

Spotlight

ENERGY AND CLIMATE CHANGE: THE POLITICS OF POWER

Caroline Lucas MP / Clive Lewis MP / Antoinette Sandbach MP

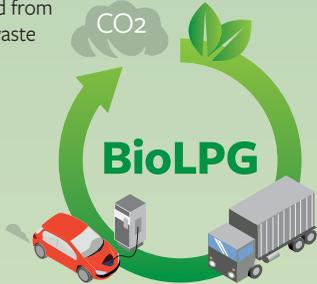


Clean Growth Strategy: how can we decarbonise the countryside?

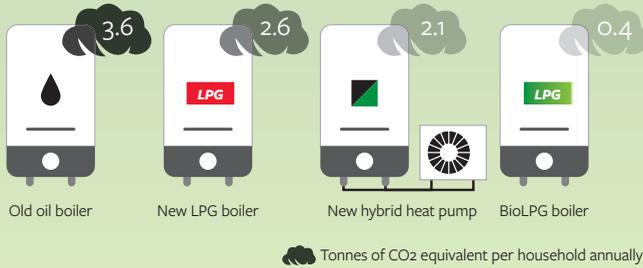


BioLPG is a low carbon, drop-in alternative

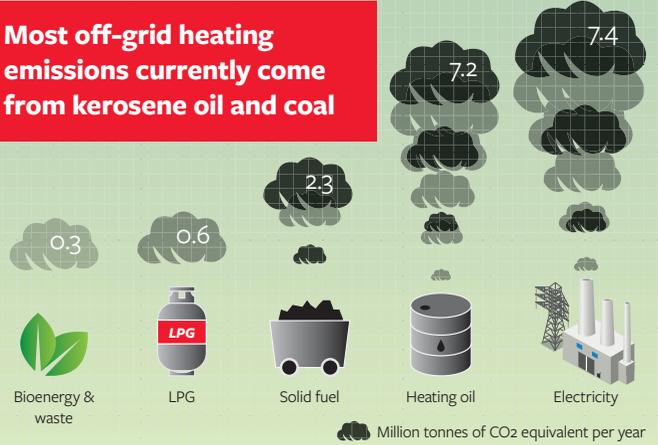
BioLPG is created from renewable and waste materials...



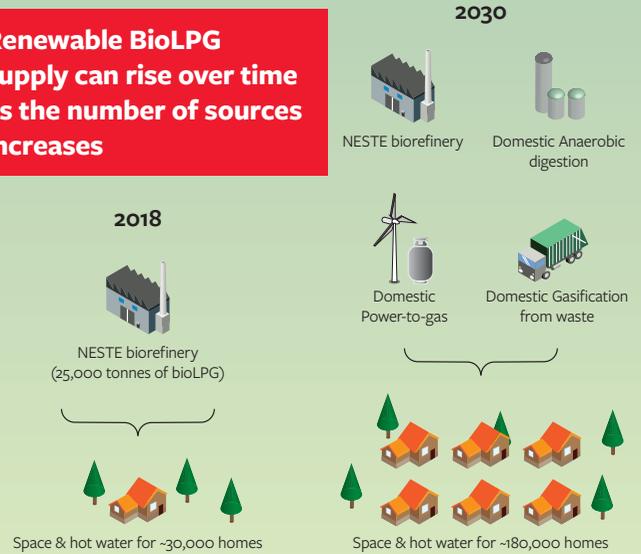
...and can help off-grid households move away from traditional fossil fuels



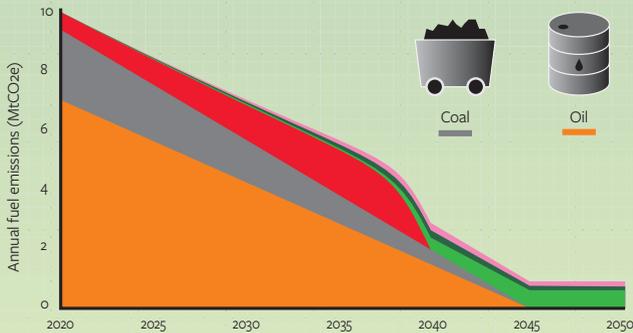
Most off-grid heating emissions currently come from kerosene oil and coal



Renewable BioLPG supply can rise over time as the number of sources increases



BioLPG and gas heating technologies can drastically cut emissions from rural properties in the long term without breaking the bank



Decarbonisation scenario modelled by Ecuity showing the impact of bioLPG and gas heating technologies on the market

What should the Government do?

- Continue with plans to phase out the use of high carbon fossil fuels used in off-gas grid Britain during the 2020s i.e. heating oil and coal
- Promote the role of clean gas and explore opportunities with industry for domestic production sources for biogases such as BioLPG
- Reform EPCs to ensure rural property owners are no longer disadvantaged by government energy efficiency policy

Figures: Ecuity Consulting calculation based on data from BEIS (2017) and EU Commission (2016)

The case for open windows



Meetings make you stupid. Science has shown this: in at least eight different studies, scientists from universities including Harvard, UC Berkeley and the Technical University of Denmark tested the cognitive function of subjects in rooms with raised levels of carbon dioxide. The average outdoor CO₂ level is a little over 400 parts per million (ppm). At 950ppm – a level commonly found indoors, in offices and schools – there were slight but measurable effects on cognition. At 2,500 ppm, researchers reported “astonishing” adverse effects on subjects’ ability to use information and initiative, think strategically and make good decisions. A crowded meeting room, filled with people exhaling CO₂, can easily exceed 3,000 ppm.

This is knowledge that might be useful – if you’re taking an exam in a hall full of nervous, fast-breathing students, ask for a seat near the door – but it might also be seen as a microcosm for the predicament the world now faces. The activities that prop up the grand shared delusion of economic progress are starting to make the environment, like a meeting room, hotter and stuffier and less conducive to clear thinking. Every unnecessary business-class flight (which produces three to six times as much CO₂ as flying economy), every big-engined executive saloon idling in a traffic jam, every needless purchase and unaffordable new building in the economy of endless growth makes us, part per million by part per million, less able to think our way out of this mess.

This is not a flippant observation. This month, YouGov surveyed thousands of Americans and found that 17 per cent of them – representing 55 million of the planet’s most profligate consumers, who emit more than 30 times as much CO₂ per person as Nigerians or Bangladeshis – believe man-made global warming to be a hoax. Idiocy is a poisonous cloud, and it is spreading.

For now, we can open windows. There is still enough fresh air to clear our heads and look again at a problem that has for too long been worried at indecisively by fogged minds in stuffy rooms. But this must happen right now, because there will come a time when there will be no more windows to open.

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News



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Renewables face VAT hike

Will Dunn

The installation of solar panels, wind and water turbines, battery storage and other energy-saving materials in residential accommodation will rise by 15 per cent from 1 October as the government implements plans to charge the full rate of VAT on green technologies. Energy-saving materials currently incur VAT of five per cent.

The decision has drawn criticism from the Committee on Climate Change and the Renewable Energy Association, which said in a statement that the higher rate would set UK decarbonisation back “by a number of years”.

The government’s explanation of the

move is that it was prompted by a judgement issued by the European Court. However, this judgement was issued in June 2015 and previous plans to incorporate the decision in 2016 were removed from that year’s Finance Bill. The European Commission told *Spotlight* that the UK had, along with every other EU state, unanimously decided on the list of goods and services that could benefit from a reduced VAT rate, and that the Commission itself proposed reform of these rules last year.

The Treasury Secretary, Liz Truss, cut subsidies to solar farms as Environment Secretary in 2014, describing them as “a blight on the landscape”.

YouTube urged to save energy

Oscar Williams

YouTube could dramatically reduce the size of its carbon footprint by introducing a series of simple design changes, according to a new study conducted by researchers at the University of Bristol.

The research revealed the video-streaming giant emits around 10 million metric tons of carbon dioxide equivalent (CO₂e) a year, around as much as a city the size of Glasgow. But a design alteration as simple as stopping sending images to users who are only listening to audio could reduce its annual footprint by between 100 and 500Kt CO₂e, comparable to that of 30,000 UK homes.

“Digital services are an everyday part of our lives,” said Bristol’s lead researcher Professor Chris Preist. “But they require significant energy to deliver globally – not only in data centres, but also in networks, mobile networks and end devices – and so overall can have a big carbon footprint.”

The study marks the first time that researchers have estimated the environmental impact of a specific design change.

Britain coal-free for longest period since 1882

Rohan Banerjee

Britain has managed its longest period without using coal to generate electricity since the 19th Century. The National Grid Electricity System Operator (ESO) confirmed that the last coal generator came off the system on 1 May; at the time of printing, on 10 May, coal remained unused. ESO’s director, Fintan Slye, said

that this achievement, with further commitment from the government to its ambition to phase out all coal-fired power plants by 2025, could become the “new normal”. “Coal-free runs like this are going to be a regular occurrence,” he said in a statement.

Coal power stations still serve as a backup energy source in the UK during periods of high demand, but nuclear and gas power stations, along with the increasing use of renewable energy sources, means it is being used less, and the relatively high cost of importing coal have made it less attractive as an energy source overall.



EPSRC funds £1.65m window research

Rohan Banerjee

A joint research venture to create new technologies to improve the energy efficiency of buildings has been awarded a £1.65m grant from the Engineering and Physical Sciences Research Council. A partnership between Loughborough University, the University of Nottingham and the University of Exeter will work on a range of heating, cooling and lighting appliances, including four types of “advanced glazing”.

Windows play an important role in

determining a building’s energy performance, explained Nottingham’s Dr Yupeng Wu, who is leading the project. “They regulate heat transfer to and from the external environment by radiation, conduction and convection,” he said in a statement. Wu and his colleagues will develop new “optical components” that can be attached to conventional double glazing to increase daylight penetration. This could reduce energy consumption from lighting, heating and cooling by over 30 per cent.

BEIS figures show that the power demands of the built environment account for over 40 per cent of total UK energy consumption.

