

# SUSTAINABLE ENERGY

**THE UNSTOPPABLE  
RISE OF RENEWABLES**

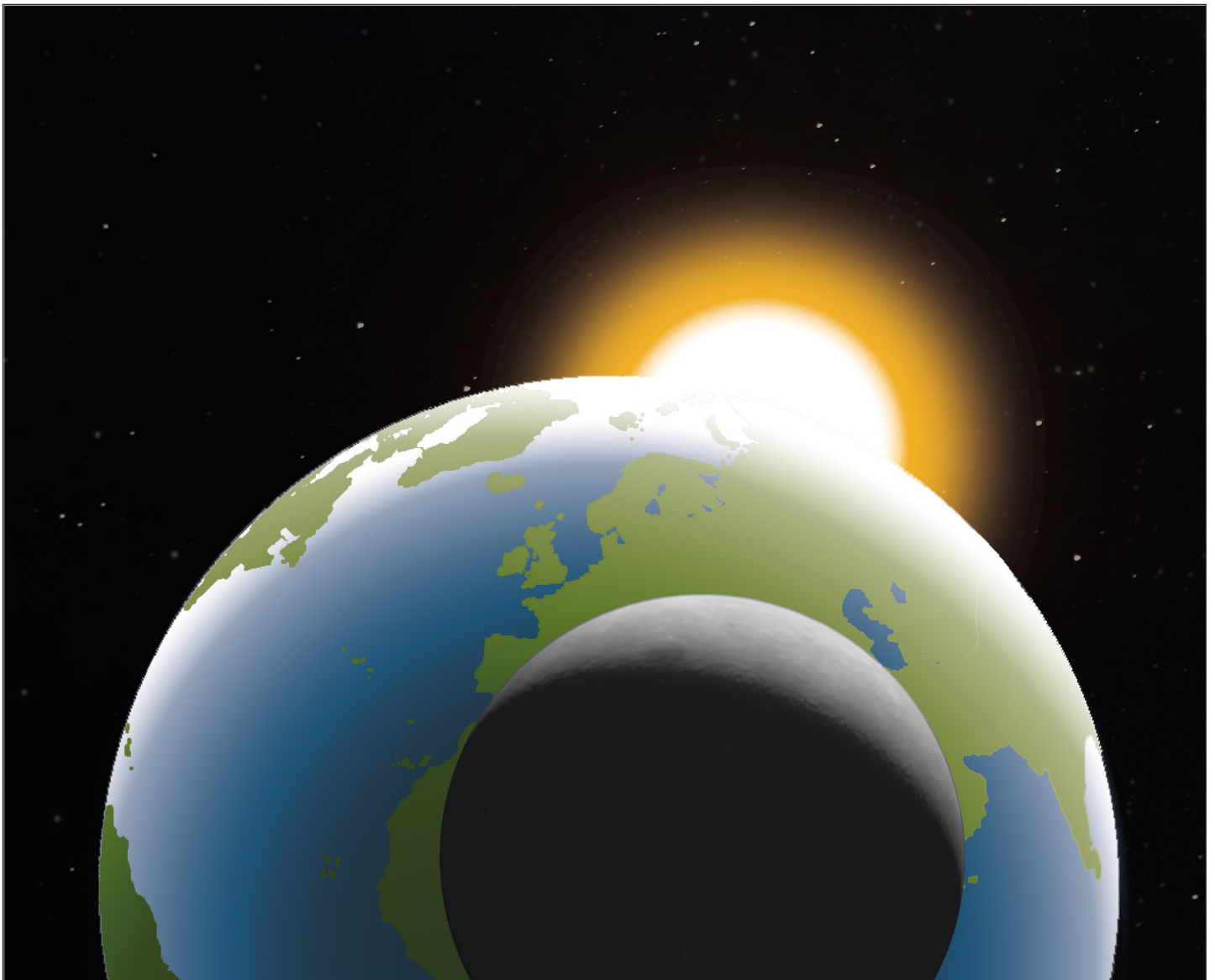
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**THE BENEFIT OF A POWER  
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**FUSION ENERGY: CLOSER  
THAN EVER BEFORE?**

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Blue & Green Tomorrow's  
**7th Guide to Sustainable Investment**  
during Good Money Week 2016



**Good  
Money  
Week**

30 October - 5 November 2016

# PUBLISHER'S LETTER

I am writing this sitting on a balcony overlooking Boscombe Pier in Dorset.

The air is clear, the sun is shining, the wind is blowing, waves are crashing against the pier's pylons and the tide is going out.

Capturing a tiny fraction of all that abundant, natural, clean energy would provide free energy for the Bournemouth suburb's 21,000 residents, and then some.

And that's the point of this fourth Guide to Sustainable Energy – the point of all our guides to sustainable energy.

All the energy we will ever need can be harnessed from nature. We have the technology, which gets more efficient and cheaper every year. The intermittency and storage problem has been solved, it's just not evenly distributed yet.

We just need the political and civic will, alongside the investment, to make the transition to a carbon neutral or carbon negative economy – locally, nationally and globally.

Coal, oil and gas have been massively subsidised over the years and their real cost - the conflict and pollution these methods of energy generation create – simply ignored.

Even if you were to ignore the impact of burning fossil fuels on our climate a la the [Four Horsemen](#)

[of the Climate Apocalypse](#) (Delingpole, Monckton, Lawson and Osborne now Leadsom), then you have to recognise the very real damage caused by extraction and the pollution burning fossils creates that kills or shorten the lives of many hundreds of thousands every year.

The sun always shines somewhere, the wind is always blowing somewhere, waves are always waving and the tide operates like clockwork. You don't need to fight wars, colonise nations, degrade the environment or pollute the air we breathe, the food we eat and the land we live on, if you use renewables.

And if you're an investor, all the investment growth opportunity is in disruptive, new and emerging renewable technology, not in the tired outdated fossil burning methods of the last century or so.

We hope you enjoy the guide. Once again we've gathered some fantastic contributions and we are indebted to all who supported us this time. 🌱



*Simon Leadbetter  
Publisher, Blue & Green Tomorrow*



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# POSITIVE NEWS FOR INVESTORS

By SIMON  
LEADBETTER

For six years Blue & Green has scoured the UK investment universe for positive options that enlightened investors can use to minimise their portfolios' harm, maximise good and still make a healthy return. It's not been easy as many sustainable or ethical funds compromise too much in our opinion, investing in companies with seriously dubious ethical or environmental practices. But we think we've finally found a positive solution.

