to own and operate the plants and cover the additional electricity demand in the form of power supply agreements.



Community energy cooperatives are another form of solar plant financing that is gaining in popularity. In Germany, more than 80,000 citizens participating in over 500 energy cooperatives are using such schemes to finance the energy transition from the grassroots level. Cooperative funding initiatives have clear advantages: Even citizens who are only able to make a small financial contribution can participate in energy projects and lend their support to generating energy decentrally and independently on a local and regional level, as well as helping such projects gain wide social acceptance.

Municipal utilities can also use the energy transition as an opportunity to gain a leading role in the market as regional suppliers of renewable energy. This is partly made possible through support from citizen participation schemes or partnership agreements with photovoltaics companies, again opening up a wide array of business models covering areas as diverse as power purchase, power production and infrastructural development for e-mobility.

European solutions

Information on these topics in a dedicated form can be found at Intersolar Europe 2013. Companies showcase solutions for the on-site consumption of solar power and 170 exhibitors are registered for the product division of energy storage systems alone. Visitors can also discover the latest information on the topics of energy storage systems and on-site consumption by attending the PV ENERGY WORLD presentation program or taking part in exhibition workshops and tours.

The Intersolar Europe Conference consolidates the topics of the exhibition and runs a double session entitled New Business Models for the PV Industry on June 18, 2013 from 10:00am–3:30pm.

With over 3,000 exhibitors and 100,000 visitors spanning four continents, Intersolar is the world's largest exhibition series for the solar industry and its partners. It unites people and companies from around the world with the aim of increasing the share of solar power in our energy supply. Intersolar Europe takes place annually at Messe München. In 2012, 1,909 international exhibitors and 66,000 trade visitors were welcomed to Intersolar Europe. The exhibition focuses on the areas of photovoltaics, PV production technologies, energy storage and solar thermal technologies. Since its founding, it has become an important industry platform for manufacturers, suppliers, wholesalers, service providers and partners of the solar industry. The accompanying Intersolar Europe Conference consolidates the topics of the exhibition. In 2012, more than 400 speakers and around 2,000 attendees discussed current industry topics and shed light on the background of technological, market and political developments.

Show tidbits

A key element of Intersolar is the chance for companies to demonstrate their wares and new offerings. Here are a few highlights to catch in Munich as well as some interesting programme activities.

Energy Storage

Phono Solar will unveil its latest storage innovations, which include its new high-performance Enercube. The Phono Solar Enercube is a storage solution designed to boost the efficiency of a photovoltaic system and is currently available in Germany, Europe's leading PV market.

The Enercube stores power generated by a PV system during the day and feeds it into the household power supply during the evening, when most power-consuming products run. The system utilises high-quality and long-life lithium iron phosphate batteries. During the summer, an Enercube and PV system work together to cover all the energy needs of a household. For the rest of the year, the system generates 30% to 65% of a home's energy usage.

Mariana Hall, Vice President of Phono Solar, said: "We're delighted to once again be present at Intersolar Europe. Europe is, and will remain, a key market for Phono Solar's global renewable energy vision. At Intersolar 2013, we will demonstrate to the industry the innovation, creativity and reliability offered by our solutions."

Phono Solar is also partnered with Borussia Dortmund football club. At Intersolar 2013, Phono Solar will auction player-signed BVB footballs and donate money raised to the BVB LEUCHTE AUF Foundation, which supports numerous charitable projects.

Chinese response

Highlighting the challenges Chinese companies face in light

of the dumping claims ReneSola is choosing to highlight its regional manufacturing strategy and commitment to EU markets at Intersolar 2013. The Chinese solar giant has announced plans to expand its production facilities in regional markets around the world to serve its growing international client base. This initiative will significantly reduce the company's transport costs while improving the availability of its locally produced products at a regional level. ReneSola currently has regional production facilities in Poland, South Africa and India, and intends to expand and open more in Europe in the near future.

"We have worked hard to establish a global presence and be a truly international business," says Xianshou Li, CEO of ReneSola. "Intersolar is an important occasion for us to show our commitment to the European market and our belief in its sustained potential. Positioning our manufacturing plants closer to our customers has long been a part of our corporate strategy. It saves money and time, while reducing the environmental impact of transport. But it also gives stock flexibility around the world, allowing us to adapt and respond better to peaks and troughs in demand."

ReneSola's regional facilities have a combined annual capacity of 400 MWp. The facilities, the first of which was established in 2009, create finished PV modules based on ReneSola's proven bill of materials, which includes ReneSola's advanced Virtus wafer technology Glass, aluminium and other more common components needed to create the modules are sourced locally, further reducing transport cost.

Each facility is operated by a production partner that creates finished products under the ReneSola brand. To ensure all modules are produced to its own high standards, ReneSola carefully selects and closely monitors its production partners worldwide, and ensures production is carried out in line with IEC (International Electrotechnical Commission) test reports and related factory inspection reports.

Banking success

The EPIA will hold a workshop "From PV Quality to Bankability" which will be held, on Wednesday, during the international solar trade fair Intersolar Europe.

Focusing on photovoltaic (PV) modules, this workshop will present the state-of-the-art technology and discuss the challenges of the industry's ongoing commitment to improving quality and reliability.

The workshop will feature an interactive panel discussion chaired by Fabrice Didier, of the EPIA Board of Directors and CEO of Saint-Gobain Solar, and will include representatives of manufacturers, PV project developers and laboratories.

European research approach

At Intersolar will be a conference entitled "Coordinated European R&D- Keystone for the reinforcement of the PV industry" which will be held, on Thursday. The event will be organised in the framework of the SOPHIA European project, in conjunction with the International solar trade fair Intersolar Europe.

Different stakeholders will gather to discuss R&D as the backbone of the PV industry. Results and experiences from different experts and researchers in the field will be shared in order to provide a common referential to conduct efficient and coordinated research work in the field of PV technologies. The conference will stand as a link between the research community and industrial members with a sole purpose to coordinate activities and strengthen the PV industry. The event will also feature an interactive panel discussion and will welcome around 100 representatives of the PV industry, PV research community, laboratories and innovative SMEs

Inverter material improvement

SMP will present inductive components for solar power inverters. The chokes are compact and low-loss with low stray fields and facilitate outstanding inverter efficiency.

The chokes' cores consist of powder composites with low magnetostriction, which SMP specifically engineers for solar inverter applications. With the low eddy current and hysteresis losses of these materials, the chokes allow the construction of exceptionally efficient inverters. Their encapsulated design ensures that they emit only low-intensity stray fields, so that they do not affect other components within the inverter. Compact choke design is another important aspect: SMP's chokes occupy 25 percent less space than conventional designs. Extremely quiet in operation, inverters with these chokes can also be used in residential areas.