UKRI offers £30m to smart energy innovators

Oscar Williams

The government has unveiled a £30m fund to support UK organisations in developing systems that link energy supply, storage and usage more efficiently.

The ultimate goal of the project, which forms part of the Industrial Strategy Challenge Fund programme, is to create a pipeline of designs which can be rolled out in the 2020s. Funds will be awarded to initiatives that harness innovations in the energy sector, lower energy system costs and emissions, and demonstrate the potential for establishing new markets.

“This competition will help to give the UK’s makers and innovators the tools to make this vision a reality, and seize on the business opportunities ahead,” said the energy minister Claire Perry.

“A future built on digital, data-driven smart systems will transform the way society interacts with the grid - delivering cheaper, greener and more flexible access to energy for everyone.”

The competition opened on 7 May and will close at midday on 7 August. The government has invited UK organisations of any size to apply.



Crowdfunded clean energy platform launches

Will Dunn

A new company offering consumers part-ownership of energy production infrastructure has launched in the UK.

Ripple, described as a “clean energy ownership platform”, will give consumers the chance to lower their energy bills by buying a stake in an onshore wind farm. The wind farm’s contribution to the grid offsets part of the cost of a consumer’s energy bill, via special discounted tariffs with partnered energy companies, allowing customers to co-own generating capacity from anywhere in the country.

BEIS figures have shown onshore wind generation to be the cheapest source of renewable energy available in the UK. Ripple will sell the electricity from its installation in ten-Watt “blocks”, and recommends buying around 1300W of capacity for a standard home. The company claims that switching to wind power reduces a person’s carbon footprint as much as becoming vegan.

Ripple is also offering equity investment in the company itself, via a crowdfunding platform.

The Labour Party won't settle for anything less than radical policymaking in the fight against climate change, writes **Clive Lewis**, shadow minister for the Treasury

The green industrial revolution



The 21st century has more potential than perhaps any other in our brief evolutionary history. We stand on the cusp of computing, genetic and energy generation breakthroughs that were only recently in the realm of science-fiction. A golden age of humanity is tantalisingly within our grasp. But this amazing potential balances precariously on a knife edge.

In striving to get here we have destroyed, drilled and polluted our way to the very brink of ecological disaster. Our delicate biosphere is reaching the limits of its capacity to support a global civilisation. With billions hooked on fossil fuels, endless consumption and unsustainable agriculture, we're now in the red for three of the nine so-called "planetary boundaries". An excess of greenhouse gases in the atmosphere is the best known of these. But biodiversity as well as phosphorus and nitrogen levels

in crops and ecosystems are also now in the red.

So, while the world's long overdue focus on the climate crisis is to be welcomed, it must be understood in the context that it is still entirely possible to lick one problem and yet destroy ourselves in numerous other ways. That's a daunting realisation. Because if the science is correct, and we have every reason to believe it is, then simply replacing a fossil fuel-based, consumer-driven economy with one powered by renewables won't cut it.

Enter the "Green New Deal". Here in the UK, the Labour Party has coined the term "Green Industrial Revolution" to reflect our own political and industrial history. The key words in each are "new" and "revolution" – shorthand for radical, systemic change. It is a bold decree that the art of the politically possible must now make way for that of the



Power potential: the UK generates twice as much electricity from wind as it does from coal

The economy must be rapidly decarbonised

SHUTTERSTOCK / VALDIS SKUDRE

scientifically necessary. That means we have a decade to enact at least a 50 per cent cut in our net greenhouse gas emissions at the same time as restoring natural habitats on a vast, unprecedented scale.

But this all takes place against the backdrop of a global economy still limping from the 2008 financial crash. A decade of austerity has followed 30 years of neoliberal economic dogma and small-state, low-tax, deregulatory mantras. But given the scale and nature of the challenge before us you could hardly dream up a more inappropriate, short-termist model of economic organisation. In the three decades since scientist James Hansen gave his groundbreaking climate change warning testimony to Congress in 1988, our neoliberal economies have been responsible for more greenhouse gas emissions in the past 25 years than the rest of human history combined.

It's why the climate crisis and dawning public understanding of its implications is giving right-wing politicians such cause for concern. They're adamant that markets alone, sufficiently regulated, will solve the problem. Perhaps when Nicholas Stern produced his groundbreaking report on the economics of climate change back in 2006, an incremental, market-based approach could have worked. But that ship sailed long ago. Conservatism and centrist politics are about maintaining current political and economic equilibrium when what is now required is radical, disruptive systemic change.

The creation of millions of secure, well-paid jobs must be at the forefront of any Green Industrial Revolution. Since 2015, Labour has been developing its policy programme and launched its "Green Transformation" pamphlet last year. Rapid decarbonisation of the economy, building new sustainable infrastructure, renewable power generation, retrofitting homes, offices and factories are central to the plan. It's also key to a just transition away from our fossil fuel reliance. After 40 years of being kicked by successive governments, trade unions, working people and their communities need to know that the often secure and well-paid jobs associated with high-emission sectors will be replaced and even enhanced. Labour committed last year to an equivalent to the GI Bill for energy workers, guaranteeing retraining, new jobs on equivalent conditions, and support through transition.

In the US, a radical, eco-socialist agenda is now being championed by the Sunrise Movement, the Justice Democrats, congresswoman AOC and Senator Markey. Central to both transformative programmes is the notion that social and economic justice cannot be separated from environmental justice. Something France's centrist president Emmanuel Macron, who ignored this fundamental principle, ran into when he introduced his recent multi-billion-euro carbon taxes. The *gilets jaunes* protests and civil unrest followed.

The wealthiest produce the most emissions

Therefore, it is only by prioritising investment in targeted communities, ensuring everything from scrappage schemes for cars and vans, to carbon and pollution taxes are geared to disproportionately benefit low and middle-income earners. We know that globally the wealthiest ten per cent are responsible for more than half of all greenhouse gas emissions. The poorest 50 per cent are responsible for around just 10 per cent. If the “polluter pays” principle is our guide, the poorest cannot give up what they don’t consume. The burden, then, must fall on the wealthiest – both here in the UK and globally.

Fairness aside, this approach makes complete sense. In a liberal democracy rapid, radical and fundamental economic change must benefit the many not the few, if it is to gain popular, long-term political support. The decades of failure under neoliberalism where economic inequality dramatically increased has come at a price – namely political instability, the rise of the authoritarian right and here in the UK, Brexit. Even if we avert the worst of the climate crisis, we will still be affected by unavoidable temperature rises, food supply fluctuations and more. Therefore, building resilience into our democracies must be a priority.

But to avoid broader ecological breakdown and achieve a net-zero carbon economy, it will be necessary to dematerialise our economy at the same time as decarbonising it. In other words, massively reducing our use material resources, ramping up efficiency and recycling. This means a rapid transition towards what is known as the circular economy.

The fewer natural resources and materials we use – everything from timber to fish and from minerals to metals – the less energy is needed along the sourcing, production, consumption and disposal supply chains. It also makes it easier to conserve and replenish critical ecosystems and vanishing habitats, as well as protecting vital natural carbon sinks, such as forests and soils.

To ensure this succeeds we need to be

able to accurately measure and account for these precious resources. The Labour Party is looking at the use of sector-wide carbon and natural resource budgets, allocated throughout government departments. It’s not beyond the realms of possibility to envisage such budgets one day becoming as important as financial ones.

Which leads us to paying for the Green Industrial Revolution. We know decarbonising the global economy could cost as much as \$6-8 trillion dollars a year, perhaps even more when the sheer scale and magnitude of the industrial and economic shifts required are considered. Certainly, higher taxes on millionaires themselves have a part to play.

But it’s likely that borrowing will be required as well. The whole point of these transformative programmes is that measures to save our planet should be judged on how effective they will be at achieving their goal. Enter the Labour Party’s fiscal credibility rule. This mechanism already makes a distinction between current spending that does need to be covered by taxes in the medium term and investment spending that does not, because future generations benefit from said investment. Given the existential threat of the climate crisis to future generations, the choice between inheriting debt and civilisation’s destruction, seems to be a no-brainer. That becomes even starker when you read about the potential financial consequences of ignoring the problem: that’s why John McDonnell has said we will task the Office for Budget Responsibility with factoring in climate change and environmental damage to their assessments and forecasts.

It’s obvious the Green Industrial Revolution will challenge orthodox political and economic thinking. That requires bravery from both politicians and electorates. Radical change worries voters with good reason. Why create upheaval and fix something, if it is not broken? The problem is our best science tells us our planet is broken, and that to fix it requires rapid and radical change to almost every aspect of our lives.

Why better buses are just the start

Battery storage is the key to the electrification of our transport system, explains Steven Meersman, founder of Zenobe Energy

Over the past few months, the UK has seen a huge push from the public, both young and old, for decisive action on climate change. Whilst the transition to renewable energy has led to a reduction in emissions, little progress has been made in energy-intensive sectors, such as transport, to reduce our carbon footprint and air quality in our cities.

Recently the Committee on Climate Change (CCC) recommended an ambitious target for the UK to become carbon-neutral by 2050. To meet this target, both government bodies and private companies must transition towards a smart, low-carbon, decentralised energy system, as soon as possible.

Transport accounts for 34 per cent of carbon dioxide emissions. We must therefore look to invest in new technologies and initiatives, including the electrification of public transport and last mile deliveries, as well as other forms of transport.

The rollout of the first battery-assisted electric bus fleet in the country occurred in Guildford in January of this year, implemented by Zenobe Energy, in conjunction with Stagecoach and Surrey County Council. Rather than waiting for an expensive grid upgrade, this scheme uses battery storage to support the constrained local power grid. The battery charges up during the day from the current grid connection and gives power to buses at night, so that they are ready to go in the morning.