All investment means some sort of compromise between the competing demands of protecting the planet, its people and delivering a profit. Investment cannot be 'pure' in the dominant economic system we have. Even if you are going to pick individual stocks and invest in pure play renewable energy companies for example, you have to accept that even these most virtuous companies use scarce materials, can compromise our country's natural beauty and sometimes divide the opinions of communities. In addition, if you don't get the balance of investments right, you might expose yourself to unacceptably high levels of risk.

Ultimately it's about balance. Whereas most funds say to hell with people and planet, there is a small universe of funds that try and balance these competing demands.

That universe has been brilliantly defined and described by SRI specialist 3D Investing as covered in our Guides to Sustainable Investment here and here. These are the funds that have been weighed, measure and scored against impartial, clear and transparent criteria. Is there still some compromise? Yes. Are those small compromises clearly explained? Yes. Do the funds balance

planet, people and profit? To a greater or lesser extent, yes.

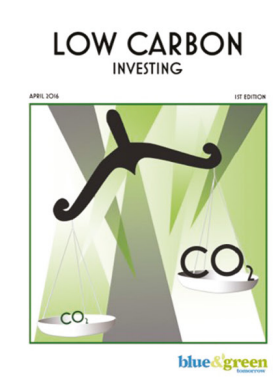
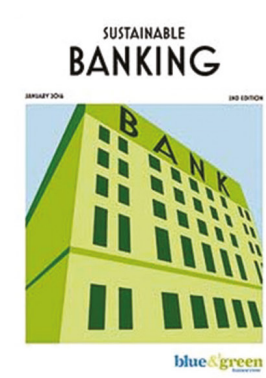
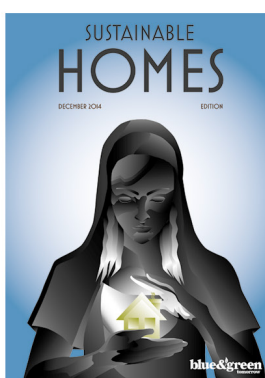
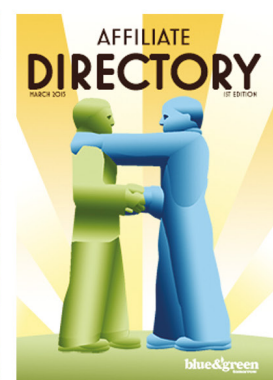
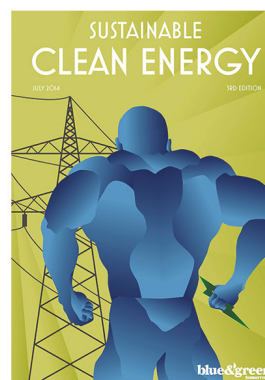
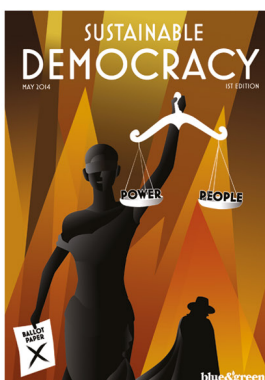
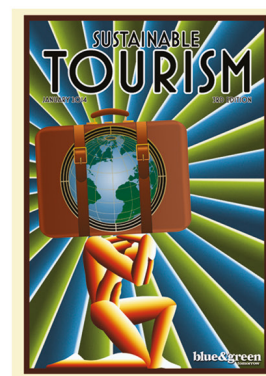
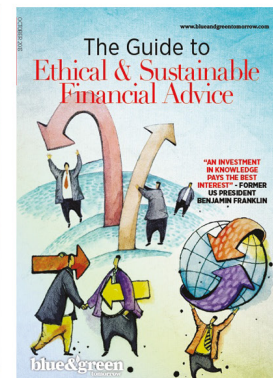
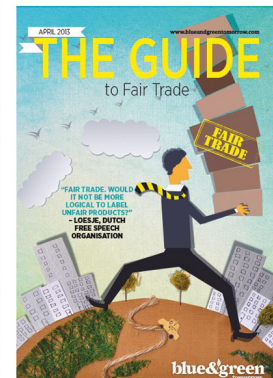
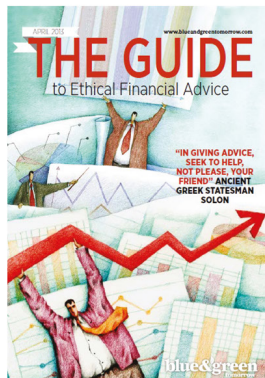
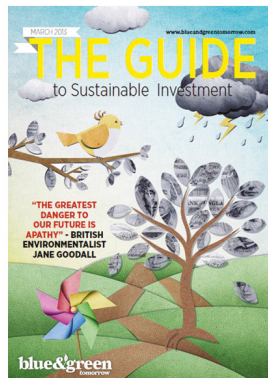
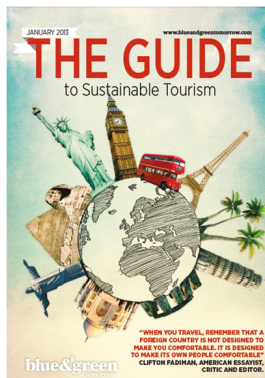
So far, so good. But what do you do if you want to invest in a portfolio of the best of these funds? You could spend lots of time and effort building and managing a portfolio yourself. You could try and persuade a wealth manager to help build one for you. You could do that or you could look at the range of portfolios developed by our friends at Pennine Wealth Solutions (PWS), who have spent the last two years working with 3D Investing to build them for you.

Using the 3D Investing fund universe and ratings combined with expert asset managers, PWS have created a range of risk rated portfolios, Positive Pennine, which in our opinion best balances the needs of the planet, its people and investors need for a return.

Pennine Wealth Solutions can only be accessed through authorised financial advisory firms. To explore these portfolios in more detail you can contact True Bearing Chartered in the North West or the online and phone adviser Bread & Butter.

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# THE UNSTOPPABLE RISE OF THE RENEWABLES

By JAMES COURT

The past year has been the most challenging the renewables industry have faced. At the REA we have grown with the industry. Set up in 2001, we have seen the evolution of 'alternative energy' through to the mainstream.

From a cottage industry spoken about in fantastical terms to standing on the precipice of delivering energy cheaper than fossil fuels. The economic direction is clear, last year saw the tipping point of renewables attracting more investment than traditional fuels worldwide.

