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Seeking stability

DESpite the European Commission revealing its decision on the dumping investigation against China there is little understanding of what impact there will be on the UK solar and PV industries. There will be no true and firm decision until December when EU member states vote on any proposed response from the investigation. It will not be until August before the industry has any surety as to the possible direction the EU will have to choose from. The EC has passed the decision over in setting up a three month window for China and the EU to reach an agreement to avert punitive duties that are as likely to hurt Europe as they are China.

Sometimes it seems that the UK industry is always in a state of uncertainty. If it is not the British government causing confusion with FIT tariffs it is decisions made outside the region that ensure investors are kept on edge and on their toes when trying to determine long term returns on their investment. Despite the aura of uncertainty the UK solar industry continues to be one of the top markets not just in Europe but the world for doing solar business.

At the moment it is the large scale projects that are causing the most interest and market growth but there is plenty of movement in smaller scale activity that will ensure the UK remains a strong market for solar growth. In fact if the industry is to achieve another 20 GW by 2020 then it will remain a top global market if it is to achieve this goal. The 20 GW by 2020 has become a bit of a carrot for the industry and will continue to be a guide as to whether success is being achieved or not. At times it appears as if the success is occurring in spite of the challenges.

The recent situation with China did provide the UK government with a chance to demonstrate their commitment to the local solar and PV industry. The response showed that despite early hiccups with the industry, there is a real effort by those in Westminster to ensure that the industry not only continues but maintains the path towards 2020. The real test will be if there is enough of a price rise in product to impact return on investment up against the subsidies. Will the government be as quick to change the subsidy rates if prices go up as they were when they dropped? The industry will be watching closely.

Although there is a chance that the current EC investigation will create challenges for the UK industry there is also opportunities that could arise in the long term. Some manufacturers are considering setting up European manufacturing to ensure any punitive duties do not impact profit margins. This will not happen immediately and if it were to happen the UK is in a better position of benefiting than many realise. Countries like France and Italy have bonuses for locally produced products but some Asian companies have expressed concerns at the labour laws there. Something Germany has dealt with for some time. Sources well placed have suggested there have been talks. It is an opportunity worth keeping an eye open for.

Times may be challenging but there is plenty of room for growth.
EU PVSEC 2013
28th European Photovoltaic Solar Energy Conference and Exhibition

The most inspiring Platform for the global PV Solar Sector
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Installations to fall as tariffs kick in

EUROPEAN PHOTOVOLTAIC (PV) installations are forecast to fall by more than 6 gigawatts (GW) in 2013, with 1.3 GW of this decline attributed to incoming EU anti-dumping duties on Chinese modules according to a recently released analysis from IHS.

Despite this dramatic fall, IHS still predicts global installations will grow at a double-digit rate to 35 GW in 2013 driven by a surge in demand in Asia.

In its latest quarterly analysis on global PV installation demand, IHS cut its forecast for the second half of 2013 in Europe by more than 1.3 GW, citing the anti-dumping tariffs that came into force on June 6. As a result of these duties, and several other factors, including changes to incentive systems, IHS predicts total European PV installations will fall to 11.6 GW in 2013, down 33 percent from 17.7 GW in 2012.

"Although the E.U. Commission has given a small window of opportunity by reducing the tariff to 11.8 percent for 60 days, IHS still expects dampened demand," said Ash Sharma, senior director of solar research at IHS. "This decline comes in stark contrast to the sharp increase in module shipments from China as buyers stockpile ahead of the net tariff increase in August. As a result IHS has cut its European forecast for the second half of 2013 by 1.3 GW, a nearly 20 percent reduction from our previous outlook."

The analysis found that the EU duties will accelerate the decline in European installations with biggest falls in Germany and Italy.

"Germany will account for the majority of this decline with installations 3 GW lower in 2013 than the previous year," Sharma added. "Italy will also contract by another 2 GW."

Despite this huge fall in European demand, IHS still predicts that the global PV market will grow in 2013, with installations hitting 35 GW, up 11 percent from 31 GW in 2012.

However, unlike most previous years, Asia will be the driving force for growth, with installations in the region predicted to exceed 15 GW for the first time and thus account for 45 percent of global demand. This will make the Asian market larger than Europe for the first time.

China and Japan will account for the majority of this and IHS predicts they will become the two largest markets in 2013 based on volume. Japan will lead in terms of revenue, as IHS previously announced.

In addition, no European countries in 2013 will rank among the top three markets for the first time ever, and IHS’ PV Demand Tracker’s Top 10 ranking forecast for 2013 is now much more evenly balanced across all geographic regions.

While the solar market is continuing to fragment geographically in terms of end demand, solar companies cannot fully rely on so-called emerging markets to provide support amid waning demand in Europe in 2013.

IHS predicts that emerging markets will add 5.9 GW in 2013 up from 3.4 GW in 2012. However, this will be made up by more than 60 countries globally.

"The good news, however, is that installations in these regions will grow to 9 GW in 2014 and to more than 16 GW in 2017 highlighting the need for solar companies to focus on emerging markets—but more importantly picking the right ones," Sharma concluded.

Solar IPO points to positive UK market

BLUEFIELD SOLAR INCOME FUND has announced its intention to launch an initial public offering ("IPO") of shares on the Main Market of the London Stock Exchange.

The Fund is seeking to raise £150 million by way of a Placing and an Offer for Subscription of Ordinary Shares. The Fund aims to deliver long-term stable distributions to its investors by acquiring and optimising a portfolio of UK based solar PV infrastructure.

Applications will be made to the Financial Conduct Authority (the “FCA”) for the Ordinary Shares to be admitted to the premium segment of the Official List and to the London Stock Exchange for such Ordinary Shares to be admitted to trading on the London Stock Exchange’s Main Market for listed securities. The Fund will be structured as a Guernsey incorporated closed-ended investment company with an indefinite life.

The IPO is being structured as (i) a placing primarily targeted at institutional investors and (ii) an offer for subscription available to investors, who are likely to be eligible to hold such investment via an ISA. It is expected that a prospectus will be published in mid-June and that the IPO will close and the Ordinary Shares will commence trading early in July 2013. Numis Securities is acting as sole sponsor, broker and financial adviser in relation to the IPO.
Oxford PV reveals breakthrough in new class of solar cell

A SIGNIFICANT STEP forward in the scale-up and commercialisation of Oxford Photovoltaics (Oxford PV) new photovoltaic technology has been achieved by establishing a new high of 15.4% efficiency for its perovskite solar cells.

Oxford PV, a technology start-up business and spin-out from Oxford University, has exclusively licensed and is developing a photovoltaic technology that has the potential to deliver low cost, efficient solar cells that can be readily incorporated into glass building facades.

Speaking at a meeting of the European Materials Research Society (EMRS) held in Strasbourg, Dr. Henry Snaith, Oxford PV’s Founder and Chief Scientific Officer, revealed the latest jump in the efficiency for the flat junction, perovskite solar cell, the technology which the company’s team is developing at its new, purpose built product development facility at Begbroke Science Park near Oxford.

Importantly, the new test results have been achieved without using Mesoporous Titanium Dioxide (TiO2) as a semiconductor, making for a more efficient conversion of energy with enhanced stability.

This improvement, allied to the large area manufacturing process development and the use of abundant and extremely low-cost materials, is enabling Oxford PV to overcome the challenges of reliability, performance and cost often associated with PV solutions.

“Our plan was to optimise our perovskite solar cells towards a goal of more than 20% efficiency but these results are ahead of expectations. I see no reason why we can’t aim higher now and accelerate the transfer of our technology into production.”, said Dr Snaith.

Backed by £4.2m of equity and grant funding, Oxford PV is moving swiftly towards the manufacture and delivery of larger modules that meet internationally accepted standards and specifications for photovoltaic products. Its primary objective is to deliver a massively scalable product for the Building Integrated Photovoltaic (BIPV) market and then, as energy conversion performance improves further, for other high-volume PV applications.

PV materials tipped for strong growth

THE GLOBAL MARKET for PV materials is poised to grow 52% to £27.2 billion, up from £17.8 billion in 2012.

As PV supply and demand come back into balance in 2015, margins will steadily improve and create new opportunities for innovative materials developers, according to Lux Research.