Initiatives such as this are already

making a considerable difference in regional areas, by improving air quality and reducing carbon emissions. They provide a dual benefit for both our transport and energy objectives – at night it dampens the peak caused by bus charging and during the day it supports the local network enabling more renewables. The use of energy storage or on-site renewables also avoids rising grid charges through optimising large energy users grid consumption. These grid charges increasingly contribute as much as 40 per cent of energy bills and are caused by an overall inefficiency on our grid.

The CCC has stressed that in order to meet carbon reduction targets, grid capacity should be significantly increased and policy and regulatory frameworks must encourage innovation, like demand response and storage. However, recent proposed changes, such as the Targeted Charging Review, could dampen innovation and hurt investment in renewables, derailing our transition to a carbon-neutral future, in line with our commitments.

For the UK to continue to lead this charge system thinking is vital. Policymakers and regulators must provide a clear mandate that encourages new, flexible, renewable technologies focusing on long-term benefits and costs rather than short-term, often disjointed, objectives.

While schemes such as the EV fleet in Guildford and the London Mayor's recent Ultra-Low Emission Zone are a great start, they are not enough. Companies and government bodies across the UK need to look at rolling these out nationwide. Partnerships between local councils and private companies can ultimately help maximise the benefit of infrastructure for the whole community, lowering costs, improving air quality and reducing our carbon footprint.

For more information, please visit: www.zenobe.co.uk

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Following a historic performance by her party in the local elections, **Caroline Lucas** spoke to Will Dunn about how energy use and climate change have become major electoral issues

The Green wave rises



Lucas addressing a student climate strike in February

It has been a good month for the Greens. In the local elections of May 2, they enjoyed the biggest proportional gains of any party, more than doubling their council seats to 362. Still more encouraging for the Greens is that while the elections involved a certain amount of Brexit-fuelled protest voting against the main parties, huge surges in membership indicate that their gains were driven not by disaffection but by the growing importance of the environment as an electoral issue.

“We had 1,500 new members just over the weekend,” reveals Caroline Lucas, the Greens’ only MP. “There was a new member joining us every three minutes.” For Lucas, the most exciting wins in the local elections were in the 53 new wards – “places like Darlington, Derbyshire Dales, Carlisle, Colchester, places you wouldn’t necessarily associate with a strong Green presence” – in which Green councillors had never been elected before. Establishing a “foothold” on new

councils is, for Lucas, crucial to the party’s success as it allows them to get past the “credibility barrier” that all smaller parties face. “Our experience is that once you get the first Green elected, the next time around you get more.”

That the Green wave is driven by voters’ desire for action on climate change rather than anger with the main parties is also confirmed by the fact that the Greens picked up seats in strongly pro-Leave areas, as well as the Remain heartlands. “I don’t think anybody voted for the Green Party without knowing what our position was on Brexit,” says Lucas, who was one of the founders of the People’s Vote campaign, but this did not prevent voters in Leave areas responding to “our position on a strong response to climate change and the crisis in nature that we face right now”.

The experience of Green candidates seems to have been unusually positive, too, on the campaign trail. While both Conservative and Labour candidates

reported being verbally abused, threatened and in two cases physically attacked, Lucas says she has heard only “very positive reactions on the doorstep, and also an appreciation of the fact that we’ve kept our campaigning positive as well, rather than slagging off the other parties. We’ve been out there talking about our record, what we’re committed to, what Green councillors have already done.”

For Lucas, demonstrable results are vital to making people see the Green vote as more than an act of protest. It is the hard work of Green councillors, she says, that has allowed the party to make unexpected gains. In the predominantly white, working-class area of Chelmsley Wood in Solihull, for example, where average life expectancy is ten years shorter than wealthier wards a few miles away and where the BNP won a seat in 2006, persistent local effort by the Greens on issues such as public spaces and housing led this month to an 84 per cent share of the vote, as “people saw



that we were a presence not just at election time, but year-round.” While the Chelmsley Wood result comes from a very low turnout (21.5 per cent), Lucas says it is an example of Green councillors “going into areas that have been, frankly, neglected by Labour for years”.

While Lucas is clearly very proud of the work Green councillors are doing, she is also realistic about the factors that create Green votes. “When environmental issues are in the news,” she acknowledges, “our vote goes up.” She credits “the David Attenborough film, *Extinction Rebellion*, the extraordinary youth climate strikes [and] the visit of Greta Thunberg” as elements that “touched a nerve in the population, who know that the way we’re living now just isn’t sustainable. And yet when you look at the other parties, they’re simply not stepping up to the plate.”

Lucas does not see much risk of Labour poaching the new Green vote by strengthening its own environmental

policies because, she says, its environmental policies are not fit for purpose. Jeremy Corbyn’s call for MPs to recognise a climate emergency came, she says, “weeks, if not months, after I’d originally put down an early day motion in this place to call for exactly that.” Lucas points out that in March, Corbyn’s colleagues in Holyrood joined the Scottish Conservatives and the SNP in voting down a motion by the Scottish Greens to recognise a climate emergency. She has asked Corbyn in the Commons if he would rule out subsidies for fossil fuels – “he avoided the question” – and notes that while “he personally doesn’t support the expansion of Heathrow airport, he refused to whip his MPs in that direction, and so under Labour you would still have the expansion of airports – aviation being the fastest-growing source of greenhouse emissions. They [the Labour and Lib Dem-led Cumbria County Council] have just given the green light to the first new coal mine in

30 years. This is not the action of a party that is taking the climate emergency seriously.”

She has put the question of airport expansion to Michael Gove, too – “he refused to answer” – and says that one of factors that is most likely to drive voters from the Conservatives to the Greens is a basic and obvious failure “to tell the truth, and to stop pretending that our record is much better than it is”. Voters are increasingly aware that government pronouncements, such as the oft-quoted idea that the UK’s emissions have reduced by 40 per cent since 1992, are hot air, because they do not count the emissions from aviation and shipping or the emissions embodied in products manufactured overseas. “The population,” Lucas says, “knows that the way we’re living now isn’t sustainable,” but most politicians have ignored the fact that this is changing the way they vote. “I don’t think they get it at all.”

Do the Greens, as a small party, enjoy the luxury of not having to come up with the pragmatic policy on jobs, trade and transport that answers the needs of the wider voting public? Lucas disagrees: without effective climate change policy it may be that within a generation or two, other policy will have ceased to matter. “If we’re serious that this is a climate emergency; if we believe David Attenborough when he says that if we carry on with business as usual, we could be facing the end of civilisation as we know it; if we look at the report from the intergovernmental panel on biodiversity that we are at risk of losing a million species... *a million species*. These are easy words to say but when you think about what they actually mean, it is horrific. A government that fails to do what is necessary is letting down not just this generation but future generations as well, in the most unforgivable fashion.”

But it is also the voters of the future that give Lucas hope. Young voters, she says, are behind “a green wave across much of the European Union, in places like Germany and the Netherlands – and it feels like that is happening now, here in the UK.”

Unlocking hydrogen's potential

Sam French and **Andy Walker**, new market manager and technical marketing director at Johnson Matthey, explain how the UK could use hydrogen to lead the drive towards cleaner energy

If technology advances – in transport, manufacturing and everyday electrical appliances – represent one of modern society's greatest triumphs, then one of its greatest challenges lies in delivering those same conveniences and capabilities without increasing global temperatures. Cars, planes and trains have transformed the way we travel, just as automation has revolutionised factory environments. Moving backwards is not an option. In the modern, mobile and digitised world – in which high-energy technologies are often the bellwethers for a country's economic strength – we must seek alternative routes to energy.

In May, the Committee on Climate Change (CCC) published its Net Zero report, exploring "The UK's contribution to stopping global warming". The move to Net Zero provides a great opportunity for UK plc, with its tremendous heritage of world-leading innovation – particularly to find

solutions for the hard to decarbonise areas such as heavy goods vehicles, locomotives and space heating.

What has been made very clear by both the Intergovernmental Panel on Climate Change (IPCC) and CCC is that our current plans for climate change mitigation are not enough. A Net Zero target requires systemic changes to the entire energy landscape. It is also clear that there won't be one single solution; we need a toolkit of technologies to address the wide range of energy uses that are supported by government policy and changes to how we live our lives. These technologies exist; however there is no market or policy drivers in place for their widespread deployment.

Despite its simplicity – a hydrogen atom comprises just one proton and one electron – hydrogen only exists in trace amounts on Earth. It can be produced in different ways, but today most hydrogen is manufactured by steam methane reforming, where, at high temperatures using processes



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Johnson Matthey's Hydrogen Refuelling Station in Swindon, operated by ITM

and catalysts developed by Johnson Matthey and others, natural gas is converted to hydrogen and CO₂. In the future hydrogen will probably also be produced at similar scale by splitting water into its components of oxygen and hydrogen through electrolysis. In both cases the process can be decarbonised by using renewable energy for electrolysis or capturing the CO₂ from advanced reforming technologies and storing it in a process called carbon capture and storage (CCS). That hydrogen can then be used to produce heat and power or used in vehicles with a drastically reduced emissions footprint.

While there has been focus on fuel cell vehicles recently, it is the sectors more difficult to decarbonise that could benefit the most from hydrogen. How do we decarbonise domestic heating, provide flexible dispatchable power generation and decarbonise high-temperature processes in industry?

As the availability of low-cost,

low-carbon hydrogen grows it will find more application in other sectors with a lowering of associated cost from production at scale. A key recommendation from the CCC report and others over the last year is that we cluster low-carbon hydrogen production in areas of high-CO₂ emissions so that we can cost-effectively implement CCS, also essential for a low-carbon society.

A country's mobility capability, in general, is a critical economic factor. As well as determining individual convenience, it represents how goods and services are moved around. A school or hospital cannot serve communities effectively without good mobility to match. Hydrogen can help to provide safe, clean, reliable and noiseless travel that is comfortable and efficient for its users. And according to a report from the Environmental Audit Committee, air pollution costs the NHS over £50bn each year. Delivering cleaner energy is a public health concern as well as a central factor in achieving resource efficiency.