The renewables industry should be a point of national pride, an area of real success, showcasing British ingenuity and innovation. We made ground-breaking strides forward in wind turbines during the eighties yet gave it away, for the past decade we have had the intellectual jump on the rest of the world in terms of marine energy and are in real danger of doing the same thing.

Solar is another area we have innovated. The drastic cost reductions seen in solar are only in small part due to cheaper panels, with EU tariff protection capping the cost of cheaper global prices. The British solar industry has driven down costs in the same way the British cycling team has revolutionised their sport, through the "*aggregation of marginal gains*", a thousand minute improvements that are the difference between winning and losing. At a time when nuclear is going up in cost, coupled with doubts over deliverability, solar costs are still dropping and can be deployed quickly, cleanly and sustainably.

The cost of new renewables may now in fact be cheaper than those for new fossil fuel generation. I say in fact because there is no way of knowing. No new gas station has been commissioned in last

4 years, and the last plant to open in 2012 started construction in 2008.

The nearest viable new gas generation we have is Trafford, who quote they need £72MWhr to complete. The current wholesale price is around £35MWhr, leaving a £37 gap that needs to be plugged if the UK is going to get our new capacity from fossils. For reference, the last round of renewable contracts, solar and wind both came in at around £79. However, that was in February 2015 so the costs will have certainly have reduced further.

But in a twist of events, 2016 will see new gas subsidised, the Hinkley deal guaranteed at £92.50MWhr and even more bizarrely, diesel is receiving subsidy. Yet arguably the cheapest of all new generation options, wind and solar, will be blocked from having access to any market. So, government policy now subsidises diesel, but blocks the cleaner more cost effective choice.

How did we get here? It is undoubtedly exacerbated by low gas prices, making new capacity unattractive for energy companies, in addition to subsidies costing more due to the drop in the wholesale price. But whilst the low wholesale price is out of the government's hands, the assault on renewables is not.

The industry has to move on from the last year and look to the new government agenda. The overall direction of renewables is clear and is an unstoppable global movement. Whilst we may have to spend a couple of envious years looking towards our partners in other countries longingly, wishing for their apparent ease, we need to get back to doing what we have already shown we are capable of, namely of innovation and finding UK solutions to UK problems.



Whilst the era of subsidies is coming to a early and abrupt end, renewables and new technologies can still find a use in some of the biggest policy problems we face in one of the oldest and most complex energy markets in the world.

Some of these problems are merely of an aging infrastructure. Last September, the then Chief Executive of the National Grid, Steve Holliday, summed up the shift in thinking that is going to have to happen. *“The idea of baseload power is already outdated. I think you should look at this the other way around. From a consumer’s point of view, baseload is what I am producing myself. The solar on my rooftop, my heat pump – that’s the baseload. Those are the electrons that are free at the margin. The point is: this is an industry that was based on meeting demand. An extraordinary amount of capital was tied up for an unusual set of circumstances: to ensure supply at any moment. This is now turned on its head. The future will be much more driven by availability of supply: by demand side response and management which will enable the market to balance price of supply and of demand. It’s how we balance these things that will determine the future shape of our business.”*

This is a business case for renewables that doesn’t rely on targets or subsidies, but of economic and consumer terms. There is a very real problem with the old way of thinking that is no longer suited to modern realities, and renewables offer part of that practical solution in a more decentralised grid.

The second is the financial environment we inherit. The old model of ‘big pieces of kit’ is increasingly unrealistic. In a nationalised system it would still perhaps be practicable to fund power generation in the billions for a single

project, but as demonstrated with Hinkley Point C, it is proving hugely difficult to raise capital and underwrite the risk and is certainly added to the overall cost. Gas plant is also proving difficult, with policy uncertainty playing its part and the low wholesale price too. But large energy companies are also sitting on reduced reserves with little incentive to risk hundreds of millions in a new asset.

Smaller, easier to fund projects are looking much more attractive and can have much lower financing costs.

Thirdly, the inherent problem of renewables variability is soon to be turned into a positive when coupled with energy storage. With energy storage, the instant dispatchability is in stark contrast to the unresponsive and inflexible nature of baseload. For many, energy storage is a green pipedream still decades away. This is now demonstrably wrong, with companies around the world already operating energy storage plants. Even better, they’re operating energy storage projects without subsidy. California is undoubtedly leading the way but the UK is looking to catch up quickly. Kilroot in Northern Ireland is a 10MW plant recently opened, with plans to extend to 100MW. National Grid announced their tender for 200MW of enhanced frequency response capacity its resulted in 68 project submissions totalling 1.3 GW. Energy storage is already viable, and we are going to see a lot more of it.

The energy sector is going to have a revolution in the coming years. Smart businesses and markets have already woken up to that fact, now is the time for the UK government, and some in the energy market clinging to the old broken models, to do the same. 🌱

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BSG Team



# THE BENEFIT OF A POWER SYSTEM WITHOUT FUEL IS PARTLY FROM TECHNOLOGY -- AND MOSTLY FROM MINDSET

In a world of flat or slow growth there are few industry sectors undergoing more exciting growth and technology innovation than power networks. We are moving from drilling, digging, shipping and burning hydrocarbons to generate our power, to people working to create an energy system that largely runs without thermal fuel.

However building this new system requires that we update our concepts and worldview so that we bring vision, policy and business decisions into alignment with where the technology and behaviours are headed.

- We are moving from a system based on a small number of big, centralised generators to a system that has a very large number, potentially millions, of decentralised energy resources, needing coordination on the grid.
- We are moving from a deterministic system where the obligation is to fulfill whatever demand users require, to a cooperative system based on a responsive philosophy, where the network works in cooperation with industrial and residential users to manage demand - turning it down or up - based on network characteristics and pricing efficiency.
- We are going from systems with high marginal cost - primarily in fuel to be burned - to systems with low marginal cost. This should change the way we think about business models, regulation, and industry.

Just as the microprocessor challenged mainframe culture in a very big way, so the energy transition challenges the traditional culture of the electricity sector, utility business models, and the role of the consumer-as-producer.

Let me give you three brief examples:

## Example 1: Rethinking the concept of “baseload” power.

By MARK  
LINDER

The idea of baseload is that society will have a constant (and growing) minimum demand for power. This demand profile varies during the day and seasonally, but the core of it – society’s basic requirement – is constant - and growing.

This historically led developed societies to build bigger and bigger centralised generation plants. There is no better demonstration of the risk management inherent in this than the evolution of bigger and more expensive nuclear power plants.

