Balancing the grid

Peaking plants ready to deal with demand spikes

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Purchasing strategies for business – managing risk and complexity
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Electricity transmission and distribution systems used to be relatively simple. Not any more – now that huge numbers of new, often small, generators are connected at both high and low voltage networks and power flows can be in both directions. We include three articles on the subject – two on the technologies used to control modern networks and one on efforts to harmonise grids across national boundaries in Europe – see page 14 onwards.

Our second theme is energy purchasing and management. We have articles on the use of on-site electricity storage as part of a purchasing strategy, how to manage risk and complexity, and the role of international standards.

Between the main features, Jennifer Johnson takes a second look at the feasibility of the UK going ‘net zero’ by 2050. We also include two articles from the EI itself: details of the views of energy professionals contained in this year’s Energy Barometer, plus the latest in the series of pieces from EI Young Professionals Networks; this time Ireland.

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FROM THE EDITOR

Facing in two directions at once

W

e are all net zero environmentalists now. Support for the government’s adoption of the Committee on Climate Change’s (CCC’s) target to end UK emissions of greenhouse gases by 2050, while hardly unanimous, was widespread – see the news story on page 8. Except, that is, for those who feel the target is not ambitious enough. Meanwhile, several other countries including France, New Zealand and those in Scandinavia have also set zero carbon targets.

No-one is suggesting that the UK can solve climate change alone, of course – the country currently emits only around 1% of the global total. (Although looking into the past reveals an entirely different story – Britain, the [first] industrial revolution and coal started the whole greenhouse gas exercise and for many decades the UK was by far the largest emitter. But that – the role of historical emissions – is a subject for another time.)

The UK is now a very small-time player – China, the US and the EU now send the largest amounts of carbon dioxide into the global atmosphere, and the answer to climate change – if indeed there is one – lies in global agreement on action to change course.

The UK government’s stance explicitly recognises this. First, the government says it will retain the ability to achieve its target with the help of international carbon credits – ie funding carbon-cutting measures outside the UK if this proves better value than some of the measures to be taken at home.

Second, it plans to have a good look, five years from now, at whether other major economies are doing their bit by also heading towards net zero in a hurry. Whether such a review would free a future government to then adjust its ambitions downwards remains to be seen.

There are several other international complications. Britain’s net zero target does not include the share of greenhouse emissions that arise from importing the majority of its manufactured goods. Is it ‘fair’ that the UK doesn’t account for, and escapes being blamed for, carbon emissions from its share of the output from factories across Eastern Europe and the Far East?

Second, the target does not formally take account of emissions from international aviation and shipping – although the CCC carbon budgets that form the base of the calculations do make allowances for these. Emissions from these two transport sectors – both of which are growing in relative importance as emissions from cleaner power systems and better insulated buildings fall – are being dealt with, rather slowly, separately.

Of course UK efforts to cut carbon are still very worthwhile. Apart from reducing the world’s global footprint by that 1%, serious target-setting and action in this country gives the UK government some moral authority to try to persuade others to do the same. And, it is argued, green economy pioneers stand to reap large economic benefits of starting early.

The classic example is Denmark, which initially did very well as a wind turbine manufacturer from being an early user of wind. Although other manufacturers, principally from China, Germany and Spain, have since caught up.

The views and opinions expressed in this article are those of the editor only and are not necessarily given or endorsed by or on behalf of the Energy Institute.

In this month’s Petroleum Review:

• Boomtime for North American unconventionals
• Who will absorb this summer’s LNG oversupply?
• Supply chain anticipates new FLNG developments
• Wave of disruption for energy supply

Petroleum Review is the monthly sister publication to Energy World, covering all aspects of the international oil and gas industry. As an EI member, you can subscribe to Petroleum Review for £57, or access it online, for free, at https://knowledge.energyinst.org/magazines/petroleum-review

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The oil major places blame for emissions increases on greater global demand for heating and cooling

Recent BP figures show ‘worrying’ rises in demand and emissions

Oil giant BP has warned of a widening gulf between demands for action on climate change and the sluggish pace of progress on emissions reductions in its 68th annual Statistical Review of World Energy.

The report shows there was a rapid rise in both energy demand and carbon emissions last year – with global energy consumption growing by 2.9% and emissions growing by 2%. The latter figure, equivalent to 0.6 gigatonnes of CO2, represents the largest year-on-year rise since 2011.