The interest in hydrogen as an alternative fuel is largely driven by the potential to manufacture hydrogen at scale with low-carbon emissions. Cars powered by hydrogen fuel cells have additional advantages over other alternative, zero-emission (at point of use) vehicles, such as those powered by batteries. They can be refuelled in a few minutes (faster than electric vehicles can be currently recharged) and have ranges typical of current gasoline and diesel-powered cars.

Where other fuel processes produce energy through combustion, fuel cells produce it electrochemically. Fuel cells, like traditional batteries, consist of an anode, a cathode and an electrolyte membrane. A typical fuel cell moves hydrogen to the anode, where it is split into its constituent proton and electron. The proton then travels through a membrane electrolyte to the cathode, where it reacts with oxygen (from the air), generating water, while the electrons complete a circuit and,

in the case of a fuel cell vehicle, drive the electric motors. As there is no combustion aspect to fuel cell power generation and there are no moving parts, they operate almost silently as well as very efficiently.

Fuel cells are, effectively, batteries that won't run flat or have their capacity reduced with each charge. Provided there is fuel (hydrogen) in the tank (stored on board the vehicle), the process can continue. As fuel cells can be stacked into a "series", the more fuel cells you combine, the more power you can generate at any one time.

While hydrogen and fuel cells' case is strong in the long term, the main challenge in upscale is in delivering the infrastructure to support this technology. A hydrogen economy can only be realised with the right level of government support through proactive policy and investment. If we are to expect more people to start using hydrogen fuel cell cars, then more hydrogen refuelling stations must be built and positioned strategically.

Collaboration between government, industry and academia is vital to making hydrogen generation as efficient as possible in the first place, and in installing the infrastructure to enable hydrogen use at scale. The UK has a great record of innovation, and the move towards a hydrogen economy offers great opportunities for UK plc to implement existing technologies based on hydrogen, and to develop new, more efficient ones, which other countries will need as they also look to decarbonise their economies.

Relative to some of the world's larger economies, the UK's impact on the global climate through its energy use is small. But supporting the hydrogen economy and leading by example can set a standard for other countries to follow. If the UK gets its own hydrogen economy right, there's every chance that others will too. With the right commitment to learning by doing, collaboration and investment, it could emerge as a world leader in this vital source of alternative energy.

Swedish startup Minesto is making waves without relying on them. Rohan Banerjee investigates a new tidal power technology that can operate in slow-current water

Current from currents

Six kilometres off the coast of Holyhead, North Wales, the Swedish startup Minesto is flying a very unusual kite. For one thing, the kite is around 100 metres below the sea. Stranger still, the company believes it may one day power thousands of homes.

The kite is “a type of tethered turbine that produces power from slow tidal streams,” explains Minesto’s communications manager, Magnus Matsson. The company calls the system that it operates “Deep Green”.

Tidal power refers to energy obtained from changing sea levels (when the tide is in or out). It has strong renewable energy credentials as it is a far more consistent and predictable source than wind or solar, which are at the mercy of the weather. Tidal turbines are similar in appearance to wind turbines, but their rotating blades are driven by water currents. Conventionally, these turbines are static structures that work most effectively in fast-moving water with

strong currents, because there is more kinetic energy to turn the blades, but Minesto’s innovation is designed to operate in calmer waters.

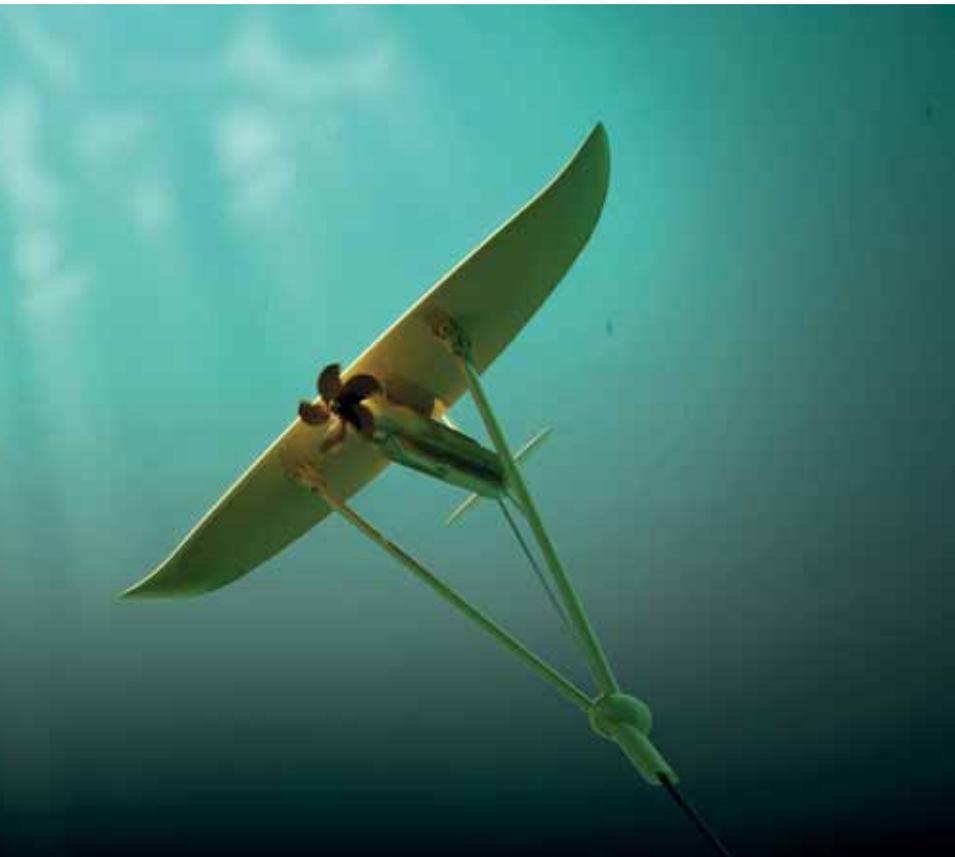
Deep Green looks like a small plane, but the principle is closer to a kite. The 12m-long “wing”, which carries a turbine and generator and control system encased in a small box, is attached to a concrete foundation on the seabed by a cable between 80 and 120m long, and “flies” on the hydrodynamic lift provided by slow tidal currents.

Matsson explains that the kite follows “a figure-of-eight trajectory”, which it is guided along “using a predetermined navigation programme, and rudders. “As the wing flies in the current,” he says, “water flows through the turbine and electricity is produced in the generator. Then that electricity is transferred through a cable in the tether attached to it. The electricity goes via the cable to the seabed foundation, and then eventually by another, longer, cable back to the grid

on the shore.” Wiring, Matsson says, is encased in “plastic materials such as polyethylene, which are then reinforced by something stronger to stop the water getting to it, like steel”.

Minesto began installing the infrastructure for its Deep Green pilot project at Holyhead in May 2018. Less than six months later, in October 2018, Minesto successfully generated electricity via slow-current water for the first time. As yet there is no onshore grid facility, so the electricity generated by Deep Green is transferred to an offshore buoy, which acts as a “floating micro-grid system, facilitating grid compatibility testing by analysing electricity” generated by the wing device. Its DG500 model can generate 500kW of power – equivalent to around 1,800 solar panels.

“We’re still at a testing phase”, says Matsson. “We’ve made adjustments to the design [of the wing] to see what shape works best. In the long term, we’d



Minesto has received €13m in EU funding

want to have multiple devices, similar to a wind farm, all feeding into the grid.” Following the successful deployment of the DG500 model, Minesto intends to install further devices and gradually expand the site to an “array” of up to 10MW total capacity.

The power available from tidal currents is considerable and consistent, as sea levels change twice a day. According to Matsson, the company’s site off the shore of Anglesey holds a total potential of “approximately 80MW” installed capacity. “Such a tidal energy farm,” he says, “would generate electricity equivalent to more than 60,000 Welsh households.” A large number of “kites” would be needed, however. “A rough comparison would be that it takes three or four Deep Green systems to generate a similar amount of power as the average wind turbine.”

Matsson explains that the fact that the wing is moving underwater means that the electricity produced by its generator

is “a lot more than if the turbine was stationary”, as most tidal power technologies are. “Most large, horizontal-axis tidal energy turbines require currents of more than 2.5m/s to actually cost-effectively produce electricity.” But Deep Green can produce electricity from currents moving as slow as 1.2m/s, and in depths of 60-120 metres, “because it moves faster than the tide flows, hence speeding up the water flow that the turbine experiences”. This makes Deep Green more flexible than static turbines, because “there are many more potential sites available for this type of technology.”

The brainchild of former Saab engineer Magnus Landberg, the idea behind Minesto’s Deep Green technology came from a search for lightweight alternatives to wind turbines, which “usually weigh hundreds of tonnes”. Matsson explains that “as sea water is about 800 times heavier than air, there was the idea to use a carbon fibre [which does not corrode in salt water] blade, or wing, to support a small turbine and generator to produce power from tidal streams.” The size of the Deep Green wing, he claims, means that the device can weigh “up to 15 times less per MW” than competing tidal power technologies. The detachable design concept, meanwhile, means that any maintenance can be done in a “more cost-effective” manner on the shore, rather than using complex equipment in the water.

The invention was transferred from Saab to students at Chalmers University of Technology in Gothenburg to study the technical and commercial viability of the concept in 2007. In May 2015, Minesto received €13m in investment from the European Regional Development Fund, through the Welsh European Funding Office, to support the development of Deep Green.

Why did Minesto choose Wales to trial and launch its technology? “We considered a range of slow-current sites around the world, but eventually identified Wales as the most suitable.” The UK’s territorial waters include around half of the European tidal resource, Matsson says, and the

“This could transform island communities”



“resource conditions” off Holyhead were ideal for testing. Furthermore, the Welsh government has shown “great enthusiasm for renewables projects”, encouraged by the “potential for local economic growth”.