Baseload has thus become a culture. Just as businesses in the 1980’s were reluctant to give up mainframes to process payroll on a PC, we are reluctant to give up our idea of growing baseload.

But our concept of baseload needs to evolve. Electrical appliance efficiency, offshored industry and consumer pragmatism are working together to contain demand. In the UK we consume the same power annually as we did in 1995.

This can be hard to believe in the context of the energy services we enjoy. For example, the data centres that underlie our huge use of smartphone and cloud services only consume about 1.5% of our power, because many gains in efficiency have saved power while increasing services. Even with PCs and other information appliances, total IT-related consumption is less than five percent - significant, but well worth its small percentage in return for the benefits.

At the same time, the “unreliability” of wind and solar is mitigated with better use of modelling and other technologies that help these sources become more predictable. So it is increasingly

out of date to think about “1 to 1” backup of renewables with additional thermal capacity. Backup is still necessary to guarantee energy, but the new ratio is more likely “0.5 to 1”

Continuing to build ever bigger centralised, fuel dependant generation in expectation of rising baseload does not make sense. Wind and solar, tidal energy, more transmission options and innovative storage (beyond batteries), combined with demand-side management can be part of an efficient, predictable energy system with a lower amount of thermal capacity.

This is why a big, expensive, central mega-plant that outputs the same level of megawatts every hour of every day for the next 60 years is not necessarily the most efficient way of solving tomorrow’s problem. Whereas the predictability and flexibility of tidal lagoons -- also large scale generators but with double the lifespan -- provides nations with the opportunity to define and optimise future systems around known characteristics of their operational behaviour. Flexible, reliable tidal lagoon energy will be there for the long term.

### **Example 2: Connecting EV batteries and crypto currencies**

Whereas traditional thermal generation takes minutes to ramp up, battery storage on the grid can respond within milliseconds. This is increasingly helpful as we reduce our reliance on baseload power and increase our reliance on variable power from renewables.

There is a tendency to visualise battery storage as big blocks of batteries. There will be some large scale storage like this, but the evolution will be much more granular and innovative.

For example, Nevada has given approval to build a network of electric shuttle trains loaded with weights that ascend a grade during periods of surplus, then when needed descend and use their generative braking systems to put power back into the grid.

Many small nodes on the network will have innovative storage, which will replicate. One of the smallest nodes will be the household’s electric vehicle, connected to the grid.

One million electric vehicles connected to the grid to re-charge could represent more instantaneous power than a nuclear reactor (or even one of our larger lagoons). When the network needs to balance power instantaneously - say, if an interconnector from Europe trips unexpectedly - the network will put out a “buy” signal, to be met in milliseconds from hundreds of thousands of electric vehicle batteries that respond to the signal, and instantly go from charging to discharging.

This kind of resource will be an important part of regulating the network in a renewable world. The question is, how does everyone get paid and how do customers connect directly to sources of revenue without being side-lined by utilities?

To make this storage work, we need smart revenue-metering systems to account for and pay those vehicle owners - without the expense of installing additional kit in every car that is under the direct control of one particular utility.

This is very different from today’s “net-metering” - where the utility visits every generating household to install a meter that is directly connected to the centre. This barely works in small scale, and is impossible at large scale.



We envision further development of an ecosystem of trusted third parties who conceive and implement grid connection and revenue systems. These third parties might well make use of crypto-currencies to keep track of and compensate vehicle owners for the power they sell, as well as the power they use.

This is, of course, a very big challenge to the culture of today's electric utilities, who grew up in a centralised world where they install, own and measure every single meter on every household and business.

### **Example 3: Intelligent energy as part of a revitalised industrial strategy**

Renewable power has a key characteristic - low marginal operating cost.

The marginal operating cost of a programme of solar parks is close to zero, whereas the marginal operating cost of a natural gas or nuclear plant is significant. We have never dealt with the opportunity of large amounts of power at essentially zero marginal cost.

This is a significant characteristic of tidal lagoon power -- higher up-front costs for the impoundment and turbines, behaving like a dam with a lifespan of over 100 years, and an average operating cost that is very low, close to zero.

The potential advent of very low cost clean power from a fleet of tidal lagoons on the Welsh and English coast enables an industrial strategy component.

Not only will a programme of construction of more than six lagoons create tens of thousands of skilled construction and manufacturing jobs

over a generation, the resulting low marginal cost of this power will enable industrial growth elsewhere in the UK.

One of our investors has a concept to make use of low cost renewable energy to make steel. Today we ship scrap steel to Turkey for re-melting because it is unaffordable to do so here. Tidal lagoon power and other renewable electricity will be used to power a fleet of electric arc mini mills that melt recycled steel.

An electric mini mill runs in a 40-minute cycle - perfect for demand-side management. The mill will ask the network, "what price if we melt now?", and get an answer that informs the economics. The network can ask the mill to "wait until melting", or even "melt now at a very low price" if the grid is flooded with renewable power.

In this world, the mill itself becomes part of the energy asset community. It adds value to the system as a whole, whilst improving the efficiency of its own operation.

This is an example of a new technology and industrial business model enabled by the transformation of power systems. And this how a tidal lagoon power strategy can be part of enabling a revitalised UK industrial strategy.

We are at the beginning of an exciting cycle. I hope these examples have illustrated my main point: that the advent of a transformed power system that runs without fuel is causing a mindset and cultural shift that will have profound effects. We will be making many new connections besides the grid connections, as we play our part in the ongoing evolution of the UK's power system. 🌱



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# FUSION ENERGY: CLOSER THAN EVER BEFORE

**N**uclear fusion is the creative process of the universe. All matter, besides hydrogen and a smattering of helium, was created in the fusion furnaces within stars as small atomic nuclei joined together to make larger ones. This reaction releases huge amounts of energy – about ten million times as much by weight as the chemical reaction of fossils fuels, and all without any harmful byproducts. One can see why it is hailed as the energy of the future, the power source that will right the wrongs of a fossil fuel-reliant past and present. But it is not easy to achieve.

The established principle for this reaction on Earth is to combine deuterium and tritium, two isotopes of hydrogen, to make helium and a neutron. In order to do this, fusion reactors must recreate the conditions found in stars, where fusion naturally occurs. This means creating temperatures of 100m degrees to create a super hot ‘plasma’ within which the isotopes come together. The neutron generated by this reaction is not confined by a fusion reactor and so flies out of the vessel; capturing the energy of the neutron is what generates electricity.