Metals, including polysilicon, metallization pastes, and metallic absorber materials in CIGS, will gain the biggest market share, reaching £12.8 billion in 2018. Polysilicon alone will make a £6 billion market, based on global x-Si module demand.

“Differentiated materials that enable high cell or module efficiencies or longer lifetime will be able to earn a premium and cash in on the growing demand,” said Fatima Toor, Lux Research Analyst and the lead author of the report titled, “From Cost Reductions to Performance Enhancements: Mapping the $27 Billion Photovoltaic Materials Market.”

“In addition, the push towards improved quality will lead to materials innovations that not only drive down the $/W but also the $/kWh, enabling sustainable growth of global PV demand,” she added.

Lux Research analysts used detailed cost and demand models to evaluate materials opportunities in the growing emerging landscape. The following is in the findings of the report.

- Crystalline silicon tops market share. Materials needed for crystalline silicon modules present the largest opportunity, reaching £23.8 billion in 2018. Materials like backsheet, non-EVA encapsulants, metallization pastes, and antireflection (AR) coatings for module glass provide opportunity for innovation.

- Differentiation is key. As module manufacturers drive to offer improved efficiencies, they need innovative materials such as silicon inks for selective emitter cell design. Other innovators include 1366 Technologies, Natcore, Bandgap Engineering, Polyrise, Cencorp, and Sinovia Technologies.

- Move toward quality. The solar industry now prioritizes low $/kWh on top of $/W, offering modules with a longer lifetime. Material suppliers like DuPont and downstream developers are setting the new standard. Simultaneously, companies such as Solar Buyer are helping financial institutions rate module quality.
Solar to return to profit

OVERCAPACITY AND POOR margins have bankrupted a multitude of solar suppliers and forced corporate investors out of the global market over the past two years. However, according to Lux Research, the industry is set to recover quickly thanks to converging supply and demand. Smart corporate investors have recognized the coming resuscitation and formed partnerships in strategic areas like system deployment or balance of systems technologies. Further, companies are seeking differentiated technologies to position for growth that will define winners and losers years down the line.

The industry’s turnaround comes as a result of multiple factors reversing its downward momentum. Lux Research’s Solar Systems Intelligence and Solar Components Intelligence teams analyzed solar market economics and 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. As a result, module margins will recover up to 10% from their near-zero averages today.

- 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.

Wafer production returns to 2011 levels

AFTER FALLING 15% in 2012, solar PV 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.

Multi c-Si technology is forecast to continue its dominance of the 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.”

However, for mono c-Si wafers to increase market share 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 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.
Trina announces 10.5MW deal

TRINA SOLAR LIMITED has announced that it has recently supplied 10.5MW of photovoltaic modules to Prosolia Energía for two agricultural projects in the UK.

Large-scale solar systems will be installed in the towns of Stow Longa, Huntingdonshire, and Seaford, Devon, with the capacity to generate 5.3MW and 5.2MW respectively using a total of 43,274 Trina Solar modules.

José María Delgado, CEO of Prosolia Energía, said: “Trina Solar panels offer excellent efficiency and performance, and the company provides a wide range of solutions and services. Prosolia Energía has been partnering with Trina Solar for a couple of years now on the development of projects, and we will continue to do so in the future because of the excellent quality of their products and because they have always been reliable suppliers.”

Ben Hill, President of Trina Solar Europe, said: “This new collaboration with Prosolia Energía is very important to us as it proves once again our wide experience as a solar leader and the reliability of our products and services. The responsible way in which we handle our business and our balance sheet makes us a stable and reliable partner for these kinds of large-scale projects, and we are delighted to be continuing to work with Prosolia Energía.”

SolarTech secures multiple solar farm deals

SOLARTECH, HAS SECURED over 25 megawatts of photovoltaic (PV) solar farm contracts across the country in the first four months of 2013.

As an experienced solar farm developer, SolarTech will be handling the entire projects from initial planning feasibility studies to installation and service solutions as well as offering a full range of finance solutions.

Shaun Taylor, Managing Director SolarTech said: “Ground mounted solar farms can be a strong additional income stream for any farming business, with a typical installation offering investors returns in excess of 10%, depending on the installation costs and location.”

As one of the most experienced renewable energy specialists in the country, SolarTech has an excellent track record in designing, installing and project-managing large-scale installations, which offer maximum return on investment and minimum of impact on the local environment.

“During 2013, we are looking to secure a further £50 million of solar farm contracts and are confident that we can offer farmers and land owners the best possible financial solutions tailored to their individual needs,” said Shaun Taylor.

SolarTech’s clients range from farmers and land owners to developers, housing associations, Local Councils, Education Authorities and commercial organisations.
Housing association chooses Green Electrician

THE GREEN ELECTRICIAN GROUP has been appointed by Wulvern, a Crewe based housing association, to install solar photovoltaic (PV) panels on its head office. The decision is a major step towards reducing carbon emissions and introducing affordable forms of renewable energy to the Association’s properties.

The works, undertaken by the Nantwich based renewable energy specialist, mean that Wulvern is now able to generate 25 MW a year of its own energy per year and will bring an additional income of £3,650 per year through the Government’s Feed-in-Tariff. Wulvern is the first organisation on Crewe’s Green Business Park on Electro Way to take advantage of solar power.

The 120 panel system will save more than 14 tonnes of carbon a year and provide a return on investment of 14%. The system will significantly save on the building’s electricity bills by contributing power directly for the building’s consumption, whilst also generating an income from the government’s feed-in-tariff to be invested in energy saving measures for tenants.

The Green Electrician Group also conducted an energy review that highlighted several areas where energy efficiency could be increased both at the head office and more widely across the social landlord’s homes. A review of lighting is currently underway, with the Green Electrician Group replacing out of date fittings at the head office with LED lights for key public areas and in the board room. A large volume of LEDS has also been supplied for Mill House in Nantwich, Wulvern’s Extra Care development for over 55’s.

Stephen Davies, Director at The Green Electrician Group, comments: “This move is a positive step forward in reducing energy bills and generating income for Wulvern’s other energy saving measures. Their decision to invest in solar has clearly paid off whilst reviewing overall energy use will have a significant impact on future energy bills. We hope other businesses and community groups in the region will see the value of this proactive approach to rising energy costs.”

Lee Smith, Wulvern’s Neighbourhood Investment Manager said: “Wulvern has already started to install solar PV panels on some of our homes, particularly in rural locations, with great success so fitting them to our head office will enable the organisation to also benefit from lower energy costs as well as reducing our carbon dioxide emissions by over 14,700 tonnes or 20.2% per year.”

Lightsource to train lawyers in solar expertise

AS ONE OF THE UK’S generator of solar power, Lightsource draws heavily on legal expertise when developing new projects. In 2011, a year after it was founded, it appointed its own in-house lawyer, Dr Ece Gürsoy, who now heads up a legal team comprising nine qualified lawyers, one trainee solicitor, and a legal secretary. The team has high-level expertise in property, project finance, corporate and construction law.

Dr Gürsoy says of the SRA accreditation: “In order to qualify to offer training contracts, a company must provide exposure to at least three different areas of law to ensure the trainee gains a broad experience base. At Lightsource, our legal team operates as a full-service law firm albeit on a small scale. It is a considerable honour to gain accreditation as many who apply find they aren’t able to satisfy the stringent criteria required by the SRA. It says a great deal about the strength of our team and the quality of the legal service we provide.”

Dr Gürsoy is now the designated Training Principal within Lightsource after an involved application process. When asked what prompted Lightsource to go down the route of applying for SRA accreditation, a process that took nearly five months to complete, Dr Gürsoy explains:

“When we hired Carolyn Gillespie one year ago she made it clear that she would only able to stay with us on a temporary basis because she needed to complete her training contract in order to qualify as a solicitor. She then proved to be such a valuable and talented individual that we simply decided to find out whether we could gain SRA accreditation ourselves.”

Carolyn is now enjoying her diverse role at Lightsource working in a close-knit team whose expertise is drawn from six different countries. Says Carolyn,

“Registration as a training establishment by the SRA not only illustrates the proficiency of our legal team, but also highlights Lightsource’s genuine commitment to investing in its employees.”