Considering Deep Green is a project still in its infancy, does the UK’s decision to leave the European Union complicate matters? “The funding we have already received is ring-fenced, so we aren’t at a risk of losing that. We were exploring opportunities outside of Europe [in Taiwan, for example] before Brexit happened. I guess Brexit has made us think about those opportunities a bit more pressingly.”

What about wildlife? Numerous wind farms have fallen foul of the risks they might pose to birds; does Deep Green face similar challenges with fish and marine mammals? The Environmental Impact Assessment and Habitats Regulations Assessment conducted at the Holyhead site have “so far found nothing that says that our devices can’t operate in unison with the marine environment and wildlife,” Matsson says. “All energy technology has some impact, but we are convinced that ours is one of the more lenient ones. Obviously this will be further studied as we deploy more machines, but in Northern Ireland [where Minesto also

conducts some of its R&D and device testing], we have seals in the area, and we have never had an incident with the mammals there.”

Minesto’s ambition to “power towns and cities” using slow-current water, Matsson admits, “is still a while off”. In the “short to medium term”, the company works in “parallel tracks to establish its product” in the market. Later this year or early next year, a smaller-scale model will be deployed off the Faroe Islands, which Matsson says will be important commercially “as there is an incredible need globally to supply off-grid users, like island communities, with clean and predictable power.”

But bigger megawatt-scale units are the company’s real ambition, Matsson adds. “We are working on the next generation of utility-scale power plants for further installations so that we can start climbing down the cost curve.”

This is where Deep Green, as with other new energy technologies, may need more government help. “Revenue support schemes,” says Matsson, “have enabled wind power and solar energy to mature and establish themselves in the energy market... The world needs to move towards 100 per cent renewable energy systems to combat climate change. To do that, more solutions than wind and solar are required.”

Policy and investment can power progress

Chris Smith, head of renewable sales at SmartestEnergy, discusses the growth of the UK's green economy

How would you describe the current state of UK renewables?

The dominance of coal and gas has been massively reduced. But progress is a slow process, and while the growing public consciousness of climate change has fostered a greater urgency in the transition to a more renewables-led energy mix, it will still take time to complete the transition. It's important to continue to raise awareness of renewable energy, but hand-in-hand we also need the right policymaking approach to support the rollout and our zero-carbon ambitions.

What are the most exciting renewables technologies on the horizon? What can be done to support them?

The developments being made in natural renewables – wind, solar and hydropower – are all very exciting. But they are intermittent energy sources and remain challenging to operate flexibly to satisfy different levels of demand. As many renewable energy sources are intermittent and dependent on the weather, the use of gas peaking power plants, or “peakers”, can provide power flexibly to meet peak demand requirements and variances in renewable output.

Generally speaking, data science has to play a more central role in managing our energy consumption. Understanding not just when, but where our energy is going, can help to inform cost savings and efficiency decisions. Smart metering allows for personal insights into energy use, which can bring about changes in the

behaviour and management of energy.

Battery and storage technologies are also worth pursuing. Having power generation closer to where it is being used would be a step in the right direction. We need to find more efficient ways of transporting energy from the point it is produced to a more localised base. There is currently 314MW of operational battery storage capacity in the UK, and up to 5GW in the pipeline waiting to be built. Of the operational capacity, 83MW is currently co-located with an electricity generation project – 24MW with renewable energy assets. Positioning renewable assets and battery storage together could unlock new opportunities. Consider, for instance, that batteries co-located with solar generation assets could help to build out the overall generation shape and improve a site's demand capabilities.

What could the government do better?

Both fluctuations in the market and the regulatory scene have an impact on renewable generator incomes. In recent roundtable discussions we have held with generators, they have voiced their concerns over the number of recent cuts to subsidies and embedded benefits. The government needs to slow the pace of policy change and create more long-term certainty for generators, in turn working to improve the investment climate for renewables. The government could also consider a subsidy framework for energy storage to accelerate deployment.

As the National Grid looks to achieve its target of 100 per cent renewable power by 2025 the need for upgrades and extensions to existing projects is plain to see. Generators should be encouraged to develop their renewable asset portfolios, participate in new flexibility services, such as the Balancing Mechanism, and receive value for their renewable certificates.

For more information, please visit: www.smartestenergy.com

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The geopolitics of gas



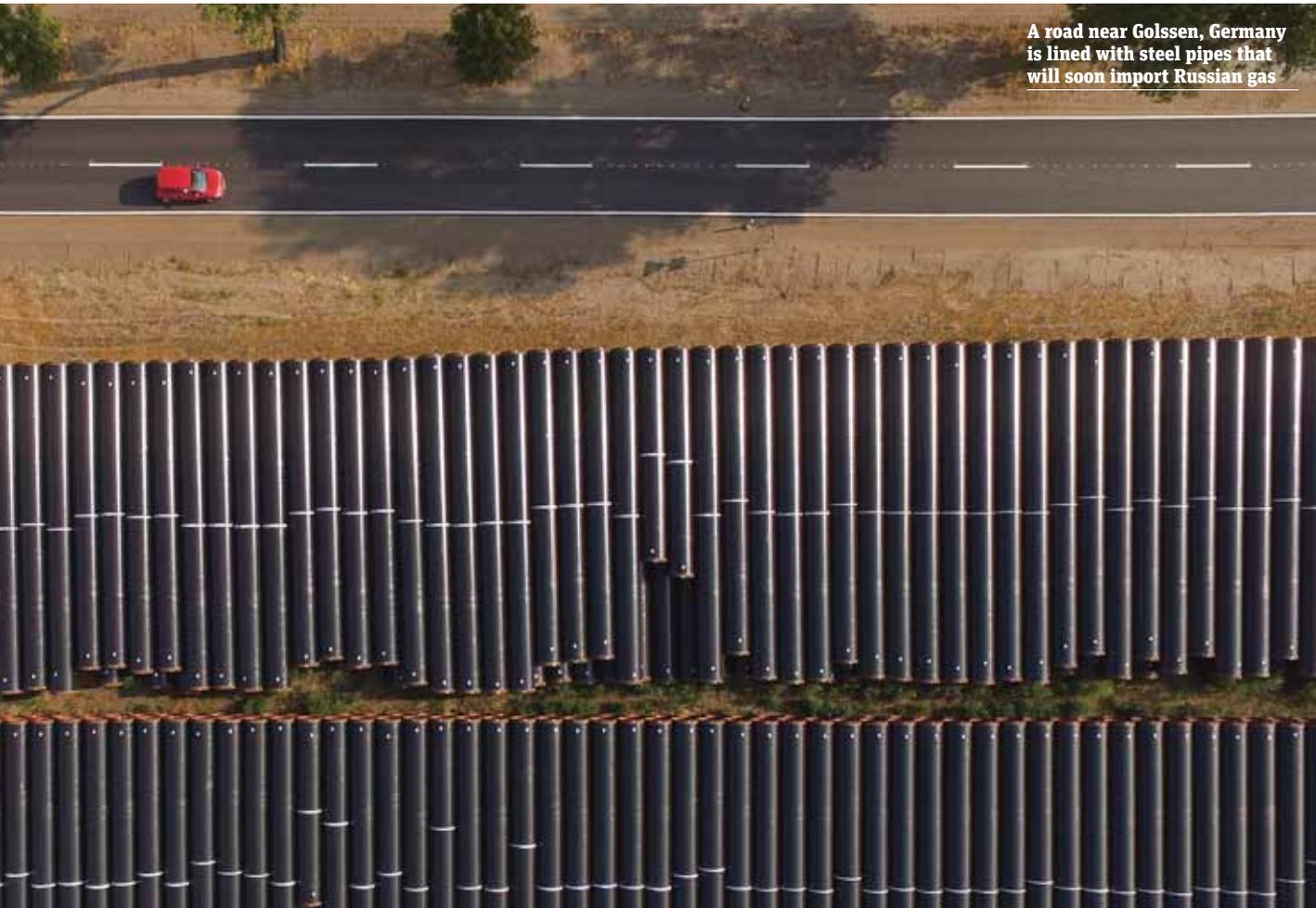
Jonny Ball asks foreign policy experts why a new gas pipeline is causing deep splits within NATO and the EU

A major project is underway that, its critics argue, will split the EU and threatens European stability. But this project isn't Brexit, or the rise of the populist right. It is a pipe, just over a metre in diameter, that will link Germany to Russia.

Last month, at a Washington summit coinciding with NATO's 70th anniversary, two years of open discord between Donald Trump and European member states had already put a dampener on festivities. Vice President Mike Pence threw cold water on any hopes of a cordial atmosphere between allies, insisting to NATO leaders that Germany was soon to become "literally a captive of Russia" if a new gas pipeline in

the Baltic Sea went ahead. The 1,200km Nord Stream 2 will link Ust-Luga in Russia with Greifswald in Germany, and will transport 55 billion cubic metres of gas a year, doubling the capacity of the existing Nord Stream. Reiterating criticisms made by President Trump, Pence linked the project with Germany's failure to meet the guideline for defence spending that NATO sets at two per cent of GDP. "Germany must do more," he said. "We cannot ensure the defence of the West if our allies grow dependent on Russia." If the Trump administration is to be believed, this pipeline turns Europe's largest economy into Putin's vassal state.

This raises concerns for Europe's



A road near Golssen, Germany is lined with steel pipes that will soon import Russian gas

Trump says the pipe makes Germany dependent on Russia

GETTY IMAGES/SEAN CALLUP

energy security. Russia has form for cutting off the gas supplies of its neighbours, and has been accused of using its vast reserves of natural gas as a political weapon, a form of strong-arm energy diplomacy, and even as part of its arsenal in a grand strategy of “non-linear warfare”. Twice, in 2006 and 2009, Moscow has suspended supplies to Ukraine following disputes over pricing, debts and supply, interrupting flows across several countries. The fear is that Nord Stream 2 could allow Russia to turn off the taps to Western Europe.