When broken down by fuel, growth in energy consumption was largely driven by natural gas, which contributed nearly 45% of the increase. Meanwhile, consumption of oil and coal increased by 1.5% and 1.4% respectively. Renewables grew by 14.5%, nearing their record-breaking increase in 2017, but renewables still amounted to just one third of the increase in total power generation.

China, the US and India accounted for around two thirds of total rise in energy consumption. According to BP, the most striking growth was seen in the US, where energy consumption increased by a massive 3.5%, the fastest growth seen for 30 years.

Much of the global surge in energy demand can be traced back to extreme weather events, as consumers across the world’s major population centres upped their usage of heating and cooling in response to an unusual number of hot and cold days.

In analysis published alongside the report, BP’s Group Chief Economist, Spencer Dale, offered two interpretations of the data. If the increased number of heating and cooling days were just random variation, the oil major would ‘expect weather effects in the future to revert to more normal levels.’

On the other hand, Dale wrote, if there is a link between growing levels of CO2 in the atmosphere and the weather patterns observed last year, there is the possibility of a worrying vicious cycle. Under this scenario, increased concentrations of greenhouse gases lead to more extreme weather events, which in turn trigger stronger growth in energy consumption and emissions as households and businesses seek to heat and cool their buildings.

‘Even if these weather effects are short lived, such that the growth in energy demand and carbon emissions slow over the next few years, the recent trends still feel very distant from the types of transition paths consistent with meeting the Paris climate goals,’ Dale warned.

BP has recently provoked the ire of environmentalists, with campaigners from Greenpeace, pursuing a drilling rig as it is towed from Scotland’s Cromarty Firth to a North Sea oil field to drill for oil. Fourteen people have been arrested since the activists first boarded the 27,000-tonne rig in mid-June.

‘We are determined to stop BP drilling new oil wells in the North Sea,’ said Greenpeace activist Sarah North. ‘We’re calling on them to act with leadership by transitioning to 100% renewable energy in response to this escalating global crisis.’

Further falls in costs due for solar, wind and batteries – BNEF

Steep declines in wind, solar and battery technology costs will result in a global power grid nearly half-powered by the two fast-growing renewable energy sources by 2050, according to the latest projections from Bloomberg New Energy Finance (BNEF).

In its New Energy Outlook 2019 (NEO), BNEF sees these technologies ensuring that the power sector contributes its share toward keeping global temperatures from rising more than 2°C, at least until 2030.

According to the report, wind and solar will grow from 7% of generation today to 48% by 2050. Over the same time period, electricity demand is set to increase 62%, resulting in global generating capacity almost tripling between 2018 and 2050. This will attract around $131tn in new investment, of which wind will take $5tn and solar $4tn. In addition to the spending on new generating plants, $840bn will go to batteries and approximately $11tn to grid expansion.

The costs of solar, wind and battery technologies are set to fall, by 28%, 14% and 18% respectively for every doubling in global installed capacity,’ said Matthias Kimmel, NEO 2019 Lead Analyst.

By 2030, energy generated and stored from these technologies will ‘undercut electricity generated by existing coal and gas plants almost everywhere,’ he added. These cost reductions, says the report, may negate the need for direct subsidies for existing technologies in many countries.

The overall outlook on global emissions is mixed, though. On the one hand, the build-out of solar, wind and batteries will put the world on a path that is compatible with these objectives at least until 2030. However, the report asserts that a lot more will need to be done with technologies other than solar and wind power – such as nuclear, biogas, hydrogen and carbon capture and storage – beyond 2030 to keep the global temperature increases below 2°C.

Elena Giannakopoulou, Head of Energy Economics at BNEF, said: ‘To achieve this level of transition and decarbonisation, other policy changes will be required – namely, the reforming of power markets to ensure wind, solar, and batteries are remunerated properly for their contributions to the grid.’

BNEF’s NEO director, Seb Henbest added: ‘Governments need to do two separate things – one is to ensure their markets are friendly to the expansion of low-cost wind, solar and batteries; and the other is to back research and early deployment of these other technologies so that they can be harnessed at scale from the 2030s onwards.’
IEA urges policymakers to embrace both hydrogen and nuclear

In a pair of new reports, the International Energy Agency has stressed the importance of nuclear and hydrogen in global decarbonisation.

Without policy changes, advanced economies could lose 25% of their nuclear generation capacity by 2025, resulting in billions of tonnes of additional carbon emissions, the International Energy Agency (IEA) has warned.

In a new report, *Nuclear Power in a Clean Energy System*, the agency outlines the risks associated with policymaker indecision on the future of nuclear energy. According to the study, ageing plants are beginning to close in advanced economies, partly because of concerns about safety, and partly because of economic and regulatory uncertainty.