As Dr Gürsoy concludes, “we offer a unique legal experience involving complex structures in a challenging and dynamic business environment, and, as a company it’s very much to our benefit to retain good people. If they stay and get to know the business well then we can set them on a strong career path.”
20 GW by 2020
How will the UK solar PV market get there?

The Solar UK Conference 2013 has brought together key players in the industry who will tell us how
With solar PV installations in the UK breaking the 2.5 GW barrier in April 2013, understanding what the drivers have been, can help explain some of the challenges ahead in reaching the 2020 target.

Speakers this year include

The 2013 event will be the biggest yet with the whole value chain represented. Speakers include Government, Trade & Industry, Manufacturing, Supply Chain, Installation & R&D. Included in the ticket price is a tour of the world famous BRE Innovation Park, networking drinks and lunch.

In addition, the SOLAR UK Industry Awards will be presented.

www.solar-uk-conference.co.uk/home
During April 2013, solar photovoltaic (PV) demand in the UK broke through the 2.5 GW barrier, confirming the explosive growth within the past three years. At the start of 2010, cumulative solar PV deployment in the UK was less than 40 MW. But with the introduction of feed-in-tariffs (FITs) at the start of 2010, declining module and system pricing, and attractive returns from renewable obligation certificate (ROC) availability at the end of 2012, the solar PV industry has truly flourished and this has put the UK on the global PV stage at last.

Drawing on over ten years analysing the UK solar PV market, and performing detailed analysis on a UK-specific database that now includes over 1,500 commercial PV projects, this article shows the PV application segments and the geographic regions that have contributed to the 2.5 GW of cumulative PV in the UK, and reviews the key issues confronting a new energy segment seeking to participate within the UK’s long-term energy supply needs.

Figure 1: Cumulative solar PV installed in the UK and the growth to the 2.5 GW level. The strong uptake in March 2013 was driven by the deadline for large-scale solar farms to qualify for the 2 ROCs/MWh rate. Source: NPD Solarbuzz, June 2013

The Drivers for PV in the UK
On 16 April 2013, Greg Barker, the Minister of State at the Department of Energy and Climate Change (DECC), tweeted the following from @GregBarkerMP: “#SolarPV continuing to make real progress. Latest stats show [UK] #Solar up from 1.8 GW in January to nearly 2.5 GW now. Staggering! #GreenAmbition.”

To the casual observer, it could have been inferred that a long-term objective had finally been realized! But very few, if any, seasoned followers of UK PV activity had remotely contemplated this landmark achievement just a few years ago.

Indeed, solar had been a second tier renewable technology for years in the UK, largely dismissed by most politicians in the past as too costly, and rarely mentioned alongside wind, biomass, nuclear, tidal or wave energy aspirations. However, the government recently established a Solar PV Strategy Group and is about to release a solar-specific working document outlining the role of solar within the long-term energy mix for the country. Furthermore, the speculative ‘20 GW by 2020’ phrase has now become embedded as an ‘unofficial binding’ target of sorts, adopted by almost everyone in the UK as a tangible litmus test of the government’s real commitment to solar PV.

Solar specific rhetoric aside, the UK continues to struggle with its renewable energy strategy, with no shortage of disparate views from respective politicians across the political spectrum going back well over ten years. Reclassifying nuclear as ‘green’ on account of CO2 emission levels was previously tabled within the context of hitting European National Renewable Energy (NREAPs) target levels. All sorts of proposals have been suggested, rejected, re-introduced and so on, with the latest debates on the viability of the Severn Estuary barrage tidal project and the introduction of shale gas production providing further examples of the uncertainty that prevails at the policy-making level.

But without dwelling too much today on any pessimism, it is beyond dispute that solar PV is getting increased prioritization...
and serious consideration in future policy implementation in the UK. In the background however, there are several factors that are strongly influencing this also; continued public objections to wind deployment, political sensitivity to signing off on new nuclear plants, risks from unproven shale gas and tidal approaches, and rising electricity bills at the consumer level causing mistrust in energy providers and policy-makers alike. But, with solar PV deployment passing the 2.5 GW level, the industry now has an installation-base upon which to showcase its capabilities. In the past, solar PV had no reference point to highlight its credentials in the UK other than a few token-gesture pilot demonstration installations, merely adding to the curiosity tag that largely accompanied any related public debate.

There are likely plenty who may choose to disagree, but perhaps the strongest driver for PV in the UK is Greg Barker. While many industry participants have bemoaned the FIT cuts in the UK and the European Commission drama that is playing out now regarding Chinese import duties, the situation...
Industry Analysis

in the UK for the PV industry could be much worse. (Small consolation for the installers that have gone under owing to the rooftop FIT boom-and-bust phase of 2011-2012, but it has to be remembered that FITs were never originally envisaged to create a sustainable GW residential rooftop market in UK.)

Regardless of any hidden agendas or political point scoring allegations, the UK solar PV industry can only thrive if it is championed directly by DECC and in this regard, Greg Barker has hit the mark way beyond any others in the past, in relative terms. But the goal now is not so much DECC buy-in, but George Osborne and the Treasury where there is limited evidence until now that DECC’s new-found solar PV optimism has been fully absorbed.

Reaching the 2.5 GW Level

Cumulative PV demand in the UK reached 2.43 GW at the end of the first quarter of 2013 (31 March 2013), and passed through the 2.5 GW level by the middle of April 2013 (confirmed by Greg Barker’s tweet). It will pass through the 3 GW level during the calendar year 2013. Depending on whether you use the 20 GW or 22 GW nominal target figures by 2020 that were cited in the 2012 Impact Assessments, this basically means that any solar strategy that seeks to hit these levels by 2020 would require some kind of carve-out for solar PV in the UK that encompasses 17-18 GW of new solar PV capacity over a 7 year period.

Therefore, back-of-the-envelope calculations suggest that – failing any boom and bust phases – UK solar strategy is largely governed by the requirement to add approximately 2.5 GW per year for the next 7 years, notwithstanding grid infrastructure, utilities acceptance, council planning permission and policy changes! So, the fact that the UK has just reached its first 2.5 GW of solar PV does represent a key moment and deserves some retrospective study now.

![Solar PV in the UK: The First 2.5 GW Cumulative at End April 2013](image)

Figure 1 illustrates the historic growth to April 2013, and getting to the 2.5 GW level of installed PV in the UK. Growth during 2010 and 2011 was dictated exclusively by FIT allocations. With the exception of some ground-mount PV farms that beat the 2011 cut in large-scale PV FITs, initial UK growth was driven by the residential segment. This included mostly new builds, retrofit installations and social housing projects. Actually, that the residential segment (and especially the social housing aspect) was the driver for PV in the UK was largely in line with the underlying ambitions of the former labour government and the coalition government that inherited existing FIT policies for PV; empowering less affluent communities or showcasing solar PV from an educational perspective.

Just as the UK PV industry started to envisage a drastic slowdown, with FIT allocations restricted to a declining number of residential-only PV rooftop installations, the ROC scheme would emerge as the saviour to the PV industry. ROCs had never been envisaged for the PV industry when originally introduced in 2002; the main driver was offshore wind. Interestingly, in 2008 as new legislation was being considered for solar PV, there was speculation that ROC tariffs at the level of 5 ROCs/MWh would be introduced for micro-generation schemes that incorporated PV. (FITs were chosen in the end.)

But, as global solar PV module and installed system pricing continued to decline during 2012, and UK-focused project developers became savvy in the large-scale ground-mount PV application/deployment process, ROCs appeared to be just perfect for the ground-mount (and large commercial rooftop) segment. It should be noted however that the marriage of PV developers became savvy in the large-scale ground-mount PV application/deployment process, ROCs appeared to be just perfect for the ground-mount (and large commercial rooftop) segment. It should be noted however that the marriage of

In reality, the fears were largely unfounded, and what emerged was a great deal for the PV industry at the time: dedicated ROC clarity to 2017 for each of the ground-mount and large rooftop segments, and a window to the end of March 2013 that solar PV would still qualify for the attractive 2 ROCs/MWh level. Large-scale ROC-enabled solar PV in the UK during the final quarter of 2012, and particularly during the first quarter of 2013, has been the catalyst in propelling cumulative solar PV in the UK first above the 2 GW level and then the 2.5 GW mark within the space of three months. By the end of April 2013, over 500 MW of solar PV had been installed under the ROC scheme, with over 400 MW in Q1’13 alone.