Harvesting solar energy

Eaton will be presenting its portfolio of electrical solutions for the harvest and grid connection of solar photovoltaic (PV) energy at Intersolar Europe.. Eaton and recently acquired Cooper Industries will look at how customers can enable safe distribution of energy from solar panels to the power grid, and how to best protect their PV assets.

Eaton's solar industry portfolio includes components that provide reliable protection, switching and control technology for the safe operation of PV systems, using integrated or external disconnection equipment for automated and manual operation and for both ac and dc. Among the product highlights in Munich will be Eaton's Cooper Bussmann Division's new PV Combiner Box that sets new standards in the protection,

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switching and monitoring of PV systems. The configuration process allows users to easily and cost-effectively customise each unit to their individual application. The boxes are IP65 rated and include breather drains making them suitable for the most demanding climate conditions including tropical and sub-tropical environments. The portfolio also comprises a comprehensive range of fuse links, fuse holders, terminal blocks as well as surge protection devices.

Grid friendly offerings

AEG Power Solutions (AEG PS) will showcase a broad range of central inverters, energy storage systems and smart grid power solutions AEG PS will show a new 880 kVA central solar inverter, which supports up to 1300 kWp. The new Protect PV.800 offers several new grid-friendly features, such as stabilizing reactive power input in case of load peaks and fault ride through capabilities configurable for voltages and current. AEG PS' field programming solution allows for individual customization for all grid codes. The new Protect PV.800 and its brother PV.800 OD for outdoor applications, complement AEG PS' multi-megawatt utility scale PV system product portfolio. AEG PS will present the new innovative battery energy storage system (BESS) for short-term energy storage, designed to facilitate the transition to new ways of generating and distributing electricity. BESS offers grid stabilization and increased power quality, namely four-quadrant operation, peak shaving and load balancing, day to night shifting of renewable PV energy, and reliable PV power supply.

"Integrating renewable energy into smart grids is clearly the biggest challenge for smart grid advancements. With grid-friendly innovations like the PV.800 and BESS, which take the increasing diversity and variability of power generation into account, we are setting new standards in smart grid connection technology", says Bob Roos, VP Solar Strategic Business Unit of AEG.

European made modules

Soleos Solar is launching a new solar module. The polycrystalline Soleos 250P module is manufactured in Europe. It has a rated output of 250 watts and a module efficiency of 14.94 per cent. It thus produces more output and has a greater degree of efficiency than its predecessors. This new module will be shown for the first time at the Soleos Solar exhibition stand at Intersolar Europe, and will then be distributed by Soleos Solar company headquarters in Germany, through subsidiaries in France, Greece and Spain and through Soleos partners worldwide. Soleos only uses European-made components in the manufacture of the SOLEOS 250P modules. By using SOLEOS 250P modules, French investors profit from a 10-per cent bonus on their PV systems.

Thanks to a specially toughened front glass and increasing the thickness from 3.2 to 4 millimetres, the solar cells of the new module are optimally protected against difficult weather conditions. Soleos 250P can withstand snow loads of up to 5400 Pascal and wind loads of up to 2400 Pascal and is also suitable for horizontal installation.

"Our solar modules are particularly robust and have the highest possible certificates and approvals, which is why we can give our customers especially high product and performance guarantees", explains David Mabille, managing director of Soleos Solar. For the first ten years, the company guarantees its customers at least 90 per cent of the performance and gives them a ten-year product guarantee. The performance guarantee is 80 per cent up to the 25th year. All the company's solar modules are tested by TÜV Nord for adherence to the international IEC 61215 and IEC 61730 norms.

Discussion topics

Intersolar is more than products and runs a number of informative programmes to catch up on latest trends and technologies. The Intersolar Europe Conference deals with the entire spectrum of PV production technologies. Dr. Florian Wessendorf (VDMA Photovoltaic Equipment) shows how using new or alternative environmentally friendly materials, for example, can increase cost-cutting potential and efficiency. Carsten Mohr (Heraeus Precious Metals GmbH) explains the example of replacing silver in solar cell production. Stefan de Haan from market research company IHS Solar summarizes the latest developments in the polysilicon market.

There is a focus on the technological advances achieved by suppliers of PV production plants, in particular those relating to module quality and reliability as well as competitive manufacturing costs.Following a market overview by Dr. Finlay Colville (Solarbuzz), presentations and discussions look at the role of automation technology and process sign-off.
There will be an insight into the technological achievements of international research institutions in the field of market-dominating, silicon-based photovoltaics, and showcase innovations from plant manufacturers and selected module manufacturers. Prof. Dr. Ralf Lüdemann (Chief Technology Officer, SCHMID Group) and Dr. Karl Heinz Küsters (Senior Vice President Technology, Hanwha Q CELLS GmbH) speak about the next level for the industrial production of crystalline modules and their prospects.

The technology sessions end with thin-film photovoltaics, which broke several records in efficiency at the beginning of the year. The presentations focus on CdTe in multi-megawatt power plants, CIGS and organic tandem cells.

India moves solar forward

India has been tipped as one of the emerging markets to watch in the solar and PV industries for a few years now but progress has been uncertain at times. Raj Prabhu, CEO at Mercom Capital Group looks at the recent growth in the country and finds an industry finally meeting expectations with almost half a gigawatt installed this year so far.

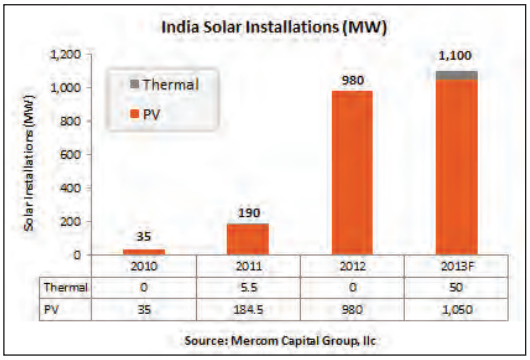
Current cumulative solar installations in India stand at 1,761 MW with about 557 MW installed so far in 2013. With most of the CSP projects that were due to be commissioned in May 2013 delayed, the forecast for installations in 2013 looks flat compared to 2012. Only about 60 percent of the targeted installation goal has been achieved so far despite the commissioning deadline of Phase 1 of JNNSM ending in May. Considering India is an emerging solar market where the growth rate is expected to be much higher than other parts of the world, installations in 2013 will likely end up disappointing the markets. The current solar policy environment looks more like an experiment than a serious policy that will help solve the current power crisis in India.

Solar can truly be a game changer in India as a disruptive energy source that has the potential to solve energy poverty, address India's massive power shortage problem and dramatically impact India's slow growth rate and inflation. However, the current "please all parties" policy regime is forgetting the key stakeholder, the consumer. Policy uncertainty is rife, with rules changing every other month.