The scientific and engineering problems behind putting a star within a box are big, to say the least. Without proper confinement of the plasma, the reactor walls would get hot and the fusion fuel would get cold; the reaction would stop. The hot plasma must be isolated from the walls of the reactor. This feat can be performed using magnets and the most advanced machine used for this purpose is the ‘tokamak’.

The best-performing tokamak in the world is JET, producing 16MW of fusion power with 24MW input in 1997 – ie 65% as much energy out as

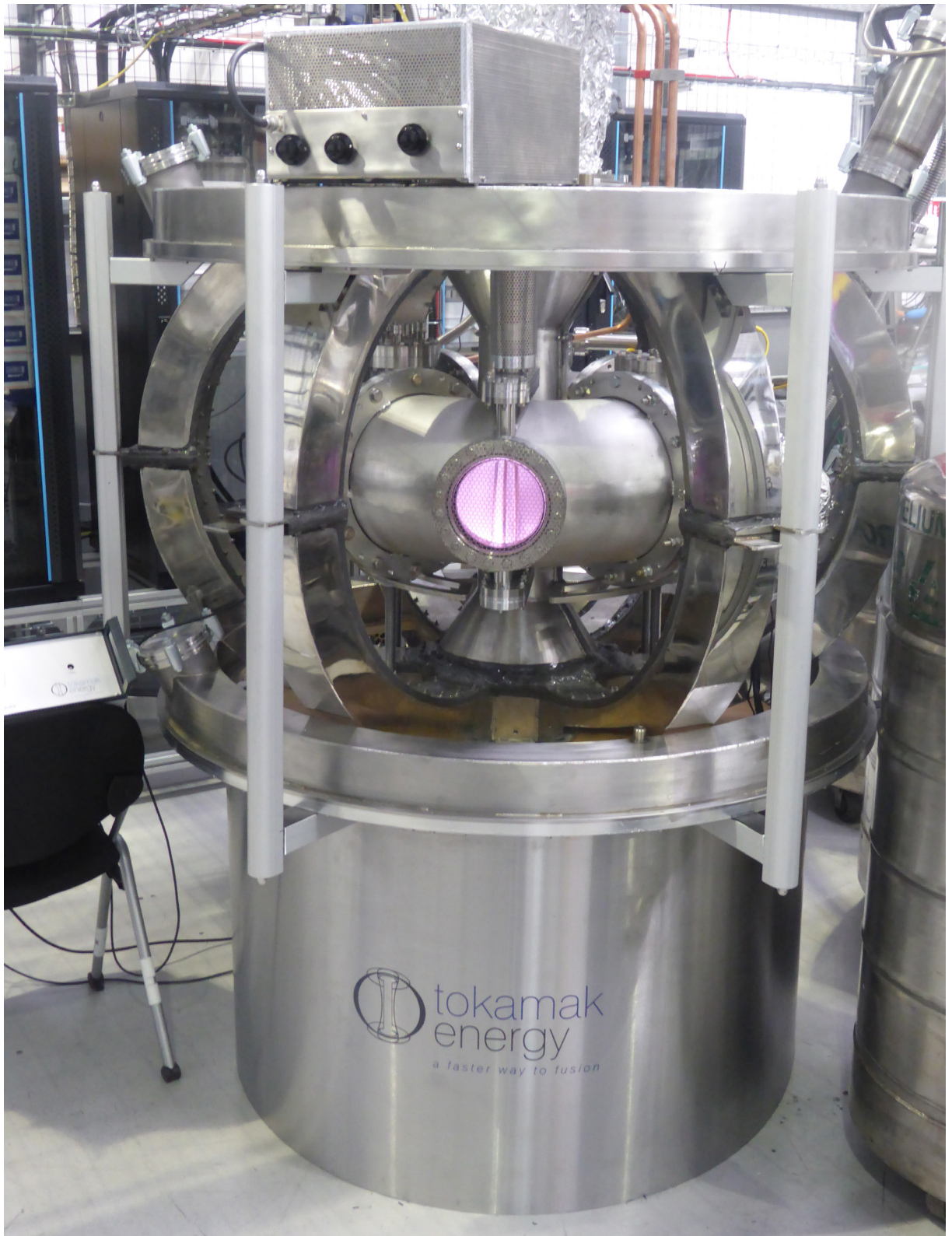


By DR DAVID  
KINGHAM

was put in. It holds the world record for total fusion power produced and for getting closest to breakeven, the point where you get as much energy out as you put in. For JET to achieve this, fusion research had followed a Moore’s law-like path. The temperature, density and energy confinement time, which indicates fusion performance, was increasing at a faster and faster rate up until the JET experiments.

But since then it seems that progress has stalled. There have still been experiments built and much learned, but progress towards energy breakeven





has slowed. We still haven't actually reached energy breakeven almost 20 years after we nearly got there.

Traditional designs have moved to larger dimensions, culminating in the ITER experiment currently under construction in the south of

France. This will be over 30m tall and weigh about 23,000 tonnes. The demonstration reactor that follows, dubbed DEMO, will likely be slightly bigger again. When ITER was being designed in the 1990s, it was believed that the only feasible way to increase fusion power was to increase machine size. But the size



and complexity of ITER has led to very slow progress, with first fusion set for the mid 2020s.

Tired of waiting so long and recognising the inherent difficulties of such a big project, the possibility of a smaller way to fusion has grabbed the imagination of inventors, innovators and now investors.

As patience with progress has begun to run out there is a new climate of private funding reaching into areas previously the domain of governments. Ventures like Virgin Galactic and SpaceX, or The Breakthrough Energy Coalition led by Bill Gates and Mark Zuckerberg; these large investments in new technologies and promising areas of scientific research are becoming more common. As Lord Rees of Ludlow, past President of the Royal Society, put it in 2015, *“the private sector now has greater appetite for risk in scientific projects than Western governments.”*

The fusion industry has benefitted hugely from this surge in funding. Jeff Bezos, founder of Amazon, and Peter Thiel, co-founder of PayPal, have invested many tens of millions into private fusion ventures in the US and Tokamak Energy is seeing the same in the UK, receiving over \$15 million so far from private and public investors. This has allowed the complex science and engineering needed for fusion to be developed faster than it has for years.

For Tokamak Energy this investment has allowed it to extend the lead that tokamaks already have in the race to fusion. With research beginning in the mid 20th century, a lot is known about how they hold plasma in a spherical reactor with magnetism. Tokamak Energy has added to this, publishing two papers that show for the first time that size is not an important factor in fusion

reactors and proving that a compact reactor can produce an energy gain; a game changer when you consider the grand scale that other fusion projects are pursuing. Proving this has helped Tokamak Energy to turn the pursuit of fusion energy into a series of engineering challenges.