Geographic Mapping of UK PV Installations

In addition to segmenting the 2.5 GW of UK solar PV across the various funding mechanisms (FITs, ROCs or the legacy Major Development, Low Carbon Buildings and Solar4Schools programmes) and the different applications (residential, small and large commercial rooftops, ground-mount, etc.), perhaps the most interesting analysis comes from the geographic split across the UK. Figure 2 follows DECC’s regional geographic
segmentation and uses a variety of historic and current government statistics, the in-house NPD Solarbuzz commercial database of UK solar projects that exceeds 1,500, and further UK PV industry channel checks and surveying. The result of this analysis is the first ever comprehensive mapping of the 2.5 GW of solar PV installations, shown by region and by segment, across the whole of the UK.

Solar PV application segments shown in Figure 2 include: residential (almost exclusively FIT-based), small rooftop (again mostly FITs), large rooftop (mostly FITs, but some legacy funding mechanisms and some new ROC based projects) and ground-mount (now dominated by ROCs). The vertical bars across each of the segments and regions are auto-scaled to illustrate the relative MW levels by application and geography.

Contrary to some popular opinion within the UK, solar adoption across the various regions in the UK is not dictated by solar insolation rates between the north and the south. Yes, this is a factor, but it ranks down the list of factors that has driven deployment in one region compared to a neighbouring region (or indeed adjacent county, district, or farm) that has exactly the same photonic exposure.

Rather, regional deployment should be considered as having additional layers of selectivity, all falling under the generic UK-wide policy umbrella. These layers include: the enthusiasm of regional and local councils to solar PV farms, land availability (greenfield or brownfield), local grid infrastructure, the presence and sales ability of downstream channels focussed on key counties, the locations of commercial rooftops owned by national brands such as Sainsburys and Morrisons, the sites chosen for new residential builds with integrated PV, and many other non-DECC policy related themes.

Various other devolved decision-making legislative powers assigned to Holyrood, Cardiff Bay and Stormont also play a role in solar PV deployment as part of any complementary renewable energy goals for Scotland, Wales and Northern Ireland. With many of the above factors in place, the South West region (driven by Cornwall, Devon, Dorset Somerset and Wiltshire) is the clear leader for PV deployment, topping the regional charts for all application segments shown here; by MW volume, the South West accounts for 27% of the first 2.5 GW installed in the UK.

Residential demand is broadly spread across all regions in the UK (with only Northern Ireland yet to contribute any strong demand), often with regional-focused installers closely managing local activities.

The situation for ground-mount is heavily biased to the south, with the South West and South East (mainly from Hampshire, Kent, the Isle of Wight, Oxfordshire and Sussex) collectively accounting for over 70% of all ground-mount MW deployment. In fact, anyone flying in regularly to some of the smaller domestic airports at Exeter, Newquay or Southampton will testify at first hand to the large-scale PV revolution at ground-level. As an example of this, Figure 3 was taken when I flew into Exeter Airport a couple of months ago on FlyBe, with the distinctive Bombardier Dash 8 Q300 propeller clearly visible out the window, casting a shadow on another new MW solar farm in Devon, built close to the runway at Exeter.

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Future Considerations

The UK PV industry is currently (and quite naturally) somewhat pre-occupied by the Europe/China trade case that is seeing increased political volleyball activity between Brussels and Beijing. But trade cases and domestic protectionism (including local content based incentives) have been part of the PV industry for many years, and the World Trade Organization has even been called to adjudicate in the past between different countries. The PV industry has never really had any prolonged period of stability beyond a few quarters, and has been in constant turmoil as it has grown from the GW-level of a few years ago to the 30-40 GW range today. However, business models have evolved constantly and, regardless of what the EC decides (and however the China reacts), downstream PV deployment in the UK will more than likely prevail in one form or another.

In fact, the Europe/China issue is definitely clouding the more pressing long-term issues for solar PV in the UK; lobbying to influence the solar UK steering committee on the contents of the solar strategy documentation set to be unveiled shortly, getting PV on the table beyond 2017 when ROCs are potentially no longer available, addressing the very real threat from the anti-solar public voice that could quickly grow from a nuisance into a real threat, identifying how to open up new regions to decrease the dependency on the South East and South West, getting a professional PR agency on board to sell PV to the public, having UK’s big-six suppliers fully embrace solar as a no-brainer revenue-stream, factoring in the impact of new DECC personnel (or a new government) after May 2015, and so on.

If 20 GW is to be achieved by 2020, the next 17.5 GW will have to be less painful to the UK PV industry than reaching the first 2.5 GW base. And if the UK can present a strong case for a risk-free 2.5 GW annual PV market for a 7-year period out to 2020, then finances and resource from global suppliers and downstream developers will not be a problem. But as with many things in PV today, this is an ‘if’ question and there is no shortage of potential roadblocks that will have to be overcome to get there before the 20 GW landscape-map is unveiled in full glory.
Averting the war

The European Commission has announced its decision in the dumping case against Chinese manufacturers. Whilst the decision is basically against the Chinese, David Ridsdale discovers the resulting layered punitive duties opens a window of opportunity for all parties to sit down and avert a financial blow to the solar industry but more importantly to avert a full on trade war between the regions.
EU Trade Commissioner Karel De Gucht appeared to be offering a compromise in announcing initial trade tariffs lower than feared but this early duty set at 11.8% is only valid until August the 6th when duties will increase to 47.6%. A figure that is much more daunting for those in the industry who feel such a punitive tariff could provide a death knell to regional industry development.

Considering De Gucht had most European countries trying to convince him to delay any tariffs it would appear more likely that he found himself in a very tight situation and this was his way of providing details of his decision whilst throwing the real work...
of potential compromise back to the European Union (EU) and China.

De Gucht had this to say in delivering the decision, “Let me be very clear: I want an amicable solution with our Chinese partners; that is also what Europe wants.”

By setting a three month window De Gucht has told the respective parties that tariffs will rise unless they can reach a compromise. In effect he is saying that the investigation has found the Chinese manufacturers guilty as charged but the political and economic fallout from such a decision is too hot a potato for him to juggle. If China can reach an agreement that all parties are happy with then duties will stay at the lower end or disappear altogether.

The tip of the iceberg
De Gucht and the EC investigation found themselves at the centre of a much larger trade situation between China and much of the developed world. While the current situation began when Solarworld led a consortium in the US to encourage a trade investigation claiming the influx of Chinese manufacturers had so vastly over supplied global capacity that they were now dumping excess stock by selling below cost with the financial support of the Chinese government and financial system. This case went against China and triggered a number of trade cases around the world both against China and in retaliation from China itself when they accused US and European manufacturers of dumping polysilicon in the same manner they were being accused of dumping modules and cells.

No-one is privy to the behind the scenes political machinations that continue as both EU and China seek a satisfactory conclusion but the bits of information available makes it clear that very few people in leadership positions are happy with the EC announcement. More than half of the EU members lobbied until the end of May in an attempt to ensure there was no duty charged and the few announcements from China suggest that they are not only displeased with the outcome but are actively looking at other industries they can instigate similar investigations upon.

When Ministry of Commerce spokesman Shen Danyang spoke to a press conference he was careful in his words and while expressing disappointment the government felt on the decision praised the EC’s flexible approach in allowing a three-month window of potential negotiation. He expressed concerns at the way the investigation occurred especially in relation to the sample group chosen and questioned why the entire industry needed to be punished. He went on to iterate China’s position was to look after their national interests and the arduous task they faced in sticking to the Chinese point of view on the matter.

At the same time the nationally controlled media outlets were being more forthright in their criticism of the process. The People’s Daily singled De Gucht out and claimed he was intentionally trying to stir up trouble between the regions and alluded to the political battles that occur between the EU and the EC. The paper warned that China still had plenty of cards to play in retaliating against Europe. In fact the paper proudly stated they had the stronger hand and Europe needs to realise their
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global power was waning. Even though many do not want to acknowledge the undercurrent of events there is a international struggle as the traditional European/North American form of capitalism is challenged. It is this larger battle that the solar industry has found itself embroiled in.