The current PV/CSP split and domestic content requirements are examples of this. The initial analysis of the Indian solar market still holds true: We said that dictating the ratio of technology (PV:CSP), rather than allowing the market to select the most efficient and cost effective technology for India, was not a good idea due to CSP costs, water shortage in India, and a 30 percent domestic content requirement. Still, policy makers bent to the CSP lobby and sliced the solar pie to please everyone, and the result should not surprise anyone. The 470 MW CSP due to be commissioned in May 2013 are struggling to complete with only 50 MW to be commissioned and the rest have been granted a 10 month extension. We strongly urge JNNSM to discontinue the PV/CSP split and let the markets pick the most cost effective technology.

Lessons to be learnt

Despite these early growing pains, there are few signs yet to indicate lessons have been learned. Domestic content requirement policies (like those that contributed to the delays that CSP developers are experiencing) are being pursued even more aggressively. There are talks about closing the thin film "loophole" in the

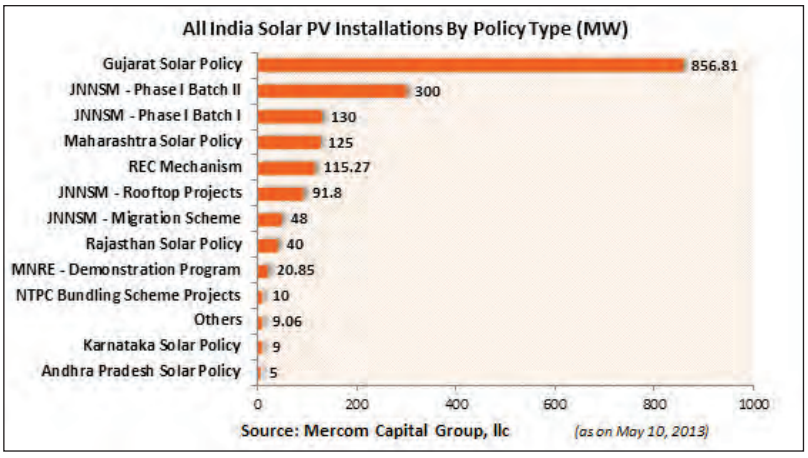


domestic content requirement, again picking and choosing technologies to appease the local PV manufacturing lobby. There is a disconnect between the policies pursued and the original goal of procuring solar at the most cost effective prices. In fact, many policy changes have been contradictory. The reverse bidding process was chosen so solar could be procured at the lowest possible bids but now all efforts are being made to ensure that developers can't access the lowest priced equipment. The government is desperate for foreign investments in power projects, but at the same time they scare away investors by dictating how projects are to be built and where their equipment should be made. All this has made the investment community very confused.

The latest WTO ruling against the Canadian province of Ontario sets a precedent and is a big blow for countries pursuing domestic content requirements. It would be wise for India to settle its trade dispute and remove the uncertainty clouded around this case.

JNNSM phase II draft policy proposal

The Ministry of New and Renewable Energy (MNRE) recently proposed a draft Phase II policy



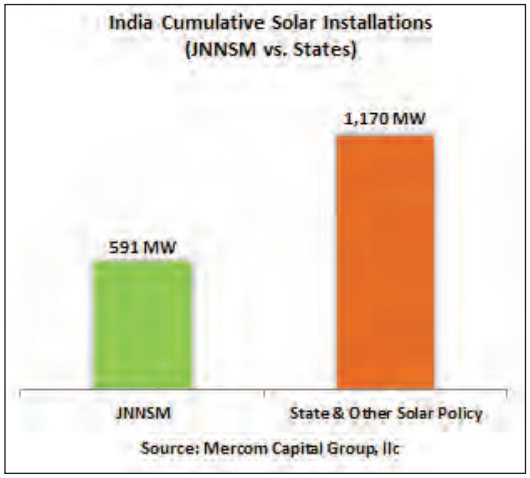
Utility-Scale Solar Projects in India	
Operational and Under Development	
Updated on May 10, 2013	
	Capacity (MW)
In-Operations	
Solar PV	1760.8
Solar Thermal	5.5
Total	1766.3
Under Development	
Solar PV	1491.2
Solar Thermal	505.0
Total	1996.2

Source: Mercom Capital Group, llc

and has opened it up for comments. Phase II would have a target of achieving 3,000 MW of solar power through various batches as previously seen in Phase I. The Batch 1 of the Phase II policy is targeting 750 MW of solar installations. Instead of bidding for the lowest tariff, developers will now be bidding for the Viability Gap Funding (VGF) requirement.

Under VGF, developers will sign a Power Purchase Agreement (PPA) for 25 years to sell power at a fixed tariff of Rs.5.45/kWh (~$0.10/kWh). In the case of accelerated depreciation, the tariff will be reduced by 10 percent to Rs.4.95/kWh (~$.09/kWh).

The maximum limit for VGF is 30 percent of the project cost, or Rs.2.5 crore/MW (~$500,000/MW), whichever is lower. The challenge with VGF is that since most of the funding is done upfront, there is no incentive to build the most productive project, a recipe for disaster in a young and inexperienced market. This is yet another experiment to see what happens. If the policy environment was conducive for investments, a mechanism like VGF to make solar projects commercially viable would be unnecessary.



To make it even more interesting, the 750 MW Batch 1 of Phase II policy will be spilt into "Part A" and "Part B". Part A does not have a domestic content requirement and Part B does. The MW split is currently under review.

With so much complexity, developers have to ask the question: is JNNSM worth all this trouble? Or is it better to pursue individual state policies? Looking at the cumulative installation data and in spite of all the noise around JNNSM and since announcing the policy in 2010, only about half - 591 MW has come from JNNSM projects compared to approximately 1,170 MW installed through various state policies.

Update on various India state policies

JNNSM - Phase I

Batch 1 – PPAs for Batch 1 projects were signed on January 10, 2011 for 610 MW (140 MW-PV, 470 MW-CSP). PV projects were due to be installed by January 9, 2012. 130 MW have been commissioned, with several delayed for months, incurring fines. 10 MW have been canceled because two project developers failed to execute.

Only one 50 MW CSP project is expected to be complete out of the 470 MW that are due to be commissioned by May 2013. The remaining projects have been granted a 10 month extension giving the developers a total of 38 months to complete from their PPA signing dates, which would move these projects to a 2014 commissioning date.

Batch 2 – 300 MW of the 340 MW Batch 2 projects have been commissioned so far with the remaining 40 MW expected to be commissioned in the next 3 months.

JNNSM - Phase II

Phase II policy announcements by MNRE are expected to be made sometime in the May-June timeframe. The target for installations under Phase II is about 3,000 MW, which would include different mechanisms like VGF and bundling of power. The draft proposal will be submitted to the cabinet for approval which is expected to take another month.

As part of the JNNSM Phase-II Batch-I, Solar Energy Corporation of India (SECI) will be announcing a Request for Selection (RfS) to set

up grid connected solar PV projects for a total aggregate capacity of 750 MW. The bidding process will be divided into two parts, Part A and Part B. Bidders can apply for projects under Part A or Part B or both Part A and Part B. Projects under Part B will have a domestic content requirement, the only difference between the two.