Thanks to funds raised, Tokamak Energy has been tackling these challenges head on with a five-stage, five-reactor plan. Its second device showed it was possible to make new high temperature superconducting magnets for controlling the plasma. These are made of a material with much increased conductivity in high magnetic fields than materials typically used for magnets in fusion reactors. The higher conductivity and higher operating temperature will allow fusion power to be produced in much more compact devices than conventionally thought possible.

By breaking down the challenges into such distinct goals, money can be raised privately to achieve each step, with success enabling more money to be raised to tackle the next challenge. Tokamak Energy aims to deliver a fusion power gain within 5 years, first electricity within 10 years and a 100 MWe power plant within 15 years, but acknowledges that this will depend on attracting a huge amount of investment.

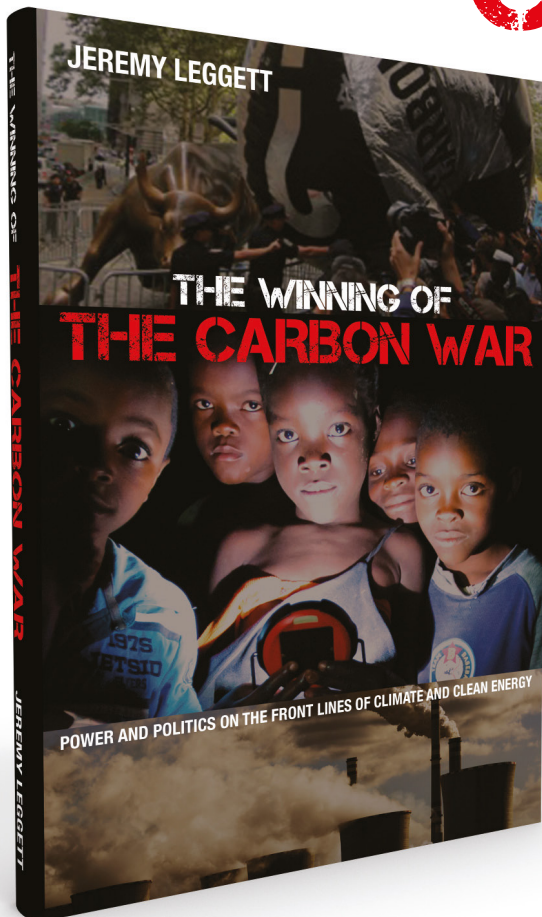
There is latent public enthusiasm; many people recognise that harnessing fusion energy is an important challenge that we have a duty to tackle. The new investment climate brings hope for this fusion future. While some hold the view that fusion will forever be 30 years beyond the horizon, Tokamak Energy is working on making it a reality.

*Dr David Kingham, CEO, Tokamak Energy* 🌱

# Can humanity win the battle for clean energy in time?

JEREMY LEGGETT

## THE WINNING OF THE **CARBON WAR**



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# BRISTOL ENERGY COOPERATIVE CELEBRATES £10M SOLAR SUCCESS

By CAROLYN HAIR

- B**ristol Energy Cooperative celebrates £10m solar success
- Bristol Energy Cooperative (BEC) celebrates reaching over £10m in its ambitious solar fund-raise.
  - This amount has funded the construction of a new solar farm in Bristol, the taking ownership of a new solar farm in Somerset and the ongoing installation of community rooftop solar arrays.
  - BEC has achieved this significant sum since November 2015 through a share and bond offer against a backdrop of Government changes to the energy sector.
  - BEC membership has more than doubled demonstrating the growing momentum to make the transition to clean energy.
  - It is anticipated that around £70,000 each year will go into a fund for local community projects for the 25 years of the projects.

Bristol Energy Cooperative (BEC) has celebrated reaching the powerful sum of £10 million in its fund-raising campaign to offer the city and surrounding area a brighter, cleaner energy future.

BEC's £10m fund-raise will not only reduce carbon emissions, but also leave a legacy of social benefits with all the profits from BEC's solar projects being invested back into the community. Around £70,000 will be available for local community projects each year for the 25 years of the solar projects.

The money raised since November 2015 through a share offer and bond offer is already working for the community's benefit with £3.5m raised through crowdfunding. BEC has built and switched-on a new 4.2 MWp solar farm at Lawrence Weston, financed an operating 4.6

MWp solar farm in Somerset and is installing solar panels on community roofs across Bristol.

Bristol Energy Cooperative has already installed solar panels on Coniston Community Centre, Easton Community Centre and Brentry and Henbury Children's Centre, which will help these organisations reduce their energy bills and carbon footprint. Around 10 additional community roofs in the Bristol region, including the Architecture Centre and Wick's Sports Centre, are lined up to join this community solar initiative.

Altogether BEC's new installations will generate enough energy to power 2,270 average UK homes; this is equivalent to 9,268 kWp of solar PV capacity, generating an average of 9,300 MWh of electricity each year.

Chris Speller, co-director of BEC said: "We're proud to announce that our fund-raise has reached over £10m enabling the funding of all the solar projects in this phase of expansion. The BEC Board of Directors would like to thank our growing community of investors and supporters who have helped us reach this significant target. "Our success demonstrates growing momentum to generate and control energy at a local level. Investing in community energy is an accessible way to make a personal positive impact on climate change, improve the local sense of community and get a good rate of return on savings. We're determined to build on this strong foundation and continue to work towards Bristol's zero carbon targets, whilst extending participation in community energy locally and beyond." People-powered energy

BEC's membership has more than doubled to 425 members, who invested in its share offer, with 800 investors in the bond and share offer in





total. This clearly illustrates the drive to make the transition to renewables as an alternative way to power cities and communities.

Since beginning this £10m fund-raise, BEC has faced many additional challenges, including changes to Government policy on community energy as well as the economic uncertainty around Brexit. The overwhelming success of the co-op's fund-raise in this context shows that there is a strong desire to move towards alternative energy generation and confidence in community energy investment with its financial, social and environmental benefits.

This fund-raising campaign also demonstrates the power of collaboration in the transition to cleaner energy. As well as developing partnerships with local community groups, including regeneration organisation, Ambition Lawrence Weston, BEC has partnered with Mongoose Energy, the UK's leading community energy business, and Ethex, positive investment platform, on the share and bond offer. Other partners including, Bristol City Council, Triodos Bank, Social and Sustainable Capital and Close Brothers, have provided loan funding for the projects.