Estonia, Latvia and Lithuania, all EU and NATO members (and all former Soviet republics, nervous of Russian revanchism) are implacably opposed to

the project. Poland, the former satellite state, is opposed. Ukraine has been engaged in a shooting war against Russian incursion into its Eastern provinces since 2014. For the Baltic states, the US, and much of Eastern Europe, Nord Stream 2 is a political project, a “Trojan horse” for Russian influence, and a geopolitical manoeuvre that will extend Russian power in Europe, increase the continent’s dependence on Russian gas and deliver a windfall for the Russian state’s gas company, Gazprom. The UK’s foreign secretary, Jeremy Hunt, shares these concerns. “There is a contradiction between asking America to spend more as a proportion of GDP on defence and

The US also wants to sell its own gas to Europe

A Ukrainian protestor demonstrates outside the German embassy in Kiev



contributing to NATO and, at the same time, doing an economic deal with Russia that is going to mean Russia is richer and more able to spend money on weapons that could potentially be used in an offensive way,” Hunt told the BBC last year. “We are very concerned about the Nord Stream 2 project, for precisely the reasons President Trump says.”

In addition to its worries about the geopolitical consequences of the project, Ukraine, currently acting as a thoroughfare for Russian gas exports into Europe, stands to lose \$3bn per year in transit fees, equivalent to three per cent of its GDP. But the strategic implications for Kiev are perhaps even more alarming. By reducing Western Europe’s dependence on the country for gas transit, the pipeline will “reduce the importance of Ukraine for European countries”, says John Lough, associate fellow of the Russia and Eurasia programme at Chatham House and

former NATO representative in Russia. The German Chancellor, Angela Merkel, has attempted to assuage these fears by promising that transit will continue through Ukraine even after the completion of the Nord Stream 2, but many fear that gas will nevertheless bypass the country, weakening it and undermining Europe’s readiness to defend against Moscow’s machinations. “They’ll see that there’s no longer a gas problem,” Lough says. “It’s a dual strategy. And it’s a very clever strategy. First it’s to weaken Ukraine, and weaken Ukraine’s influence in security policy thinking in the EU and NATO. Second, it co-opts Germany as a country that can be helpful to Russia, using the Germans to enhance their interests... So it’s a smart policy, if you can pull it off.” While much of the Western foreign policy establishment decries its blind transformation into Putin’s pawn, Germany is now isolated in NATO and

the EU, institutions it has helped anchor for decades.

But for large segments of German industry and the German political class, Nord Stream 2 is backed as a purely commercial project, essential to European energy security. In a drive for lower emissions, Germany is phasing out coal-fired power. In the wake of protests after the Fukushima disaster, the country also announced it was winding down its nuclear energy production, and, in addition, has since banned hydraulic fracturing. Natural gas – touted as a “transition fuel” between more polluting hydrocarbons and renewable sources – is promoted as the solution to Europe’s energy needs.

While American opposition to the project is ostensibly political, large commercial interests are also at stake. The more gas Europe sources from Russia, the less it will import liquefied natural gas (LNG) from the US and its ally, Qatar. Trump’s rhetoric of a “captive state” may be an attempt to muscle a direct competitor out of a lucrative market – and it may have worked. In an attempt to alleviate tensions with the US, and in the face of White House threats to impose sanctions on Nord Stream 2 companies, including the Anglo-Dutch giant Shell, Germany has agreed to build its first LNG terminals, providing infrastructure for American companies to export gas to Germany. Unfortunately for the US, pipeline gas is cheaper than its own fracked LNG.

Richard Sakwa, another Russia expert at Chatham House and professor of Russian and European politics at the University of Kent, says the extent to which Russia has used its energy diplomacy to further its political and strategic interests is “massively exaggerated”. The country’s interests are “basically commercial,” he says. Sakwa contends that interruptions to Ukraine’s gas supply in 2006 and 2009 weren’t a result of Russian malfeasance, but down to Ukraine’s late payments and Russia tiring of “selling gas at hugely subsidised prices, not global commercial rates”.

“Attempts to stop Nord Stream 2 are a reflection of the new Cold War,” says Sakwa. “But even during the original Cold War, this went forward. So this new Cold War is far worse than the first one.” Throughout the latter stages of the Soviet era, when much of Eastern Europe beyond the Iron Curtain was occupied by the Red Army, natural gas and primary materials still flowed steadily from East to West. “If we got Russian gas already in the Cold War,” asked Merkel at the Munich Security Conference earlier this year, “...and the old German Federal Republic introduced Russian gas on a large scale – then I don’t know why times today should be so much worse that we cannot say: Russia remains a partner.” Some in Germany, particularly in quarters of the Social Democratic Party that have traditionally sought closer ties with Russia, see Nord Stream 2 as a means for positive engagement with a wayward neighbour, bringing them into the fold and stabilising relations, reinforcing mutual interests rather than creating unhealthy dependencies.

“Nord Stream 2 is an enormously revealing moment about the dynamics of international politics today,” Sakwa says. The divisions over the project are a symptom of long-held antagonisms between Anglo-American interests, Russian interests, the interests of new EU member states in the East, different political factions within Germany, and a Trump administration that – despite criticism for its links with the Kremlin – acts as Nord Stream 2’s number one detractor. For Sakwa, “the bottom line is that Western policy is contradictory, possibly mendacious, and we’re back into the 1980s, when the United States vigorously tried to stop Western Europe, Germany, France and Italy developing oil and gas pipelines.” In the 1980s, the pipelines went ahead regardless. So, it appears, will Nord Stream 2, as commercial interests override political interests, and Europe’s industrial powerhouse puts its own reading of *realpolitik* ahead of that of its neighbours.

**BY THE NUMBERS:
NORD STREAM 2**

55bn

cubic metres of gas, enough to fill the Royal Albert Hall 600,000 times, will be pumped per year

5

countries passed through

26m

homes that can be powered

50%

amount the EU’s domestic gas production is predicted to fall over the next two decades

€9.5bn

Project cost

Enabling a cleaner, greener future

Smart meters can be the catalysts for a more efficient, low-carbon world, writes **Robert Cheesewright**, director of corporate affairs at Smart Energy GB



Smart meters – digital energy reading devices which measure gas and electricity use – will play a key role in the national upgrade of our energy network, ensuring we have a reliable, clean and affordable energy system which can better integrate renewables and electric vehicles. That means understanding that every gadget, every gizmo, and every digital service that we use, has a direct impact on the health of our planet. Beyond delivering cost savings and efficiency, then, smart meters are an innovation that can help to bring our outdated energy system into the 21st century.

There are nearly 14 million smart meters currently installed in households and microbusinesses across Great Britain. This is a good start, but there is more hard work to do yet.

Through the Climate Change Act, the UK has committed to a 57 per cent reduction in greenhouse gas emissions compared to the levels of 1990 by 2030, with this becoming an 80 per cent reduction by 2050. The creation of a

smarter energy system, of which smart meters play a key part, is vital in meeting this ambition, by ensuring our energy use is more flexible and efficient.

In the past, the demand for energy was predictable and stable, as generation from fossil fuels and nuclear power stations produced virtually all electricity. As our energy system becomes low-carbon, we are moving towards far greater levels of renewable energy generation. Renewable energy sources can be intermittent and less predictable, and the relationship between supply and demand from the old system becomes more complicated. We need a smart energy system, therefore, to cope with evolving and complex energy needs. Smart meters are the building blocks for this energy revolution and an important step towards the development of smart energy networks.

As with so many things in this brave new digital world of ours, any potential success of a smart grid hinges heavily on data. Our current energy grid simply can't map the demands from homes and

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We need an energy system that is geared to the future

small businesses granularly enough, leading to a risk of inefficiencies as our electricity demands get more complex. The energy use data that smart meters are able to collect and collate will allow our energy networks to understand how much energy is being used, when and where across Britain. This will reduce waste because it will know where to better direct our resources. Smart meters allow us to better plan and shift usage away from traditional peak times, which are heavily reliant on energy generated from fossil fuels, and make more use of renewables.

Our environment will benefit hugely from a reduction in carbon emissions when we have a smart grid and smart meters installed in our homes, because they will help the nation to conserve energy. Furthermore, our energy supply will be greener because the smart grid will be able to supply more reliable, efficient and low-carbon energy to households and help us all to manage our valuable resources more efficiently.

Across sectors, technology has changed the way people engage with their day-to-day lives. Take Spotify, which has revolutionised the accessibility of music, or Netflix, the streaming service that could supplant TV. To view smart metering in the same context – as a moderniser – is no exaggeration. Think tariffs that reward customers for using energy at off-peak times, smarter automatic switching services so households will always be on the best deal, and selling excess energy generated from the home. The possibilities for change that benefit the consumer, the grid and the country are ever-growing, but at their very core many rely on the digitalisation of the energy grid through the smart metering system. Introducing a positive incentive to use energy outside peak times will help us as a nation balance supply with demand without having to build and generate more dirty and expensive energy. The National Infrastructure Commission, in fact, predicts that a truly smart energy system can save the overall UK economy around £8bn

each year.

A smart grid is also a necessary development to help with the wider rollout of electric vehicles. The transition from liquid fossil fuels to mainly grid electricity is fantastic news for the environment. But it also means that enormous amounts of power will need to be supplied to electric vehicle owners, and this new demand needs to be managed as smartly as possible. A smart grid will do this by allowing consumers to charge their vehicles when rates are low and energy is greenest, lessening the burden on our utilities.

The transition of the energy system to a more flexible decentralised and decarbonised system is central to the UK reducing its CO₂ emissions and providing a reliable and cost-effective system for consumers. We need an energy system that is geared to the future, and to make big changes, sometimes we have to start small. Smart meters can't solve climate change on their own, but with the more efficient energy system they help to create, they are a start.

As Dr Andrew Turton, principal analyst at Delta-ee, puts it: "People are now used to real-time services enabled by digitalisation rather than simply purchasing products. Just as the benefits of music services like Spotify are greater than not having to buy CDs, smart meters are a transformative technology and open up a whole host of new services to customers which can benefit their lives and reduce their costs. Without smart meters, customers risk being locked out of this future."