Tamil Nadu
Tamil Nadu proposed a goal of 3,000 MW of solar power by 2015 through utility-scale and rooftop projects. It announced a 1,000 MW tender in December 2012 for solar projects. However, qualifying bids only amounted to 494 MW. Out of that, only 266 MW of projects were issued a letter of intent; the rest are pending.

Tamil Nadu used an L1 bidding process (the lowest bid has to be met by all bidders). This resulted in a very low (Rs.5.47/kWh - ~$0.10/kWh) bid which was deemed unviable and prompted Tangedco (the state DISCOM - or government utility) to fix Rs.6.48/kWh (~$0.12/kWh) as the acceptable bid.

Essentially, Tamil Nadu is establishing an FiT even though it is calling the process "bidding."

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Tamil Nadu faces severe power shortage problems, but the state is also notorious for not paying the power producers on time.

Gujarat
Gujarat currently has 857 MW of solar PV plants commissioned and no policies coming up in the foreseeable future for solar development.

Odisha
Odisha is scheduled to announce a new solar policy by the end of June. The state has installed a total of 13 MW; 5 MW under JNNSM Batch-I and 8 MW under JNNSM rooftop projects. Another 55 MW have been allocated and work on these projects is expected to begin soon.

Madhya Pradesh
The Madhya Pradesh Power Management Company, the holding company for all DISCOMs in the state, signed PPAs for 225 MW of PV projects with five project developers under a reverse auction mechanism, and another 50 MW with National Thermal Power Corporation (NTPC) with a December 31, 2013 deadline for commissioning.

Andhra Pradesh
Andhra Pradesh announced bids for 1,160 MW of solar PV projects which was oversubscribed by 570 MW, totaling 1,730 MW. Project sizes are 5 and 10 MW each. The highest bid was Rs.15.99/kWh (~$0.30/kWh) and the lowest bid was Rs.6.49/kWh (~$.0.12/kWh).

Chhattisgarh
Chhattisgarh recently announced a solar policy with a goal to develop 500-1,000 MW of PV projects by 2017. Projects amounting to 225 MW are pending PPAs and may be signed in three to four months. The delay in signing PPAs is due to the local DISCOM reportedly sitting on a power surplus, a rarity in India.

Maharashtra
Maharashtra State Power Generation Company Limited (MahaGenco) currently has 160 MW of PV projects installed. 125 MW of the 150 MW Dhule solar project is complete with the remaining 25 MW to be commissioned. The project has a rich Rs.15.31/kWh (~$0.29/kWh) tariff and is split between 50 MW thin film and 75 MW c-Si modules.

Rajasthan
Rajasthan issued a 200 MW RfS for 100 MW of solar PV projects and 100 MW of CSP projects, resulting in only 75 MW of solar PV projects being selected due to a lack of interest in CSP projects. The lowest bid was Rs.6.45/kWh (~$0.12/kWh) through an L1 bidding process.

Punjab
Punjab had set a target of 1,000 MW of solar power generation capacity under the 2012 New and Renewable Sources of Energy (NRSE) Policy released in December 2012. The tender is expected to open in May and will follow the L1 bidding process.

IEA reports on German energy progress

Germany has been the global leader in solar and renewable energy adoption for many years but this has come at a cost with the country's energy costs the highest in Europe. The IEA has published a report that looks at the country's progress and calls for cost reductions, investment in networks and closer regional co-operation to maintain the impressive progress.

In a review of German energy policies the International Energy Agency (IEA) commended Germany for its commitment to developing a low-carbon energy system over the long term, in particular its comprehensive energy strategy, ambitious renewable energy targets and plans to reduce energy consumption. The report noted that Germany has successfully implemented a broad suite of robust energy policies across all sectors notably in energy efficiency and climate change.

Nonetheless, the scale of Germany's energy policy ambitions, coupled with the size and energy intensity of its economy, and its location at the heart of Europe's energy system, mean that further policy measures are necessary if the country's ambitious energy transformation, or Energiewende, is to maintain a balance between sustainability, affordability and competitiveness.

Who pays and for what?

To date, German consumers have absorbed the costs of the Energiewende, but the debate over the social and economic impacts of the Renewable Energy Sources Act (EEG) has become more prominent as the share of renewable energy has continued to grow alongside rising electricity prices.

"The fact that German electricity prices are among the highest in Europe, despite relatively low wholesale prices, must serve as a warning signal," said IEA Executive Director Maria van der Hoeven as she presented the report, Energy Policies of IEA Countries – Germany 2013 Review.

Electricity from renewable sources, has expanded dramatically thanks to the support of feed-in tariffs established by the EEG. This policy tool has been successful in bringing costs down. Conversely, the federal government has been less successful in managing the volume of new capacity. The rapid, uncontrolled deployment of PV has become a major policy concern and represents a significant cost for consumers.

Germany's PV growth in 2010 & 2011 was largely driven by cost decreases in the Chinese market and policy changes in other countries. In 2011, together with Italy, Germany accounted for nearly 60% of global market growth! In both 2010 and 2011, the amount of capacity installed in Germany was more than double the forecast in the National Renewable Action Plan. Germany reacted to an over supply of energy and quickly reformed the feed-in tariff regime. Lessons have been learned but the IEA cautions that further growth must happen in a controlled manner and in parallel with grid developments and investments in distribution networks as well as the new smart grid.

The federal government has reformed and refined the EEG on a number of occasions in an effort to reduce its costs: for example by introducing flexibility and market premiums, tariff reductions and a cap on eligibility. The report warns the federal government they must continue to explore and implement mechanisms that reduce the cost of new incremental capacity and bring new additions closer to market requirements.

Long term commitments

Despite the cautions the IEA praised the fact that energy policy is based on long-term investment decisions, and the framework conditions in Germany for a policy consensus in favour of large-scale deployment of renewables have never been better.

Van der Hoeven added, "The German government should maintain its policy course based on a predictable and stable regulatory framework while actively seeking means to reduce the costs. Sudden changes can undermine investor confidence and will drive up costs in the long term: Any form of retroactive tariff cuts – even if applied for only a short period – must be avoided."

The report suggests there is a need to develop suitable mechanisms to manage the cost of incremental renewable energy capacity via cost-effective market-based approaches, which will support the forecast growth of variable renewable electricity generation and brings new capacity closer to market needs, supports investments in appropriate locations and complements planned network expansion.

Large investments are needed in order to keep pace with the unpredictable growth of renewable capacity, notably solar PV and wind power. The expansion of the transmission and distribution networks is the most important means of transforming energy supply away from nuclear power and coal towards greater levels of renewable energy.

Changes to the German Energy Act and the introduction of the Network Expansion Acceleration Act represent significant steps forward. The report praises the ten-year network development plans that have been published and should deliver greater investment in network expansion in a coordinated manner. Nonetheless significant challenges remain, not least managing the costs, estimated to be up to EUR 70 billion.