Christine Davis, Manager at The Architecture Centre in Bristol, one of the buildings which will benefit from BEC's community solar, said:

*"This is a fantastic scheme that really exemplifies the potential of the 'triple bottom line' approach - bringing social, environmental and financial benefits. Investing in this scheme will enable small charities and community organisations like us to invest in something we could not otherwise contemplate - and will have a lasting positive impact on our organisation, the people we work with, and the planet."*

*"As an independent not-for profit-organisation we would reinvest money saved in our activities - for example helping us to reach more young people through inspirational programmes such as Shape My City which provides life-changing mentoring opportunities and empowers young people to help shape their neighbourhood for the better."*

Find out more about how to get involved with BEC on its website:

<http://www.bristolenergy.coop> 🌱

# VIEW FROM THE INVESTMENT COMMUNITY: ABUNDANCE INVESTMENT

**A**s ever, the renewable energy industry has had another year of highs and lows. Feed-in Tariff levels across a number of technologies have been cut, causing uncertainty in the investment market just as the UK is producing record amounts of clean electricity from those very technologies. Despite this, there are still new investment opportunities around and we expect to see a growing number of these coming from joint public-private funding of local authority projects. This has already been successfully demonstrated with a 4.8MW ground-mounted solar farm in the borough of Swindon.

Swindon Borough Council (SBC) has a vision to be a leader of the low-carbon economy and part of this vision is a target to produce 200 MW of electricity from renewable sources by 2020. SBC – as with many other local authorities – is also looking for ways to generate long term incomes to help them continue to plan and deliver services to their residents, while also encouraging greater levels of participation and engagement with

council activities amongst residents. The solution is Swindon Common Farm Solar CIC.

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By KATRINA  
SIDENIUS

The solar farm was developed on Council owned farmland and refinanced with a £3 million loan from SBC and a further £1.8 million from a groundbreaking local retail Debenture (bond) offer through Abundance. The investment offer was a resounding success, with more than 700 investors raising the full amount more than a month ahead of schedule and individual investments ranging from £5 to more than £50,000.

This model is already being replicated with SBC for a potential second solar project and can be easily applied to a wide variety of infrastructure projects. It's the ultimate win-win: investors have a financial and emotional interest in their local solar farm, the Council earns long term income from the energy produced and business rates, and the UK produces that little bit more of its own clean energy. All of which means our message to investors is: watch this space, investment opportunities in renewables aren't going away. 🌱

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# RENEWABLE ENERGY: OPPORTUNITIES AND CHALLENGES

By MIKE  
APPLEBY

**W**e like renewable energy because – fundamentally – it will help to reduce CO2 emissions and combat climate change; now recognised as an existential threat to both the global environment and the global economy. As such we think that there will be structural growth in wind and solar power as they continue to displace conventional installed thermal capacity (fossil fuels) over the next decade and beyond.

We see renewable energy generation as a big disruptor to existing thermal power utilities. We believe established energy providers will struggle as their business models are challenged by increasing renewable penetration on the grid and the resulting super-abundant power at virtually zero marginal cost. There are opportunities in improving the grid and we think that, in time, energy storage will be a big feature as battery costs fall.

The sector is, however, currently going through a transition period before the majority of renewable energy can compete with other forms

of electricity generation without subsidies. In this deflationary environment for wind turbines and solar modules, we are wary of profit margin compression in pure manufacturers of these main renewable technologies. While competition is good for driving down prices and increasing competitiveness, structurally falling margins do not make for a good backdrop in which to generate investment returns.

Thus, while we see good growth in renewable energy generation over the medium to long term, finding companies that have reasonable prospects of becoming profitable is harder. We see more opportunities in energy efficiency where more visible business fundamentals give us confidence that growth in these areas will be profitable – and so generate good investment returns. Specialist components used to make cars more efficient or safer; building insulation to reduce the energy needed to regulate the temperature of buildings; and efficient lighting methods like LEDs are all areas we are invested in.

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\* MIT Technology Review, 2014



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# UK ENERGY TRANSITION

By DAN WELLS

A fundamental change is underway in the way in which energy is generated and managed, both in the UK and on a global basis. We are moving from a relatively simple traditional centralised energy network utilising centralised generation from large-scale, carbon-intense assets, to a much more complex and dynamic system based on a decentralised, low-carbon generation network, highly flexible grid infrastructure and greater connectivity between markets.

Driving this transformation has been the rise of energy from renewable sources; globally more renewable energy was installed in 2015 than fossil fuels for the first time. Although the initial impetus for this was recognition of the need to reduce greenhouse gas emissions as part of a comprehensive strategy to mitigate future climate change, dramatic decreases in the cost of renewable energy technologies such as wind and solar has meant that there is no longer a required trade-off between economic and sustainable development. Further, once built renewables typically have a close to zero cost of production of energy, so in many cases can outcompete other fuel sources and begin to set prices in a market.

This dynamic presents electricity grids with two challenges. First, renewable energy generation assets tend to be more decentralised on the grid than large-scale conventional power plants. Second, the output of renewable energy is by nature intermittent. These factors increase the complexity of maintaining supply and demand balances in the system.

However, it also creates investment opportunities in flexible grid infrastructure that can achieve this end; both in terms of hardware (such as reserve

power generating plants that can rapidly respond to changes in the grid balance, and energy storage assets) and software (including intelligent energy management systems).

Decentralisation of energy and the introduction of “smart” grids means consumers – whether they be industrial and commercial users, or individual households – will increasingly have control over their energy management. Home energy management systems and the “internet of things” give such control; for example through appliances which respond to changes in the supply / demand balance to take advantage of cheaper energy prices at certain points in the day as they occur. Generation of power through on-site renewable energy equipment, and increasing use of electric vehicles, means that the flow of electrons between consumers and the grid will no longer be in one direction only. The dawn of the “producer-consumer”, or “prosumer”, has arrived.

Concurrently to these changes within electricity networks, connectivity between national grids is increasing due to pressure for market liberalisation and standardisation. This in turn creates opportunities for investments in interconnector cables which will enable countries such as the UK to benefit from lower wholesale power prices from continental European neighbours as well as reliable supplies of clean energy from sources such as hydropower in Norway and geothermal from Iceland.

The energy landscape in the UK and the world as a whole is changing drastically as the shift continues to reduce our dependence on fossil fuels and a centralised grid. The market will be an exciting one to watch in the coming years.