Smart Energy GB is the government-backed organisation tasked with informing Great Britain about the benefits of the smart meter rollout. Search: "I want a smart meter" or call: 0300 131 8000

Calls to this number from UK landlines and mobiles are charged at the standard rate (i.e. the same rate as calls to 01 and 02 numbers), and may be included in your usual call allowance. Please check with your provider.

ENERGY

The latest contracts, jobs and training



ENERGY OPEN TENDERS

1. Crown Commercial Service

Supply of Energy and Ancillary Services
Bid deadline: 20th May
Tender value: Up to £10bn
CCS welcomes bids from suppliers for a framework agreement to cover all gas and electricity needs for the UK public sector and its associated bodies and agencies over the next four years.
Contact: supplier@crowcommercial.gov.uk

2. Crown Commercial Service

Utility Switching Services
Bid deadline: 22nd August, 2022
Tender value: £1.5bn
CCS intends to establish a comparison website to assist public sector clients to make switching decisions on their suppliers. The service is aimed to cover gas/electricity products but may also include water and fuels.
Contact: supplier@crowcommercial.gov.uk

3. London Borough of Hackney

Hackney Energy Company White Label Energy Supplies
Bid deadline: 7th June
Tender value: Up to £45m
Hackney Council is looking to enter a long-term partnership with a licensed energy operator to support its new branded energy company that will supply renewable energy to local residents and others around the UK.
Contact: procurement.admin@hackney.gov.uk

**Tender and framework data
supplied by**

tussell

4. Department for Business, Energy and Industrial Strategy

Ageing Society and Clean Growth Grand Challenge
Bid deadline: 29th May
Tender value: Up to £500k
BEIS seeks a lead partner to develop and deliver a national design competition for the Home of 2030. The aim of the project is to engage industry around energy-efficient architecture and planning.
Contact: bethan.ellis@beis.gov.uk

5. University of Sheffield

Waste to energy boiler
Bid deadline: 30th May
Tender value: Up to £321k
The University of Sheffield is establishing a flagship national Translational Energy Research Centre to deliver low-carbon energy central heating and carbon capture projects, and welcomes partnership applications.
Contact: james.noble@sheffield.ac.uk

6. Transport for Greater Manchester

Energy efficient grants (multiple)
Bid deadline: 31st December
Tender value: Unspecified
Transport for Greater Manchester is offering short-term grants to cover some operational costs of the most energy-efficient small to medium-sized enterprises in the local area.
Contact: kate.bass@tfgm.com



ENERGY JOBS NOW OPEN FOR APPLICATIONS

1. Head of Environment and Offshore Renewables Decommissioning

Salary: £51,300-£58,312
Location: London
Closing date: 19th May
The position holder will manage a

team in charge of auditing existing and potential sites for energy generation technologies in terms of their impact on the environment during their use.

2. Senior Data Engineer, Office of Gas and Electricity Markets

Salary: £53,825-£83,640
Location: London and Glasgow
Closing date: Ongoing
Ofgem welcomes applications all year round from experienced data scientists to manage and maintain its IT software and infrastructure, as well as identifying consumer trends to inform market strategy.

3. Senior Lecturer in Renewable Energy Systems, University of Portsmouth

Salary: £39,609-£48,677
Location: Portsmouth
Closing date: 28th May
Portsmouth's School of Energy and Electronic Engineering is on the lookout for an academic to lead and develop modules on emerging wind, solar and hydro energy technologies

4. Procurement manager, United Kingdom Atomic Energy Authority

Salary: £30,341-£54,936
Location: Culham
Closing date: 30th May
UKAEA is recruiting for two new members of its procurement team, charged with assessing the most viable commercial developments of fusion power and related technology in the UK.

5. LEAN Engineer, Vestas

Salary: Competitive
Location: Isle of Wight
Closing date: 8th June
Wind turbine manufacturer Vestas wants to recruit an experienced engineer to join its design team, working on the development of new and existing products.



6. Senior Energy Adviser (part-time), Foreign and Commonwealth Office

Salary: £63,135 pro rata
 Location: London
 Closing date: 27th May
 The FCO is looking to recruit an experienced civil servant with a background in the energy sector to advise the government on potential international energy partnerships, identifying emerging technologies worth investing in.



ENERGY EDUCATION AND TRAINING OPPORTUNITIES

1. MSc Wind Energy Systems, University of Strathclyde

This one-year postgraduate course,

accredited by the Institute of Engineering and Technology, is aimed at mechanical and civil engineering students, who wish to strengthen their understanding of new wind turbine designs.

2. PhD Offshore Renewable Energy Technology, University of Edinburgh

With funding from the Engineering and Physical Sciences Research Council, Edinburgh's School of Engineering can support three-year research projects in various offshore and marine energy ventures.

3. MSc Efficient Fossil Energy Technologies, University of Birmingham

The Midlands Energy Graduate School has launched a new taught postgraduate programme covering various fossil fuel management and disposal techniques, including carbon capture and storage,

and efficient combustion, as well as chemical reactions and sustainable power plant design.

4. PhD Nuclear Energy Futures, Imperial College London

With funding from the Engineering and Physical Sciences Research Council, Imperial is able to support research projects into reactor technologies, nuclear waste management and fusion over three years.

5. MSc Marine Renewable Energy, Heriot-Watt university

Delivered at Heriot-Watt's Orkney Campus, this one-year postgraduate course covers various aspects of marine energy engineering and oceanography, as well as the politics and economics of site planning, including environmental impact assessments.

The government has a responsibility to incentivise the use of renewables, writes *Antoinette Sandbach MP*, member of the Business, Energy and Industrial Strategy Select Committee

Power to the people



Despite what you might read on a placard, the UK has a good record on tackling climate change. There are areas where we need to do more but since the Coalition government came to office in 2010, the UK has led the way among major economies by reducing Co₂ emissions 50 per cent more than any other G20 country. This was emphasised when the UK went over a week without using coal – the longest period since the industrial revolution. And our Co₂ emissions per person are at the lowest level since 1858.

This is a record that deserves defending and one that demonstrates that Conservatives need not conform to the coal-guzzling, climate change-denying stereotype from across the Atlantic. However, despite this record the government hasn't got everything right, and it needs to recognise that there is more it can do to decarbonise the UK and put the individual at the heart of our work to tackle climate change.

We must do this by recognising that the age of the big monolithic energy industry is ending. Whereas in the past the costs of extractive equipment have put home-grown, small-scale energy production well beyond the means of ordinary people; today small-scale renewables are not only possible, but preferable and deliverable. Instead of a market where individuals are on one side of the fence, consuming energy provided by huge energy companies, now those individuals – and their communities – are straddling that fence, playing the role of both producer and consumer – they have become “prosumers”.

Renewables have enabled this new world to come into being. I was recently invited to meet a local community group that had installed something called an Archimedes' Screw. Slightly uncertain about what I was stepping into, I was relieved to discover this was a small-scale hydro power scheme which is capable of powering 77 local homes, improving the

habitat of local fish and eels as well as generating a financial return which will be reinvested into the local community for the next 40 years.

This is a far cry from the old days of big energy companies monopolising the energy sector. It is also a fundamentally conservative principle, a people-powered energy policy which starts small and works within communities and sees the National Grid as a network for individuals to contribute.

However, recent changes to policy have thrown up a huge degree of uncertainty and the government must answer some detailed questions if this potential is to be fulfilled. The renewables industry has grown substantially since 2010, but it remains vulnerable to shifts in policy.

The biggest of these shifts has been the end of the feed-in tariff. This scheme guaranteed payments to those who generate their own electricity – be it through solar, wind or other renewables. This programme saw solar PV installed



Communities can lead energy policy

on nearly a million homes since 2010. It was clearly a huge success and the closure has had a substantial impact on the renewables industry – for instance 30-40 per cent of solar firms are contemplating closure, and international players are leaving the UK market.

That is why MPs from across Parliament are asking for a fair minimum export price for energy sent to the National Grid. This will ensure that prosumers are not ripped off while the industry and any new regulations are implemented. It will also encourage suppliers to get their systems in place in readiness for market-wide, half-hourly settlement, which will help accelerate the smart energy transition.

It is also why I've been asking about SMETS 1 meters – the earlier kind of Smart Meter, which are in 17 million homes. They cannot yet relay export data to the Data Communications Company. This limits a prosumer's ability to get paid for the energy they export to the

National Grid.

This certainty, that a fair price would be paid for electricity, would be a shot in the arm for a sector that sorely needs it. The recent announcement by Octopus Energy to offer a Smart Export Guarantee shows it is not unreasonable to expect suppliers to offer a fair payment and that some will without government intervention – this intervention would simply give greater certainty to prosumers.

I look forward to the government's response to its recent consultation. However, many in the sector need swift action if we are to avoid squandering our past successes. They are teetering on the brink and the certainty an announcement would bring would be hugely beneficial for a sector that not only creates high-skilled jobs but also is central to our fight against climate change.

The government must also look to the future. The opportunities for new technologies to improve our energy sector are numerous. If we can apply machine learning to energy efficiency we can dramatically reduce consumption – in 2016, Google used its Deepmind programme to reduce its own consumption by 40 per cent through machine learning algorithms.

Likewise, there are suggestions that its partnership with the National Grid could improve grid efficiency by up to ten per cent. However, to achieve such efficiencies will require breaking down regulatory barriers and embracing open access data in the energy sector. It may not be in the interests of the public and private monopolies who currently run things, but it is in the interests of both the public and the planet.

If we can combine certainty for the present with innovation and embracing the future, the UK can remain a world leader in renewables and combatting climate change. We can also offer reassurance for the public, who are rightly concerned by the risks of climate change. If we do not take this chance then we will find ourselves dictated to by countries who have stepped up to the task, we can either lead the international consensus, or be led by it but there is no escaping it.