Germany must also develop structural co-operation at regional level, and within existing European mechanisms, in order to enhance security of supply at reasonable cost, especially under extreme weather conditions or periods of prolonged high demand. Furthermore, decisions on German energy policy inevitably have an impact far beyond the country's borders and should be considered within the context of a broader European energy policy framework and in close consultations with its neighbours.

Report recomendations

Among the key recommendations, the report calls for:

- The development of suitable mechanisms to manage the cost of incremental renewable energy capacity via cost-effective market-based approaches, which will bring new renewable capacity closer to market needs, support investments in appropriate locations and complement planned network expansion;

- Measures to ensure that the costs of the Energiewende are minimised and allocated fairly and equitably across customer groups, including households and small businesses, producers of renewable energy and energy-intensive industry and limit the growth of the Renewable Energy Sources Act surcharge attributable to the deployment of additional renewable energy capacities, while drawing all benefits from the rapid decrease in technology costs that has occurred;

- Timely and cost-efficient investment in transmission and distribution networks and a regulatory system that provides sufficient financial incentives and investment security for mobilising the necessary investments in distribution;

- An assessment, in co-ordination with all relevant stakeholders, of the extent to which the present electricity market arrangements en able the financing of economically viable investments in new, flexible gas-fired generation and cost-effective electricity storage. Part of this assessment must examine the suitability of capacity markets as a transitional measure to support the adjustment to a post-nuclear power system.

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Moving forward

The solar industry remains at a cross roads as politicians argue about the best way to deal with trade concerns regarding the fairness of the international market. The fall out from these issues have had a far reaching effect across all companies and areas. Companies from China face international concerns in manufacturing and financial practices creating problems whether they have been involved in issues or not. Investor confidence has been shaken and one Chinese based international company has decided to pro-actively tackle concerns.

One of the biggest hurdles in trying to get a solar power project off the ground is securing finance. As well as looking at yields, lifecycles, tariffs and running costs, lenders and operators will also pay close attention to the manufacturer of the solar panels at a given site. To help with this last aspect ReneSola, has created a comprehensive guide to its PV operations, the Bankability Book, which the company says will help European and U.S. businesses in particular secure solar financing faster.

"In today's financial climate, particularly in the Eurozone and the U.S., banks need convincing that the money they lend will see a return," says Xianshou Li, CEO of ReneSola. "We want to lead the solar industry in terms of providing the information finance houses need, so that our customers can get on with making money from their ReneSola panels at the earliest opportunity. We want to be transparent about our work and this document will help investors, installation companies and banks get everything they need."

The Bankability Book is a novel financing tool that provides information on the company, which should satisfy the vast majority of financial houses' requirements in terms of due diligence. It was created to tackle the growing number of PV projects that require bankability in order to get off the ground.

Transparent dealings

The catalogue of information includes details on every aspect of ReneSola's business from product development and manufacturing to marketing and after sales service. It is a live directory, and ReneSola will constantly update it with the latest information, ensuring it meets even the most specific of information requests.

The Bankability Book will be particularly useful in supporting smaller businesses and banks, which generally have less experience of the solar industry. This lack of knowledge understandably raises an above-average number of questions at the planning stage that must be answered before finance is awarded.

Of course "bankability" itself varies from project to project and requirements differ, with larger projects in particular requiring a more detailed approvals process. Also, ground-mounted PV projects almost always require bankability. Looking at 2011 alone, installed ground-mounted PV capacity accounted for

Founded in 2005, ReneSola is a global manufacturer of high-efficiency solar PV modules and wafers. Leveraging its proprietary technologies, economies of scale and technical expertise, ReneSola uses in-house virgin polysilicon and a vertically integrated business model to provide customers with high-quality, cost-competitive products.

ReneSola solar modules have scored top PVUSA Test Conditions (PTC) ratings with high annual kilowatt-hour output, according to the California Energy Commission (CEC). ReneSola solar PV modules can be found in projects ranging in size from a few kilowatts to multi-megawatts in markets around the world, including the United States, Germany, Italy, Belgium, China, Greece, Spain and Australia.

29% of the worlds installed PV capacity. A standard bankability analysis process looks at legal, technical and economic risks of a project, with the PV modules accounting for the majority of the technical assessment. For a PV module to be deemed bankable, it must prove its worth in several key areas. Firstly, market-specific certifications are essential. Modules must also have a proven track record of yield and long-term performance. Suitable guarantees and warranties are also checked and an assessment of cell and module technology is carried out. Finally, the manufacturer's own brand image is taken into consideration. The Bankability Book from ReneSola addresses each of these areas and delivers all the necessary information to support the company's products.

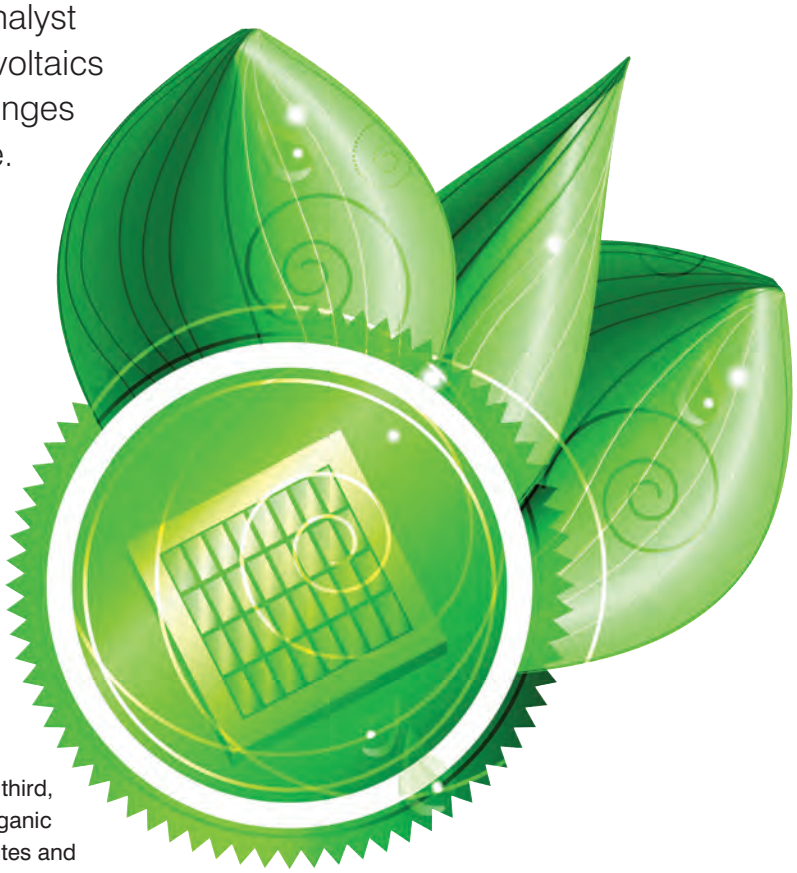
Consistent development

Since ReneSola's PV manufacturing facility started producing solar PV modules in 2005, the company has continued exploring new ways to build better modules with globally recognised accreditation. The Bankability Book includes details on these efforts as well as the company's production processes, products, bank and insurance details, certifications, test and audit reports, as well as international project references. The world of solar PV manufacturing is congested with little to choose between manufacturers in terms of technology. With increasing commoditization, customers are looking increasingly at other areas such as customer support, financing and availability when choosing a PV provider. With that in mind, the Bankability Book will help customers get their projects approved and also give ReneSola a competitive edge by clearly and swiftly demonstrating the value of its products.