**Anything you can do**

Currently in the media there is a desire to assume any trade dispute must be connected to the anti dumping case. Just after the EC announcement the Chinese government announced they were investigating wine imports from France following complaints by local producers that the French were dumping their stock in China below cost price. While it is tempting to assume this case is a direct retaliation the truth is this complaint began 18 months earlier. The timing of announcement that the case was progressing certainly had the desired effect in France and putting that country on notice that both sides had cards to play in this disagreement.

Only days later that Chinese fired another salvo but this time it was about a new complaint and was targeted to the luxury car market suggesting German manufacturers had been undercutting Chinese auto producers in an attempt to create market share in the huge market.

This challenge will be taken very seriously in Germany and is seen as restrained in some quarters focusing only on a section of the market. They are letting Germany know there are things to trade against and things could get much worse.

The Chinese feel slighted by the attack on their solar industry but will fight the European announcement much stronger than they did the hors d’oeuvre that was the USA trade dumping dispute. The reasons are purely economic. The US market was still in its infancy and a small percentage of the global market when the dispute occurred. Europe still makes up a bulk of the global market and the cost to the Chinese industry will be much more substantial. Many people inside China see the EC investigation as a Trojan horse hiding much larger international issues and this could be the real danger to European concerns.

**UK impact**

In simple terms the impact on the UK market cannot be completely determined as time will be the biggest teller of this. With a heavy reliance on Chinese imports the impact on the UK will potentially be greater than on areas such as Germany. Even without the trade disagreement margins had become extremely tight for the UK industry and subsidies were falling in line with cost and output.

As government support has fallen in line with falling prices the realistic question is whether the government respond the same if prices climb due to the fallout of the EC investigation. In such times of austerity it is difficult to see such a reversal but it is this gap between subsidy and cost that is the real determiner of the health of the overall UK industry. The UK government did not shirk in attempting to persuade the EC to decide not to impose tariffs with a high level delegation led by the minister for energy and climate change, Greg Barker went to Brussels and urged other EU member states to vote against any provisional duties. He was accompanied by UK industry leaders and urged the EC to consider the impact of their decisions. The Alliance for Affordable Solar Energy (AFASE) sponsored Prognos report suggested the fall out in the UK would be the greatest, as 80% of modules in the UK were from China.

Barker had to work a fine line of acknowledging a commitment to free trade whilst arguing that imposing sanctions for breaking such agreements would work against European growth. The argument was simply that the renewable energy industry had created numerous jobs and opportunities and these sanctions could put the brakes on Europe’s attempts to continue as a global player in the sector. The main reason cited for this growth by Barker is the falling cost of solar and PV.

In just three years, the per kilowatt cost of installing solar electricity has dropped by around 60pc. Barker claims this has been achieved by advances in technology alone but he carefully steps around the impact subsidies had in creating the markets to enable the market to grow enough to drive prices down. The truth is that areas like the UK benefited greatly from those reduced prices even if they came from one country dumping product to reduce their own over capacity.

In this situation the pursuit of international trade laws to the letter would come at an unacceptable cost to local economies and markets. Now that the EC has decided in favour of duties the UK government must continue to lobby in Europe as China hold talks with all parties in an attempt to stave of the looming August increase.

Recent announcements from some of China’s biggest players suggest that some have almost reached the end of their current stock and there is even fears there may be a shortage of product despite last years oversupply of almost 15 GW. This would suggest some canny product line efforts in reducing costs as margins fall and as preparation for any EU fallout.

Companies have been gearing up for a potential decision against the Chinese in various ways from adding an insurance cost to their product or reducing output so product cannot be hit with punitive duties. Some companies are also ensuring that their main business moves away form the EU region which may further damage the EU and UK markets.

One question the UK government is not answering is whether they are prepared to increase Feed in Tariff options if solar prices rise in the same way they decreased them when prices fell. Without this flexible support the government risks missing out on plans to achieve 20GW by 2020.

There will be mad scrambling with calculators now the decision has been announced and the industry will be looking to see the government backs them in a more active way than strong words. As welcome as those strong words may be.

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Nominations for The Solar Industry Awards 2013 are now open

This year it could be YOU

www.solar-international.net/awards
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.

"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 and cell manufacturers at the expense of thousands of EU based..."
Avenues being explored to keep projects economically viable include striking supply deals with EU cell and 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 and 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 and 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 its 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 and 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 and arrows are thrown.

This misguided EU proposal will likely impact British jobs and should be opposed strongly by David Cameron’s Govt.”, Pascoe commented.

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Energy storage is the next big thing when it comes to renewable energy. The ability to store intermittent supplies until later use is a touchstone for the industry and whoever cracks it will be in for large rewards. A new report suggest the UK could have a solution in liquid air that could potentially unlock a £1bn industry and provide 22,000 much needed UK jobs.

Liquid air is a proven energy storage technology that could play a critical role in Britain’s low carbon energy future, according to a major new report from business and academic experts. The use of liquid air for grid-based energy storage could increase UK energy security, cut greenhouse gas emissions and create a new industry worth at least £1bn pa and 22,000 jobs to the UK, the report found.

The report, published by the Centre for Low Carbon Futures (CLCF), concludes that liquid air technologies could be a key factor in furthering renewable technology usage. The report also found the technology could also significantly increase the efficiency of road vehicles, particularly in Britain’s fleets of buses, vans and refrigerated lorries.

Short term solutions
If such a technology path was followed the short term benefits could be
• Strengthen UK energy security: a single gasometer-style tank of liquid air could make good the loss of 5GW of wind power for three hours - equivalent to almost 10% of the UK’s peak electricity needs[i] – and help to protect British homes from black-outs.
• Smaller systems can be used to provide zero-emission backup and reserve services, warehousing wrong time, surplus energy to replace diesel gensets.
• Reduce diesel consumption in buses or freight vehicles by 25% using a liquid air dearman engine / diesel hybrid.
• Cut emissions from refrigeration on food lorries by 80%

It also raises the possibility of zero-emission Liquid Air city cars filling up at road-side forecourts at a fraction of current fuel costs and with lower lifecycle vehicle emissions than either electric or hydrogen powered vehicles.

Energy when needed
With ‘wrong-time’ energy from renewable generation a growing challenge to the electricity grid, there is real demand for affordable large scale energy storage solutions both in the UK and abroad. The report highlights the opportunity for a nation-wide network of liquid air energy storage plants that are charged by surplus energy at night, feeding the energy back into the system when it is needed most during the day. The plants would be built from standard industrial equipment and technologies in which the UK is a world leader.

Such a network could develop into a business worth at least £1bn per year by 2050 and create 22,000 jobs in the grid electricity storage sector alone, and the Government has recognised this as a major growth opportunity for British industry.
“Liquid air has the potential to open a global market worth tens of billions of pounds,” said John Hayes MP as Minister of State for the Department of Energy & Climate Change last year. An earlier report for the Carbon Trust found that the savings from electricity storage for the system as a whole could total £10bn by 2050. The CLCF report concludes storage could also cut grid emissions by up to 20% in a high wind scenario.

Professor Richard Williams, Pro-Vice Chancellor University of Birmingham, who led the report for CLCF said, “Solving Britain’s energy crisis requires better ways to store power of at large scale without relying on scarce natural resources, and liquid air provides a missing piece of that puzzle.”

He added, “We have an opportunity, and growing need, to scale up our investment in technologies that will ensure the energy from renewables is not wasted, and the opportunities for the UK industrial sector are not lost. The Government is investing to give academic and business communities the chance to lead the world and develop new technologies and industries that can benefit the UK. Liquid air should be part of that effort; as the CLCF report published today shows, it is a prime example of a technology that has the potential to deliver a more efficient energy system and bring the benefits of green growth to the UK.

“Through our report, this conference today, we invite policy makers, the research community and private sector to consider our recommendations, join in the evidence gathering and debate, and build on the work already underway,”

Government support
As the Rt Hon David Willetts MP, Minister of State for Universities and Science, pointed out in his paper ‘Eight Great Technologies’, the UK has lost previous opportunities in energy storage to other countries because of the gap between our basic science and our manufacturing techniques. It was that gap which “gave the Japanese their chance” in battery technologies, he argues, and “we must not repeat that mistake”.