How to make sure the UK gets renewables right

Renewable energy cannot succeed without complementary policy and infrastructure, explains Keith Anderson, CEO of ScottishPower

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Recent weeks have seen the issue of climate change thrust into public consciousness through Extinction Rebellion demonstrations in London and school children around the globe striking to raise awareness.

At ScottishPower, we have long recognised that our sector has a critical role to play. In January, we were proud to announce that we were the United Kingdom's first integrated energy company (that generates, delivers and sells energy) to generate 100 per cent green electricity, through offshore and onshore wind. Decarbonising energy generation in this way is significant, but it is only a start. If we are to meet government targets we must work to reduce emissions in other areas, building a renewables-led economy.

Sitting at the heart of this is our energy network. Often discussed in the context of ownership models, it is less well understood that networks are an essential component of the decarbonisation agenda; the transmission networks that act as energy motorways, linking our wind farms to sub-stations; and the distribution networks, the trunk roads, that bring this power to millions of homes and businesses. Nor is it understood that we must act now to ensure that these vital networks can support the electrical transformation as required.

Transport is one area where progress needs to be made to meet carbon reduction targets. The successful rollout of electric vehicles simply will not happen without investment in

our networks – investment which responds to regional variances.

Innovation is critical. Energy companies such as ours need to push the boundaries, trying things we have never done before, just as we are doing in partnership with stakeholders in the Liverpool City Region through our trailblazing £8.5m Project Charge. It will, for the first time in Britain, merge transport and network planning to create an overarching map of where charge points will be required and where the grid can accommodate them. We need to work closely with policymakers and we need a regulatory system that allows innovation and investment to thrive.

We are now at an important stage with Ofgem formulating the future framework and it is vital that networks are not restricted in their ability to invest and innovate. Doing so now, at exactly the moment we need to drive innovation, would be hugely counterproductive. If we don't get this right, we will feel the consequences for decades.

We need new investment mechanisms to accelerate the delivery of EV infrastructure. This means a dedicated funding stream to support investment now, for the necessary growth in the future. We also need to ensure that cities, towns and rural communities have control over their own energy ambitions, we need regional devolution of Ofgem powers allowing for fair rollout of new technology investment and innovation, driving decarbonisation in transport and heat across networks.

These two simple measures will benefit everyone, from the biggest cities to the smallest villages, from coast to countryside. Further democratisation of a system that is already delivering will set Britain, and our energy networks, on course to deliver the green future we need, creating jobs, improving public health and supporting strong regional economic growth along the way.

Digitisation must leave no energy customers behind

Advances in technology should benefit the whole of society, writes **Mark Coyle**, chief strategy officer at Utiligroup

I'm sure everybody reading this feels the ongoing transformation of life through connected technology. The internet has connected our devices and enables us to interact via only our voices. We are only at the start of this industrial revolution which creates a new basis for a society we cannot yet imagine. We are already experiencing the power of online collaboration to bring people together and disinformation to divide them.

Our businesses, councils and social enterprises also transform from a pre-digital basis of delivery to support the fast-changing, instantaneous culture of today. Sectors such as retail, financial services, price comparisons and clothing are all moving to new business models with most providers adopting a first online business model. This will accelerate as this first generation that grew up with the internet will see it as the first place for their engagement.

As society changes, then so too must our essential services. Energy is one of the last sectors to transform, operating on a basis designed in the early part of the 20th century. The pace of innovation in such as renewable generation, storage and electric vehicles threatens to overwhelm the old basis of our energy delivery. Even 20 years ago at the start of the internet era, customers were able to manage their mobile phone bill flexibly online each month but were until recently receiving estimated paper bills half yearly from their energy supplier.

However, the energy sector is now changing rapidly to underpin our digital society.

Smart meters and in-home displays are being offered to all consumers in the UK, at first to help develop understanding of energy, then to combine with connected devices for simple use energy control.

Over time the meter and its communications will connect and measure the various ways in which we produce, exchange, store, export and optimise our energy use across technologies. From smarter metering, a similar transformation is underway in energy networks so they become flexible and in our cities to integrate energy, transport and other sectors.

Maybe we will all produce some energy, share it, move our usage automatically and minimise our bills. But there is a new, evolving risk, which is that the most technologically literate people, with time and money to invest may receive the most benefit. There are many people and social enterprises who are disengaged, distrustful, busy, vulnerable, ill, fearful or lacking funds who could tune out for rational reasons.

While a competitive market brings price leadership, rivalry to improve service and innovate, it may not reach all customers. That is why non-for profit Suppliers such as Robin Hood Energy and Bristol Energy plus the partner councils with these and others are vital. Their mission is socially driven, to ensure nobody is left behind and to reach those who might not otherwise engage. Innovators are simplifying the technology user experience and complexity, so that trusted service providers can optimise energy for everybody ensuring we can all afford to live well and in comfort. The internet, energy and transport are converging and as complexity emerges, the control of energy must be simpler so that everyone benefits. That's why our focus at Utiligroup is to make utilities smarter for everyone.

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An ESG Company

How data can empower energy users

Jon Thompson,
head of data
analytics at amber
energy, discusses
the role of data
science in managing
energy consumption

What can data tell you about your energy habits?

In noting the nature of their energy consumption, organisations have the opportunity to not only cut costs through becoming more efficient in the use of resources, but can also develop a better understanding of their overall business. A restaurant would do well to know when its peak service period is, so it can turn kitchen appliances on or off accordingly. High Street retailers might analyse footfall to know when to use their air conditioning in the summer months.

Data science asks whether a site is being managed as effectively as possible. As specialists in data analytics amber energy can help to safeguard against energy waste, while also giving its clients a more detailed picture of how their business operates. Many companies collect data as par for the course, so it is important that the insight that can be gained from that information is harnessed.

Why is this important?

Beyond the obvious cost savings – any company would surely be grateful for the chance to save on its energy bill – there is a longer-term advantage to the environment. Where some organisations may get anxious about the expense of installing energy-efficient measures to keep pace with environmental consciousness, the beauty of data science is that it can help to bring about change by analysing existing setups. There is no extra cost in terms of installing new

infrastructure (such as solar panels, for example); rather, it is a case of ensuring an awareness of how different datasets relate to each other. As well as knowing when to turn appliances off, data science is as useful in knowing when to turn them on. Air conditioning can have an impact on the comfort of a workplace, which can have an impact on employees' productivity.

What are people's concerns about data science, and how can you address them?

The success of data science, naturally, hinges on the concept of data protection. At amber energy, we take any of our third-party collectors' compliance with GDPR standards, for instance, very seriously. But hang-ups over privacy – the vast majority of data collected is anonymous – should not overshadow the potential benefits to be had. Different companies already collect different datasets for a variety of purposes. We are in favour of a culture of data exchange, where the information about one set of customers could help to inform the operation of another business. Integrating products and services is the bread and butter of a smart city and forms the bedrock of a more seamless experience for people in general.

What does amber energy do differently?

amber energy has used data to help make a range of sites more energy-efficient. Our Student Energy Project uses smart meters to help the residents of student accommodation around the UK to monitor their energy use, and incentivise lifestyle changes with a range of prizes. Even the small changes in people's behaviour can make a huge difference. Our Power2Africa programme, meanwhile, is our not-for-profit initiative which encourages clients to donate the cost savings they achieve towards a renewable energy project in Africa. Through that scheme, we have been able to set up a cyber café in Kenya. **For more information, please visit: www.amberenergy.net**

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The light switch is in need of a redesign

When it comes to climate change, the concept of personal responsibility is something of a political football. But encouraging more conservative energy use is as much a blame game as it is a sincere attempt to save the planet. It's easier for politicians to put the onus on the public than it is for them to enact radical policies that might require them to negotiate with industry and upset consumers. If politicians are serious about creating a culture of energy efficiency, though, they have to consider how appealing to people's social consciences and trying to change the personal habits of human beings is far from easy.

Humans are ultimately flawed creatures. We know this much from the predicament that the planet finds itself in. Modern machinery, mobility, and agriculture are the energy-intensive aspects of our evolution. Most people do recognise this reality as a concern and are trying to change their behaviour accordingly. But for many others that does not translate into real practice. A survey by MoneySuperMarket found that nearly a quarter of people in the UK admitted to not turning electrical appliances off because it "takes too long".

The idea that if we all do our bit – to switch to renewable energy sources, to drive less, to walk more, to remember to turn things off when we're not at home – then everything will be fine is a nice one. It is also incredibly naïve.

While the people making positive lifestyle changes to curtail their energy consumption should be encouraged to do so, those who aren't do not necessarily



Energy is being wasted on an industrial scale. Sensors should replace switches, writes Rohan Banerjee

deserve condemnation. In an age built on the convenience of technology, even the most environmentally aware human could be forgiven for making a mistake.

Research by Utility Design, which makes automatic lighting, found that people in the UK are wasting £4.4bn worth of energy every year by leaving the lights on at home. Around 21 per cent of Brits, the firm reported, admitted to leaving lights on when leaving a room, wasting the same CO₂ emissions of 62 round-the-world flights every year.

In public and work settings, too, energy is being wasted. Lights in office buildings are frequently left on overnight; computers are left running but unattended during meetings and lunch breaks; many street lamps light up roads with nobody on them.

Too much power hinges on the flick of a switch. The best way to address this problem is to shift the responsibility of saving energy from humans to devices themselves. Not only are smart technologies a catalyst for cost savings, but they reduce the pressure placed on people.

Sensor-enabled lighting, which only turns on if a person is in a room, is widely available and pays for itself. Smart heating is becoming popular for the same reason. Making these technologies design requirements in all public and commercial spaces is exactly the sort of radical policymaking the planet needs. The need to preserve people's freedom to leave the car running or the lights, meanwhile, on is not as important as the need to preserve everyone else's right to a healthy environment.



We see possibilities everywhere.

From renewable energy and cleaner-burning natural gas to advanced fuels and new low carbon businesses. BP is working to make energy cleaner and better.

»»» keep advancing



Natural gas burns 50% cleaner than coal in power generation.