ReneSola's Bankability Book was prepared following a comprehensive factory audit carried out by Accelios Solar GmbH, a specialised solar consulting service, which visited ReneSola's 1.2 GWp capacity plant in Yixing, Jiangsu Province, China, on several occasions.

The future's organic

Dr Harry Zervos, Senior Technology Analyst at IDTechEx discusses Organic Photovoltaics (OPV) unique selling points and challenges facing the industry for the next decade.



The first two generations of photovoltaics, wafer-based and thin film devices, have seen mass market adoption in recent years, with different technologies characterized by varying degrees of success. Crystalline silicon platforms are by far the most successful, holding over 80% of market share, but are currently characterized by low profitability. Thin films have found success in markets where large land areas are available (e.g. solar farms) or in parts of the world where weather conditions limit the power output of silicon modules (e.g. humid, hazy regions).

These first two generations are now being followed by a third, which includes dye sensitised solar cells (DSSC) and organic photovoltaics (OPV). These devices offer different attributes and are characterized by different performance metrics.

As discussed in the recent IDTechEx Research report "Organic Photovoltaics (OPV) 2013-2023: Technologies, Markets, Players" organic photovoltaics, although potentially a disruptive technology, do not currently offer very high efficiency levels or lifetime and these characteristics limit their market uptake. On the other hand, OPVs can offer versatility in form factor, improved indoor performance and low capital expenditure for large scale manufacture.

The report discusses in detail the market trends and forecasts for growth in the next decade, as well as the main sectors that will be initial target markets for organic solar cells.

Organic PV: attributes, unique selling points and challenges

Printability and flexibility of form factor are the main characteristics in which organic PV outperform competing technologies but difficulties in achieving long lifetimes and higher efficiencies pose a barrier to further adoption of the technology. Based on extensive interviews with players across the industry, including academics, manufacturers and potential end users, there are now roadmaps tracing yearly developments in efficiency, lifetime and cost levels of organic photovoltaics.

Efficiency

Efficiency levels are likely to remain under 10% in the next 5-8 years, even in tandem-cell modules. Analysis suggests that no breakthrough in technology will occur and improvements take place slowly and linearly in time. This holds true in spite of the fact that a diverse range of active materials can be envisioned and synthesised for use in OPV cells.

This means that OPVs will struggle to outperform more established technologies of today. As a conclusion, breaking the 10% barrier in module performance is not anticipated before

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Lifetime

OPV device performance degrades severely when exposed to ambient moisture and oxygen. The net effect typically is that OPV cells die within days if not encapsulated while lifetime remains on the order of 2-3 years when passivated using existing flexible encapsulation solutions.

Rigid glass encapsulation (such as float glass for instance) allows for 10+ years lifetimes to be achieved but of course, it compromises the attributes of flexibility in form factor. There is currently active R&D for developing flexible barriers with sufficient performance, solutions are explored based both on plastic substrates with transparent inorganic layers deposited on them (3M, Toppan, etc,) and on thin flexible glass developed by major glass companies such as Schott, Corning or NEG. Although able to reach adequate performance characteristic none of the current techniques offer favourable price points.

Future potentials

Putting together a roadmap based on our understanding of the industry and announced lifetimes of organic PV cells from major developers, we have included three different scenarios:

- Interest in OPVs remains limited leading to reluctance from barrier companies to invest further. In this scenario, high performance remain achievable but at prohibitive prices.
- Highest performance barriers remain out of reach but an intermediate range of barriers become available at reasonable price points. In this scenario, the market pull stems from applications such as posters and point-of-sales, indoor consumer electronics, etc.
- The market pull is strong, leading to large-scale investment in barrier technology. This scenario is helped by the fact that OLEDs also suffer from a similar challenge, resulting in a synergy that pushes market demand.

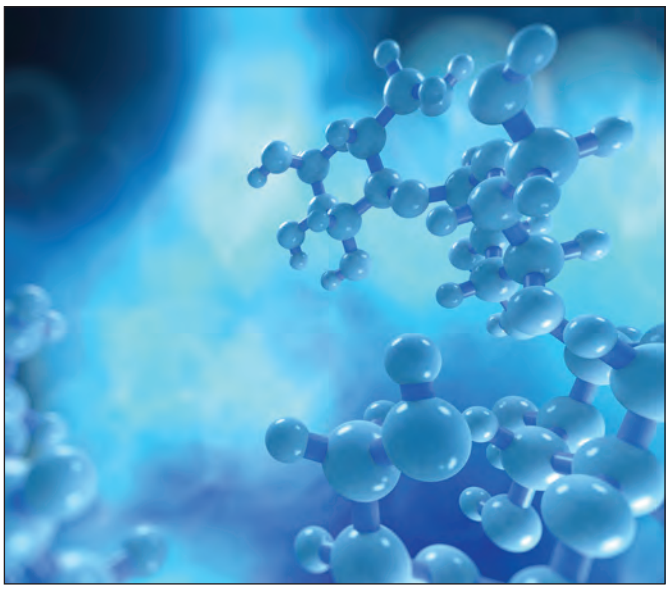
Cost roadmaps

The energy generation cost is the most critical aspect of a given PV technology. It largely determines the market demand and penetration. Based on potential future technology developments, we estimate a cost per watt metric, with assumptions that there won't be significant changes in factors such as:

- The price points for transparent conductors
- Low cost encapsulation such as glass
- Small volumes of active materials due to limited market penetration

In this case, even a 6.8% efficient organic PV module would be characterized by a cost of $2.8/Watt. Based on the above analysis of efficiency, lifetime and cost developments in the next ten years, we are expecting OPVs to initially serve niche markets.

As a result the overall value is expected to remain smaller than $87 million in 2023 and the total installed capacity in 2023 at <74 MW. These are not large values considering that the total installed PV capacity in 2011 was 23-24 GW. Therefore, organic PV will remain a small market with approximately 1% total market share.