Responding to the new report Mr Willetts said: “Energy storage has the potential to bring significant economic benefits to the UK, but we must get better at taking our research through to commercial success. This is why we have invested £30 million to create dedicated research facilities to develop and test new technologies. This will drive growth and put our universities and businesses at the forefront of innovation.”
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What manufactures need to know about renewables

Convincing potential clients about the benefits of solar can be difficult. Prescient Power are renewable energy consultants and installers and offer this simple guide on the five things manufacturers need to know about renewable energy.
ENERGY MARKET

We are seeing a surge of interest in renewable energy by manufacturers. Progressive, innovative companies are realising that energy is a security issue hitting the bottom line and beyond.

With incentives delivering short payback terms, great quality products, and prices at a record low level, now is the time to build extra income streams and insurance against rising fuel costs into your business plan.

So is it really worth it and what do you need to know? With years of experience in renewable energy and the benefits that it can bring, here are our top tips:

Not all companies are equal
If your space or process heat load and electrical consumption is high, then your energy risk may be significant. Do you know what percentage of your input costs are energy related? How sensitive is your business model to energy pricing?

If these considerations strike a chord then you have a good basis to consider renewable energy. Offsetting some or all of your fossil-fuel energy into a lower, fixed cost, and sometimes free alternative, gives protection against the unforecastable energy price rises. Many manufacturers fall into this group, which is why there is an increased interest within manufacturing right now.

It’s not just about solar panels
There are six mainstream types of renewable technology split into two distinct groups.

Renewable Heat:
- biomass
- heat pumps (using heat from the ground, water or the air)
- solar thermal (hot water)

Renewable Electricity:
- solar panels (photovoltaic panels)
- wind turbines
- hydroelectric

The type of technology that you employ will depend on your budget, your needs as a site and the space and resources that you have available. If you are relying heavily on oil or gas for heating in processes then a biomass boiler might fit your purposes. If you have a high electrical outlay to run machinery, and you have the space, then wind may serve you well. If you are interested in space heating - heat pumps might work best.

The important thing is to get someone in to look at your site and have a detailed discussion about what you want to achieve. Ideally, get a consultant involved who will be able to talk across all technologies to make sure that you have a full choice of options. Solar panels aren’t for everyone, and if it’s the only product an installer is offering you might be drawn down that route.

Don’t forget that in conjunction with a becoming an energy generator, you should also investigate energy saving measures.

Many of these attract grant funding and can add a significant benefit to your business.

Renewable energy isn’t just about being green or earning CSR points
Although meeting sustainability objectives and showing a genuine concern for the environment often makes up a part of the reason for getting involved in renewable energy, it isn’t often the driving factor...saving money is all.

All renewable technologies carry an initial capital cost followed by reduced running costs. The measure of how beneficial this technology will be is the payback period.

Renewable energy pays back through the following ways:
- Reduction on energy bills - in most technologies, after the initial outlay, the generation of energy is free enabling you to quickly slash your energy bills. Heat pumps require a small amount of electricity in order to extract heat, and biomass boilers require a fuel source, but both greatly reduce the original bill.
- Incentive payments - Government schemes such as the Feed In Tariff (FIT) and Renewable Heat Incentive (RHI) ensure that you receive payments for every unit of energy that you generate.
- Selling electricity back to the grid.
- Lower carbon footprint, mitigating any future taxes or levies introduced by Government.
- Increased brand and customer engagement. Shouting about your commitment to sustainable practises wins you loyalty and gets you talked about (in the right way!)

You get paid for generating energy - even when you use it
Sounds too good to be true, but it’s true.

The Government have backed two main incentive schemes:
- Feed in Tariff (for renewable generation of electricity)
- Renewable Heat Incentive (for renewable generation of heat)

Feed In Tariff
With the Feed in Tariff, you are paid an amount by your energy provider for every unit of electricity that you generate. You are free to use this electricity on site, and indeed it’s best if you can because you reduce your electricity bills at the same time.

Any surplus energy is then fed back through to the grid, and you are paid a separate lower amount for this electricity.

When your system is connected to the grid, the amount that you receive for each unit will be fixed over a 20 year period, ensuring that you continue to receive a fixed rate for that energy. So it makes sense to get started as soon as you can, to make sure that you receive the best rates.

Once you have entered into the agreement, it is underwritten by law, meaning that a change of Government policy will not affect the amount that you receive.

There are different rates according to the size of the installation, the current rates are on our website.
Renewable Heat Incentive
The Renewable Heat Incentive is an amount paid out by the Government for every unit of heat that you create from renewable means. As heat can’t be fed back into the grid, there is only one unit rate for generation, this heat is then used within your processes.

Again, the agreement is underwritten by law, and the current rate at point of installation is the fixed rate that you continue to receive for 20 years.

You don’t necessarily need to raise CAPEX
We won’t lie to you; the best financial rewards through renewable energy come from raising CAPEX from your own funds, seeing a fast payback (maybe within 5 years), and then happily generating 15 years worth of income from your renewable technology, not to mention the additional savings as well.

However, raising CAPEX isn’t always an option and sometimes isn’t the ideal for your own financial model. The way we see it there are five other ways:

Get a loan
Banks are increasingly happy to loan for renewable technologies as they are becoming more familiar with, and seeing the benefits of, this investment. Although your payback will be slightly longer, it’s still a great option.

Get a lease
A lending body will pay for the installation and will own it at your property for the period of the lease. You get the decreased energy bills and the Feed in Tariff or RHI and pay a set amount each month to the lender which will usually be covered by the benefits of the system. Once the lease is paid, ownership transfers to you and you get all the benefits.

Get an Energy Supply Contract (ESCO)
The system is installed, operated and maintained by a third party. You pay reduced rates for the energy and the third party sees their return investment through the money you pay them, and from the RHI or FIT.

Get crowdfunding
Similar to the ESCO, except that the installation is bought by a community buying shares in the installation. It’s a great way to engage with your stakeholders and promote your green values as well as saving money on your bills.

Rent your roof or field
An investor pays for the installation which they will install at your property or on your land. You receive the sustainable energy for free or at reduced cost. The investor then receives all of the Feed in Tariff or RHI and may also pay an amount to your for the rental of your roof or land. We don’t often recommend this option as it delivers the least benefit to the client.

So there you have it. In a nutshell, the five things you need to know about renewable energy.

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A company weeks away from the planning decision on what is thought to be the first small-scale commercial electricity pumped storage scheme to be built in the UK, has been awarded a grant by the Department of Energy & Climate Change aimed at accelerating Britain’s move towards renewable energy.

Already the UK’s centre of expertise in small-scale pumped storage, the Quarry Battery Company will use the grant to learn even more from operators in other countries around the world. Pumped storage uses low cost off-peak electricity to pump water from a lower to an upper reservoir. At times of peak demand the water is allowed to flow back downhill through a

Energy storage is the next factor required for renewable energies and with solar in the UK turning toward large scale plants there is a need for large scale solutions. The Quarry Battery Company is working on one storage solution that takes advantage of disused quarries to develop storage solutions. With a government grant for pumped storage research the project will help wean UK off carbon-based power generation.
turbine to re-generate electricity. A pumped storage battery can store enormous amounts of energy, and release it very quickly. Two quarries are required, one at higher altitude than the other. When the Grid has spare electricity, the battery charges by pumping water to the upper quarry. At peak times the water is released through a hydro generator turbine. Peak electricity is more useful and hence more valuable than off-peak electricity.

Grid-scale batteries are an essential part of an efficient and renewable UK energy supply. Powered by electricity, pumped storage batteries produce no smoke and do not require fuel deliveries. Once the quarries have been made water tight and connected with a pipe, a properly maintained facility will work indefinitely. The technology was thought only to be viable when used on a large scale, such as the 1800MW facility at Dinorwig in north Wales. Few locations in the UK are suitable for such installations. However, QBC is confident that much smaller scale pumped storage is commercially viable. QBC’s proposed scheme for the old slate quarries at Glyn Rhonwy would output around five per cent of the electricity of nearby Dinorwig. The company is currently in talks with a number of partners about the funding of the £100m construction phase of the scheme.