*Dan Wells, Partner Foresight Group* 🌱





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# THE CURRENT SWEET SPOT IN RENEWABLES

By JON  
FORSTER

**G**lobal energy markets are undergoing fundamental and rapid change towards a greater reliance on renewable energy. Growth in wind and solar markets is driven by government concerns for energy independence, a will to reduce nuclear power operations post Fukushima and to mitigate climate change, as evidenced by the outcome of the Paris Climate Agreement last December.

There are many ways to access the investment opportunities in the high growth renewables sector. Here we discuss the current merits of three different areas for investment in the renewables value chain.

## 1. Risks in “yieldco’s” often overlooked: “unfavourable”

Wind farms and solar parks are high up the wish list for European pension funds and sovereign wealth funds which tend to regard them as effective vehicles for long term liability matching. In this low interest rate environment we see a significant risk for investors who may well be overpaying for the income from these “yieldcos”. We believe that “yieldcos” offer limited upside. Furthermore, many investors do not appear to be aware of the power price and political risks to which they are exposed in some markets, or of the depreciation of the underlying assets which is rarely taken into account in their valuations.

## 2. Equipment suppliers: “some interesting opportunities”

As in other energy sectors, there will be periods of both over and under supply which impact margins and growth rates. Equipment suppliers are cyclical stocks and can be volatile. For example, a leading global manufacturer of wind turbines, has seen operating profit margins

ranging from losses to +13% over the last 10 years. The sector is currently attractive and we have identified opportunities in companies with solid growth and attractive valuations. Similarly, solar panel manufacturers which saw a massive margin opportunity during the period to 2011, when supply was constrained, have seen their margins undermined by overcapacity in Chinese manufacturing in the subsequent years. With the expansion of end markets, and subsidies becoming a smaller aspect of project economics, the solar industry is now more broadly based and we see low cost manufacturers (predominantly in Asia) with positive and growing margins once again. An active investment process supported by deep industry and stock research is needed to navigate the complex dynamics of this market.

## 3. Project developers: “the current sweet spot”

In a world of falling technology and installation costs, and with growing demand for completed assets, we believe that developers of renewable energy projects currently have strong growth prospects. We see opportunities for significant upside from development and construction of projects and their subsequent sale to institutional investors or “yieldcos”. Our listed equity funds hold a number of these companies with balanced exposure to US, EU and Asian markets.

There are also interesting investment opportunities in the form of private equity pooled vehicles which focus on renewable infrastructure development. These vehicles purchase pre-construction assets (individually or in portfolios) for construction and eventual sale. This “buy build sell” model should mitigate development and construction risk for investors while maximising value to deliver strong returns.

*Jon Forster, Director, Senior Portfolio Manager,  
Impax Asset Management* 🌱



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THE QUEEN'S AWARDS  
FOR ENTERPRISE:  
SUSTAINABLE DEVELOPMENT  
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# ENERGY STORAGE POISED FOR GROWTH

By PHILIP BAZIN

**W**hen looking to the future of renewable energy production in the UK, as a bank and as an investor, we believe that energy storage is poised to grow rapidly in the UK towards 10GW in the 2030's.

This insight into growth is the outcome of a new report entitled *“Energy Storage – towards a commercial model”*, authored by energy experts Regen SW, in association with Triodos Bank, Green Hedge Energy and UK law firm TLT. But what are the next steps needed for an emerging energy storage market to lift? The report shows that action is required to align the technology with market and policy signals if we are to realise this potential.

It's clear from the advances made in other countries and now the UK that proven sustainable electricity storage solutions exist and that their cost is fast reducing. What we now need to make

these solutions more financeable is a clear, long-term policy and regulatory framework to support the demand for these solutions and create an exciting sizeable new market in the UK.

The deployment of sustainable energy storage solutions in the UK is one of the fundamental pillars that is required to achieve an energy system that is 100% sustainable - a low carbon, resilient and balanced energy system. It's essential that financial institutions work in close collaboration with developers and policy makers to create a conduit for energy storage technology that will support the wider strength of renewable energy production.

But if this unsolved 'Rubik's Cube' begins to shift into alignment, the potential for the new energy storage market is unbridled.

*Philip Bazin,  
Environment Team Lead Triodos Bank*



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# TRANSFORMING THE FUTURE OF ENERGY

By PAUL  
PIZZALA

These are extraordinary times for renewable energy. Records are broken, commitments are made and setbacks occur almost on a weekly basis. It would be too easy to lament the latest UK Government reshuffle and what it means, because looking at renewable energy purely in a UK context risks missing the bigger picture.

The 'big picture' trend is for sharp falls in the unit cost of solar spurred by aggressive competition and a lack of financial discipline from Chinese manufacturers. This has two broad effects; firstly it means that solar energy is becoming more attractive as a source of energy, which in turn is driving adoption rates. But it also means that as investors, we have to pick our way through the landscape and take a nuanced view on the opportunities.

This is analogous to the way the Internet developed, with the back bone of superfast optic fibres providing the platform on which businesses such as Google, Apple, ARM and Amazon developed in new and unexpected ways.

It is not always possible to predict with much accuracy how new industries and technologies will develop. However, the key to long-term investing in this case is understanding the evolution of the market overall as a source of value creation and destruction.

An example of this this type of market progression at a local level is crowdfunding, where social media platforms have enabled the aggregation of community energy schemes. This combines a social movement with technological change to create a better vision of the future.

This type of reaction is referred to by economists as a 'spillover' effect when new markets and technologies meet to spur each other on. For instance, Nintendo revolutionised gaming when they put a movement sensor from a car into a control panel and created the Wii.

It may yet be too early to call, but the possible game changer in renewable energy is effective battery storage. This could solve the problem of intermittency in renewable energy supply as well as changing the whole energy distribution system.

Networking this additional capacity and using it to power local grids, as well as the growing fleet of electric cars would disrupt not just the electric utility industry, but also the automotive sector, and the oil and gas industry.

The transformative effects may be difficult to predict with certainty, but the impacts are likely to be truly extraordinary.

*Paul Pizzala, Business Development Manager,  
WHEB Group* 🌱



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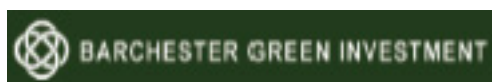
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### **Prest Financial Services**

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### **Profit With Principle**

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### **SMYTHE & WALTER**

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### **Smythe & Walter**

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### **Stewart Investment Planning**

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