OPV device performance degrades severely when exposed to ambient moisture and oxygen. The net effect typically is that OPV cells die within days if not encapsulated while lifetime remains on the order of 2-3 years when passivated using existing flexible encapsulation solutions

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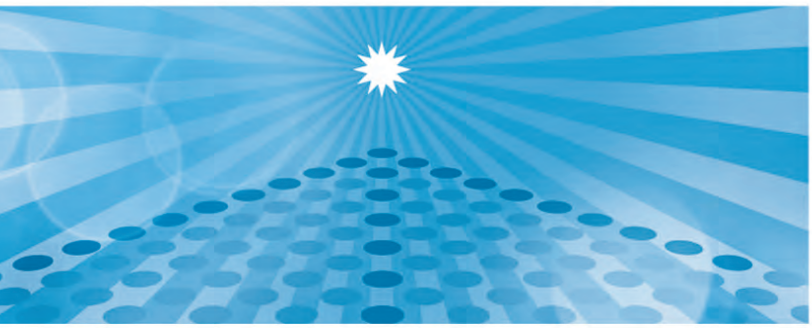

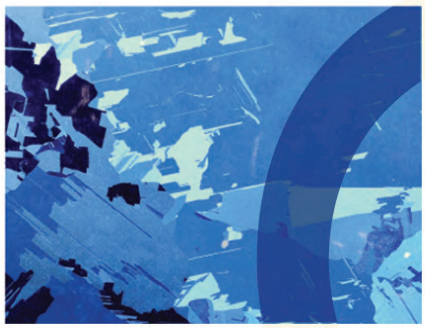

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Return to profitability

After two years of turmoil the solar industry is set to rebound, and surviving stakeholders have a fresh new outlook that's ripe for investment, says Lux Research.

OVERCAPACITY and poor margins have bankrupted a multitude of solar suppliers and forced corporate investors out of the market over the past two years. However, according to Lux Research, the industry is set to recover thanks to converging supply and demand. Smart corporate investors have recognized the coming resurgence and formed partnerships in strategic areas like system deployment or balance of systems technologies.

The industry's turnaround comes as a result of multiple factors reversing its downward momentum. Lux Research's analyzed solar market industry movement, and found the following:

• Margins recover as oversupply plummets in 2015. Thanks to the bankruptcies of uncompetitive players, and underlying financial constraints preventing capacity expansion, overall module capacity will decrease to 58 GW in 2015. Meanwhile, the growth of new markets like China will lead to global demand growth from 31 GW in 2012 to 52 GW in 2015. In combination these will lead to module oversupply of only 12%, down from 100% in 2012. Module margins will recover up to 10%.

• Corporate thought leaders will race to re-enter the market. Some early movers like BASF and Johnson Controls have already made strategic moves to enter the market by leveraging existing technologies or market platforms, while ABB made a billion-dollar acquisition of a major solar inverter supplier. Others will race to form partnerships and make acquisitions in 2015, driving up the cost of entry. Those that choose to slow-play the market will risk finding themselves on the outside looking in.

• Stakeholders are planning years ahead. As the surviving supply landscape becomes increasingly clear, winners are ensuring their positions in the market for the long-term by investing in technologies to increase performance, lower costs, improve product quality, and enable new features. Areas of investment range from high-efficiency crystalline silicon cell technologies – note First Solar's acquisition of Tetrasun – to hybrid photovoltaic/thermal cogeneration systems from the likes of IBM, to coatings for higher-quality, longer-lasting modules – a major focus in light of recent allegations of defective products.

The market has changed drastically over a short span of time. Large, dominant manufacturers have risen in concert with many spectacular failures thanks to steep cost reductions. Meanwhile, corresponding incentive reductions have forced developers to quickly adapt business models and find new markets. These growing pains have scared many investors away but the positive outlook on market and industry player health is sure to bring many back into the fold.

The industry's rough maturation has cast it in a poor light, but solar's growing presence in the future energy mix is undeniable, as also exemplified in the energy outlooks from several prominent oil companies. What remains to be seen is which corporate leaders will find mutually beneficial partnerships and investments early and reap the rewards of growth for a low price, and which laggards will miss out on the opportunity.

Japan tipped to be number one

Japan set to become world's largest solar revenue market in 2013 as installs boom.

JAPAN'S solar installations surged by a stunning 270 percent (in gigawatts (GW)) in the first quarter of 2013, positioning the country to surpass Germany to become the world's largest photovoltaics (PV) market in terms of revenue this year. Although Japan is forecast to install fewer GW than China (which is forecast to be the largest market in GW installation terms) in 2013, the high prices of PV systems in Japan will drive it to become the world's largest market in revenue terms.

A total of 1.5 gigawatts (GW) worth of PV systems were installed in Japan in the first quarter of 2013, up from 0.4 GW during the same time last year, according to a new report entitled "The Photovoltaic Market in Japan" from IHS .The phenomenal growth that started the year is expected to continue throughout 2013 as demand for solar energy is forecast to double, making Japan the world's largest market for PV installations on a revenue basis for the first time in a decade. Japan's share of global PV system revenue will rise to 24 percent in 2013, up from 14 percent in 2012 and just 9 percent in 2011, as presented in the attached figure.The former top-ranked country, Germany, which had held the No. 1 spot from 2009 through 2012, will fall to third place this year, behind Japan.

"Following the earthquake and tsunami in 2011 that led to the shutdown of nuclear facilities and a shortage of electricity, Japan has aggressively moved to promote solar energy," said Sam Wilkinson, solar research manager at IHS. "Japan's government has introduced a highly attractive FIT to help stimulate solar growth. In contrast, the European market that historically has led global solar demand is slowing as regional market conditions become less attractive. The deceleration in Europe and the implementation of the FIT in Japan are combining to propel the country to the top of the global solar market this year."

Japan is forecast to install $20 billion worth of PV systems in 2013, up 82 percent from $11 billion in 2012. In contrast, the global market is set for tepid 4 percent growth. The strong revenue performance for Japan this year is partly driven by the high solar prices in the country.

"High system prices in Japan have always resulted in the country accounting for a significant proportion of PV system revenues," Wilkinson said. "Now these high prices are making Japan the world's No. 1 market—and attracting the attention of global suppliers in the process."

Interest now has shifted away from Europe toward Japan from global PV suppliers, who see the country as representing a huge opportunity. Given that prospects are evaporating in many of the markets where they had previously focused, Japan's boom comes at a good time. In contrast to solid expansion in

Japan, installations in Europe declined by 34 percent year-on-year in the first quarter. Europe previously had been the main focus of almost all PV suppliers and had provided the lion's share of global demand. But in the first quarter of 2013, Europe accounted for 40 percent of global demand, down from 70 percent just one year before. As European markets become less attractive, suppliers are seeking greener pastures elsewhere.

"Continued reductions in feed-in tariff rates and incentives, combined with the introduction of antidumping import tariffs, have resulted in many of the largest suppliers switching their focus to new opportunities," Wilkinson said.

The PV market in Japan is not without challenge. While growth opportunities exist in the country, capitalizing on them is not easy. Strict certification requirements make it difficult for suppliers to release products. Furthermore, a strong preference for Japanese brands, particularly in the residential market, means that forging partnerships with local suppliers is essential.