Environmental awareness
The company looks carefully before choosing a suitable location and have looked at various options for developing the quarries. The preferred design avoids using the quarries that are home to rare birds and rules out using Llyn Padarn as a lower reservoir. The pipe route – or penstock – has been designed to minimise disturbance to the landscape. Of the 3 options for disguising the pipes including cutting and filling, shallow tunnels and deep tunnels, the preferred design shows the cut and fill option because there are still many uncertainties over the geology beneath the site. Cut and fill involves excavating a trench, laying the pipes side by side and then filling the trench and covering the pipes up.

At the construction stage, further mitigation measures may include avoiding certain construction activities during bird nesting and breeding seasons and, where possible, crushing slate waste on site for reuse in the concrete mixture to minimise waste and blend structures into the landscape. With all these factors taken into account, the development will require work to stabilise and line the quarries and improve access to and around the upper quarry. It is estimated that a 20m dam on the upper quarry and a 15m dam on the lower quarry will be needed as well as tunnels to move the water up and down; and a turbine house and grid connection.

The size of the development at Glyn Rhonwy is measured in terms of the energy stored. This is directly linked to the volume of water that can be held in the quarries. The volume of the quarries and the size of the dams are designed to make the most of this energy storage capacity. At Glyn Rhonwy, the operator will pump 1.1bn litres of water up to the top quarry. This amount of water represents the storage of about 500 megawatt hours of energy (MWh).

Growing support
A growing number of energy experts and environmental groups including Friends of The Earth believe that the development of many such smaller sites will enable the UK to slash its dependency on fossil fuels and more easily meet its climate change obligations. Greater pumped storage capacity would resolve a central problem with renewables – that their generation ability is weather- and time-dependent, and therefore intermittent. Pumped storage sites would absorb power from wind turbines and other renewable sources, then release it back into the electricity grid at times when there is no wind, sun or tide. Conventional power stations which must currently be kept on standby to fill these gaps in generation could be stood down, saving further costs and carbon emissions. QBC managing director Dave Holmes said, “The potential partners we are talking to about the construction phase at Glyn Rhonwy are excited, not only at the projected returns but also at the opportunity to get in on the ground floor of an industry that has the potential to help end Britain’s reliance on fossil fuels for electricity generation.

“We know we can make pumped storage work on a much smaller scale than before, but we think there’s still much to learn from how it’s done in other countries. In addition, there may be technologies and techniques in parallel or quite unrelated sectors that we can apply or adapt to make pumped storage even more efficient and less costly.”

The Quarry Battery Company was founded from ideas that originated at the Centre For Alternative Technology near Machynlleth. QBC’s scheme for Glyn Rhonwy near Llanberis was designed in conjunction with AECOM, Gwynedd Council, Cadw, Countryside Council For Wales and Environment Agency Wales. The company already has options on other sites in England and Wales.

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Energy control

Controlling the power that is generated by PV systems has become an increasingly important part of the process as companies ensure a higher amount of energy reaches the consumer. One company has chosen to tackle this issue by increasing the output of systems already installed as well as improving new system capabilities. This Israeli company continues to expand globally and is one of the most financially watched in the industry.
SolarEdge Technologies is a solar power harvesting company that was formed in Israel in 2006. Since its launch SolarEdge has raised around $100 million in venture capital and has established itself as the leader in DC power optimizer segment with over 70% market share. By the end of 2012 SolarEdge had shipped over 1,800,000 power optimizers to more than 40 countries worldwide.

The company’s main manufacturing factory is in Migdal Ha’emek and was set up by Flextronics for the company. They now employ 220 workers in the factory and in 2013 expect to ship near 2 million products with a production capacity of 400 megawatts. Quite an achievement for a company entering its seventh year and there appears little let up in the growth plans of the company.

The company was founded by Guy Sella, who remains the company CEO and Chairman, as well as Yoav Galin, VP Research & Development, Meir Adest, VP Core Technologies, Head Software Engineer, and Lior Handelsman, VP Product Strategy & Business Development. One of the main factors for success has been how this core group has developed collaborations with key players in the solar energy industry, including Schott Solar, Isofoton, BP and GE.

SolarEdge was successful in recognising that traditional PV installations suffer from a broad range of limitations. The industry has taken enormous strides to reduce the dollar per watt cost of PV-generated electric power through increased cell efficiency and other innovations; there is still room for improved power harnessing improving the output of current offerings.

Existing power harvesting systems use centralized or string inverters that perform Maximum Power Point Tracking (MPPT) regulation on the entire serial solar array as a whole which leads to unavoidable power losses due to panel mismatch, partial shading sensitivity, suboptimal MPP tracking as well as complex system designs, poor roof utilization, fire and maintenance safety issues, and ineffective panel theft prevention measures.

As a result, conventional power harvesting systems assume a 20-30 percent systems loss when calculating the expected energy output of a PV system. According to SolarEdge the technology they offer is capable of allowing systems to produce up to 25% more energy from every solar panel.

**Technological improvements**

The SolarEdge three-fold architecture consists of power optimizers which perform module-level maximum power point tracking (MPPT), a highly reliable solar PV inverter, and a portal for module-level monitoring and yield assurance. The power optimizer is connected by installers to each PV module or embedded by module manufacturers, replacing the traditional solar junction box.

A highly-optimized algorithm ensures that each module is constantly kept at maximum power point (MPP), preventing energy losses due to module mismatch or partial shading conditions. In addition to the energy benefit, module-level MPPT is faster than MPPT performed by a centralized inverter. Allowing the modules to better react to changes in sun irradiance and temperature and minimizing power loss on cloudy days when changes in irradiance are frequent and
What is ESIA?
A non-profit, non-governmental organization that set sights on representing the business interest of solar companies in the UAE. We:
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Case Study

SunGift Solar, award winning installer and partner of SolarEdge Technologies, installed a 50kWp Solar PV system split over two roofs at Woodbury Business Park. Mr. House, the owner of the site, runs a successful storage business and sublets three other large industrial units to local businesses.

Aware of the rising energy costs, the system has provided the owner with a sustainable solution to reduce both his own energy bills as well as to offer his tenants cheaper electricity rates. To offer Mr. House maximum energy output and service, SunGift Solar used SolarEdge power optimizers and inverters for the installation.

First, power optimizers remove module-mismatch as a challenge. Therefore, SunGift Solar were able to install modules at different orientations or tilts or in partially shaded areas without risking disproportionate energy losses resulting from module-mismatch. In addition, the flexible installation design helped SunGift to keep balance of system costs minimal and roof utilization optimal.

Finally, SolarEdge power optimizers also monitor each individual module. A virtual site map on the SolarEdge monitoring portal allows for pinpointing individual modules and the portal provides immediate alerts on any irregularities. In commercial size installations such as this one, module-level monitoring can significantly reduce the time it takes to maintain the site and increase system uptime; Woodbury Business Park and their tenants benefit from proactive customer service.

“We believe the PV delivery chain is only as strong as its weakest link,” said Guy Sella, chairman, CEO and founder of SolarEdge. “By adopting a ‘systems first’ philosophy that identifies and eliminates the Achilles heel in each step of the solar lifecycle, SolarEdge enables a constraint-free delivery of sun harvested energy that makes PV more affordable and paves a faster path to grid parity.”

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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.
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/m² or higher is needed and optimally, 700W/m².

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

So when solar cells are inspected from the front, a thermal imaging 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.

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.

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Large scale concerns

A recent conference held in Truro in Cornwall was designed to bring together investors and PV project designers and builders with the goal of exploring the growth potential of large scale solar in the UK. Cornwall was picked as it has been the leading county in the area since the solar market kicked off in the UK. What the organisers may not have accounted for when they began to develop the programme was the changing dynamics in the industry and the local response to such an event.

Minister of State at the Department of Energy & Climate Change (DECC) Greg Barker was the key note speaker and he once again showed the industry that he has a personal belief in the UK solar and PV markets and remains a strong supporter of industry growth. He reiterated his call for 20GW by 2020 and followed many other speakers in pointing out that large scale projects was the most likely to bring about such a goal. As he was speaking the recent European Commission decision on Chinese product dumping he expressed caution to the industry that such a decision could have a huge impact on the industry.

Barker made his strongest point on an issue that obviously was not on his initial speech. He correctly responded to the unusual sight of protestors at the main entrance to the conference venue and rightly pointed out that this changing attitude of the public and consumers was potentially the greatest problem the industry now faced. Barker pointed out that he had never seen any form of protest at a solar event and it was something the industry needed to look to.

Protesting vision

The group of around thirty protestors were from the Cornwall region and were the first sign of social discontent towards solar as a renewable option. I wandered out and met the protestors who represented a wide range of society. At first it was difficult to determine what the concerns were as the issues were mixed with other renewable issues. Although initial discussion suggested there were health issues with solar the group was unable to back this up.

Another issue was the impact on sheep and experts were cited who claim it is bad for the animals. When I pointed out I had just listened to another expert state this was not the case and we had been showed images to back the claim the response from the protestor was negative. When it was suggested how much safer renewables were and would they prefer nuclear power, the surprising answer was yes they would as they felt that recent literature they read spoke of the safety of nuclear.

I was determined to get to the bottom of the concerns and a few more questions revealed that it was the size of the projects and the lack of local consultation or returns that really irked the protestors. In one sense it was a traditional British complaint against landowners changing the landscape and not considering the visual impact on a county that relies so heavily on tourism. There were concerns that the council was changing the laws so new solar farms could be built closer to residential areas than currently allowed. There seemed little benefit to the community and the protestors saw only the wealthy would benefit. The fact that the conference cost to attend only reinforced their sense of isolation on the topic. While some attendees at the conference found the protest amusing others saw it as the warning sign that it is. The solar industry has to take stock of these community concerns if it truly intends to reach 20 GW by 2020.
Industry activity

The protestors and the Barker speech had quite the impact on the conference with much of the question and answer sessions looking at the challenges facing the industry and seeking industry driven solutions. The need for industry wide solutions to challenges facing the value chain became a prominent concern even prompting the minister to call on the various industry bodies to develop more cohesive responses to the challenges faced.

One individual pointed out that a simple issue that could be developed would be standard nomenclature in describing the activities of the large scale solar industry. His solution was that everyone chooses to use solar farms when describing large scale activities as the industrial terms used only provided fuel to the protestors concerned. The entire conference felt this would also help the farming community explain that a large scale solar project was another form of photosynthesis. There was also calls for a better understanding of how solar could go hand in hand with other farming activities and contrary to scare mongering tales placing solar on farm land did not make it useless for other activity.

Other speakers went through their case studies and know how through their presentations but each Q&A would reveal that the bigger industry issues were of a greater concern to attendees. There was some excellent advice on the potential tangles people could find themselves in terms of planning, logistics and approvals needed for projects and that there was a need to get a handle on the red tape required rather than drown in following the tangled paths. This issue allowed discussion on the realities that it is getting harder and harder for SMEs in the industry to move forward as the regulations and rules were changing too much for smaller enterprises to keep abreast of. The ROC scheme received special attention for this problem.

Acknowledging success

Barker also spent time to thank Ray Noble who has been an industry stalwart and the instigator of the National Solar Centre which opened the same day in nearby St Austell. Noble gave a typical humorous presentation pointing out that the UK was still on track for 20 GW by 2020 but he also gave assurances that he had inside information from Brussels that a deal would be reached with China and no duties would be levied against them. Sadly that did not come to pass and his informant was a tad eager for a result.

Cornwall is the biggest solar county so many speakers were from the area and provided some fabulous stories of success in the region. There was also talks from local and county councils and whereas this can often be a sleep inducing part of such an event it was a pleasure to hear from informed individuals who were positive in their response to the solar issues. All the locals also pointed out that community attitude was the biggest issues facing the industry and despite all the talk of such issues there was very little in the way of a plan to ensure a national approach to improving the awareness of solar.

National success

The National Solar Centre was also opened on the same day and the same special guests greeted the crowd on hand to applaud the realisation of a national solar centre that is planned to become the centre for excellence and knowledge in the use of solar energy in the UK. The new centre will provide a technical and independent voice for the industry and related parties and will provide industry led research, analysis, testing and training.

The centres goals are to allowed the industry to mature and thrive. DECC has supported the development of the centre to facilitate this process and there is no doubt the outcome is a result of the vision of Ray Noble who was moved by the tributes to him. The National Solar Centre will be run by BRE, which is already recognised for its technical capabilities within both the construction and solar industries.

Cornwall Council is fully supportive of the venture and has provided infrastructure and finance for the project. The new centre is located at the eco-community at St Austell in mid Cornwall and the site will eventually have purpose built facilities including a solar farm and indoor and outdoor testing capabilities.

Despite the excellent opportunities such a project opens up I was amazed to find massive local disagreement on the centre and its location. Locals felt the new building was an eyesore and did not expect local benefit. The nearby Eden project had promised great local returns to an area of high unemployment that never eventuated and the locals have long memories. Another reminder that local support is going to be key for the UK solar industry in making positive growth steps for the future.

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The solar industry is often seriously misunderstood. A widespread lack of information and conflicting arguments have created a culture of distrust among the public, challenging the everyday trading which many small solar companies rely on.

The Return on Investment debate, which should still be one of solar’s strongest selling points, is now a minefield of conflicting information, skewed figures and chopped feed-in tariffs. Operating in the trade, we understand that the return has shrunk – but only to remain in line with the shrinking investment required for the systems, meaning that the percentage is still what it was when solar first hit the market. The ROI is as strong as it has ever been. The perception, however, is not. This challenge has increased further still following the irresponsible knee jerk reaction of many rogue traders, who have accordingly lowered the quality, performance and standard of their systems in order to slash the cost and often hugely exaggerating the returns. In the short term, this makes honest trading much more difficult for those of us who value our reputation. In the long term, it will demonstrate to the public the value of high quality technology.

A misinformed market

Despite the opportunities available in the UK solar market, many of the regulations and policies keep changing making it hard for smaller enterprises to keep up with the change. Some local markets have been tarnished by unscrupulous traders compounding business concerns. Ian Murray, Technical Director at Clear Focus offers some musings and insights from a smaller solar fish in the UK PV pond.
Forward with integrity

The only way for the industry to combat this information gap is to educate; provide honest, clear advice, limitless transparency and in depth technical expertise; encourage new PV prospects to shop around and compare quotes. With the right guidance and correct information to hand, the startlingly cheap deals will lose their appeal. Long-term investments must be prioritised alongside short-term gains. Existing customers are a fantastic source of independent endorsement, vouching for system quality, service and the delivery of profitable returns.

Building these necessary relationships with customers is second nature to many small traders. Communicating openly on a personal level is much easier for us and the relationships tend to be genuine and organic, without a call centre and tiers of staff to separate us from the customer.

Although when the water gets choppy we feel the waves, there’s a certain advantage of being a small fish in a big pond.

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**Boldly going**

THIS IMAGE shows a cutting-edge solar-electric propulsion thruster in development at NASA’s Jet Propulsion Laboratory, Pasadena, California. The engine is designed for space travel and uses xenon ions for propulsion allowing for a more efficient means of space travel than chemical rockets can provide. Although such an engine is unlikely to lift a rocket from terra firma it would be used once the ship was in space and derives its engines from photovoltaic energy. The system accelerates xenon ions using a magnetic field to generate thrust and are powered by solar panels.

The engine is being considered as part of the Asteroid Initiative, a proposal to robotically capture a small near-Earth asteroid and redirect it safely to a stable orbit in the Earth-moon system where astronauts can visit and explore it.

The solar powered engine is a small glimpse of where PV technology can go and the ingenuity of engineers of imagining such a machine in an attempt to capture an asteroid. Putting an asteroid into orbit around the moon would be one of the most amazing engineering feats of human technology and it is pleasing to see the driving force is sustainable and efficient.

An earlier version of this solar-electric propulsion engine has been flying on NASA’s Dawn mission to the asteroid belt which is looking at the asteroids Vesta and Ceres. This image was taken through a porthole in a vacuum chamber at JPL where the ion engine is being tested.

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