"Although international suppliers have only been able to win limited business in the residential sector, mostly by supplying local suppliers through agreements with original equipment manufacturers, the situation for larger systems is quite different," Wilkinson said. "The fastest-growing market segment is forecast to be systems larger than 1 megawatt, which is expected to grow by more than 500 percent in 2013. International PV module suppliers have been more successful in partnering with local project developers and have been able to ship large volumes to Japan to serve this market."

Maintaining energy control

SiC device could mitigate blackouts and prevent equipment damage.

NEW RESEARCH indicates that silicon carbide could prevent surges in the power grid. A local power failure in Ohio ten years ago caused a series of cascading power failures that resulted in a massive blackout. This event affected 50 million people and caused billions of dollars in damage and lost revenue. Such blackouts could be prevented in the future, according to a new piece of equipment developed by engineering researchers at the University of Arkansas. The device regulates or limits the amount of excess current that moves through the power grid when a surge occurs.

"We didn't invent the fault current limiter," says Alan Mantooth, Distinguished Professor and executive director of the National Centre for Reliable Electric Power Transmission, based at the university.

"But we have developed the first one using a silicon-carbide semiconductor device and technology, which we have developed over the past five years. The significance of this material cannot be overestimated. It is much more durable and responds so much faster than materials currently used in systems on the U.S. power grid."

A fault current, also known as a surge, occurs when too much current flows through the electrical power grid in an uncontrolled manner. A fault current is typically caused by an accident or unintended event, such as lightning or contact between power lines and trees. These events cause short-circuits, which result in a rapid increase in the electricity drawn from power sources within the grid. When these sources do not have extra power to give, cascading or rolling blackouts can occur. This is what happened in Ohio, much of the northeast United States and parts of Canada in 2003.

A fault current limiter can be thought of as a giant surge protector. When excess current travels through a power line, the limiter absorbs it and then sends only what is necessary farther down the line, Mantooth adds. The system thus ensures uninterrupted service when the fault is intermittent. Most consumers would not even detect a problem.

What's more, if the fault is more permanent and will require repair to power lines, Mantooth points out that the device then opens much like a normal circuit breaker, which would thus prevent further damage due to excess current. Proper coordination and device placement will prevent cascading outages, says Mantooth. "This device really can mean the difference between 25,000 customers or 5 million customers being affected," Mantooth continues. The U of A researchers worked with SiC that is stronger and faster than conventional materials used in the power grid. High-speed switching devices within the limiter rapidly insert energy-absorbing impedance into the circuit or use advanced control techniques to limit the fault current, Mantooth comments.

Silicon carbide has other benefits as well. Its properties allow for extremely high voltage, and it is a good thermal conductor, which means that it can operate at high temperatures without requiring extra equipment to remove heat. Use of the material will reduce the mass and volume of equipment needed on a power grid.

Mantooth envisions the device working in concert with circuit breakers on individual buildings, especially critical facilities such as hospitals. It could also serve neighbourhoods, where one limiter could regulate current and thus preserve power for many houses. Depending on the size of the building or neighbourhood, devices would vary in terms of amperage and voltage.

Mantooth said the U of A's system, and fault current limiters in general, are examples of devices that will make and serve a "smart" grid, meaning they will play an integral role in the U.S. Department of Energy's vision for a more efficient and more reliable power grid.

The National Centre for Reliable Electric Power Transmission is funded as part of the federal government's focus on research and development on smart grid and renewable technologies. The centre is one of only a few university-based research centres chosen by the Energy Department to investigate electronic systems to make the nation's power grid more reliable and efficient.

The Energy Department has funded the centre since 2005 because of the university's research expertise in advanced power electronics and long-term investigation of silicon-carbide.

Mantooth is holder of the Twenty-First Century Chair in Mixed-Signal Integrated Circuit Design and Computer-Aided Design in the College of Engineering.

OrcaLab receives needed energy assistance

CANADIAN SOLAR has announced that its subsidiary, Canadian Solar Solutions Inc., has donated solar modules, which are now powering a world-renowned OrcaLab Whale Research Centre ("OrcaLab") on a remote island off the British Columbia coast near Alert Bay.

OrcaLab has been recording the Johnson Strait whales for more than four decades. Founder, Dr. Paul Spong and his wife Helena Symonds have spearheaded global research which confirms orca "clans" have distinct, highly sophisticated dialects. This scientific evidence in turn has led to bans against commercial orca hunting, and to the creation of nearby orca sanctuaries.

"The solar installation is performing beyond our expectations," said Dr. Paul Spong a whale expert and advocate. "We are now running all of our power needs without a generator, and looking forward to a future here without oil. We are so grateful to Canadian Solar for everything they have done for us."

The new donated solar system allows the off-grid OrcaLab to cut gas generator use and fuel costs dramatically, increase battery performance and life, expand the range of microphones and cameras, and improve amenities for summer volunteers.

The system is designed to perform with minimal maintenance for many decades to come. In addition, the panels will power the main OrcaLab site, and a network of underwater microphones and cameras which will track migrating orca whale and other marine animals.

"We are honored to be involved in the ground breaking OrcaLab foundation's noble orca whale research," said Shawn Qu, chairman and CEO of Canadian Solar. "We are proud to be able to help advance the team's ambitious work through this latest exciting application of solar energy. As an industry leader, Canadian Solar strives to also lead in our philanthropic efforts with organizations around the world."

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Editor-in-Chief David Ridsdale
T: +44 (0)1923 690210 E: david.ridsdale@angelbc.com
Director of Solar Publishing Jackie Cannon
T: +44 (0)1923 690205 E: jackie.cannon@angelbc.com
Sales Manager Shehzad Munshi
T: +44 (0)1923 690215 E: shehzad.munshi@angelbc.com
Director of Logistics Sharon Cowley
T: +44 (0)1923 690200 E: sharon.cowley@angelbc.com
Design & Production Manager Mitch Gaynor
T: +44 (0)1923 690214 E: mitch.gaynor@angelbc.com
Subscriptions Manager Debbie Higham
T: +44 (0)1923 690220 E: debbie.higham@angelbc.com

Published by: Angel Business Communications Ltd (London Office), Hannay House, 39 Clarendon Road, Watford, Herts WD17 1JA, UK

USA Representatives: Tom Brun, Tom Brun Media,
T: 724 539-2404, E: tbrun@brunmedia.com
Janice Jenkins, Tom Brun Media.
T: 724 929-3550, E: jjenkins@brunmedia.com

Japan Representative: Katsuhiro Ishii,
Ace Media Services Inc.,
T: 81-3-5691-3335 E: amskatsu@dream.com

China Representative: Parker XU, Unionbandy Limited,
T: 86-755-83753881, E: xp@unionbandy.net
Directors:
Bill Dunlop Uprichard – CEO
Stephen Whitehurst – COO
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