While extending the operational life of existing nuclear plants requires substantial capital investment, the IEA says that its cost is competitive with other electricity generation technologies, including wind and solar. However, market conditions don’t favour these extensions, largely because a prolonged period of low wholesale electricity prices in many countries has cut profit margins.

Investing in new nuclear is even more challenging, according to the report. Planned projects in Finland, France and the US have faced significant budget overruns and construction delays. South Korea remains an exception, largely building and delivering plants on time, though its government has announced that it plans to stop building new nuclear.

If low-carbon technologies, namely wind and solar, are to make up the nuclear shortfall, the IEA says their deployment would have to accelerate to an ‘unprecedented’ pace. In the past two decades, wind and solar PV capacity has increased by some 580 GW in developed economies. But over the next 20 years, nearly five times that amount will need to be added to make up for a lack of new or life-extended nuclear.

The lack of further lifetime extensions of existing nuclear plants and new projects could ultimately result in an additional 4bn tonnes of CO2 emissions.

Meanwhile, the IEA has also issued a report calling for the further development of a global hydrogen economy so that sectors such as long-haul transport, chemicals and steel can be decarbonised. However, the document: *The Future of Hydrogen: Seizing Today’s Opportunities* notes that hydrogen still faces significant challenges, among them that producing the gas using low carbon energy is a costly process. The development of hydrogen infrastructure is also slow and holding back widespread adoption, as are prohibitive regulations in some regions.

The IEA’s study identified four actions that can be taken in the present day to lay the groundwork for the development of a global clean hydrogen industry. These include:

- making industrial ports the nerve centres for scaling up the use of clean hydrogen;
- building on existing infrastructure, such as natural gas pipelines;
- expanding the use of hydrogen in transport by using it to power cars, trucks and buses that run on key routes; and
- launching the hydrogen trade’s first international shipping routes.

Reducing the emissions associated with hydrogen production is another challenge that must be overcome if hydrogen is to be rolled out worldwide. One approach, the IEA says, is to capture and store or utilise the CO2 from hydrogen production from fossil fuels. Another approach is for industries to secure greater supplies of hydrogen that has been produced using clean electricity.

Drone inspection for Swedish and Finnish turbines

Switzerland’s Sulzer Schmid, which specialises in using unmanned aerial vehicle (UAV) technology for rotor blade inspections, and WKA, a blade inspection and repair service provider, have been enlisted by Vestas to conduct a drone-based blade inspection campaign in Scandinavia on 1,250 wind turbines in less than 12 weeks.

The blades of the 1,250 Vestas turbines located across Sweden and Finland must be inspected in time for the beginning of the repair work season that traditionally takes place during the less windy summer months.

The HD images captured by the drones are analysed using artificial intelligence and automated reports on turbine health are generated by Sulzer Schmid’s software.

*Photo: Sulzer Schmid*
European consortium launches new carbon capture and storage project

A consortium of 11 European stakeholders, including ArcelorMittal, Axens, IFP Energies Nouvelles (IFPEN) and Total, has announced plans for a new industrial carbon capture and storage (CCS) project.

The €20mn DMX Demonstration in Dunkirk (3D) project, which is part of the Horizon 2020 EU research and innovation programme, aims to demonstrate the new DMX process for capturing carbon dioxide (CO2) emissions at the industrial level, using the ArcelorMittal steelworks site in Dunkirk as a pilot site.

The pilot, designed by Axens, will begin construction in 2020 and will be able to capture 0.5 tonnes of CO2 per hour from steelmaking gases by 2021. The DMX process, a patented process stemming from IFPEN’s Research and to be marketed by Axens, uses a solvent that is claimed to reduce the energy consumption for capture by approximately 35%. Additionally, using the heat produced on site will cut capture costs in half, to less than €30 per tonne of CO2, says the consortium.

The 3D project’s ambition is to validate replicable technical solutions and to achieve industrial deployment of CCS technology around the world. It could play a major role in enabling industries with high energy consumption and CO2 emissions, such as the steel industry, to reduce their emissions.

Following the pilot, the consortium aims to implement its first industrial unit at the ArcelorMittal site, due to be operational from 2025. It should be able to capture more than 125 tonnes of CO2 per hour. This unit will be part of the European Dunkirk North Sea cluster, which aims to capture, pack, transport and store 10mn tonnes of CO2 per year once operational by 2035.

EU could miss climate targets ‘if members fail to raise their ambition’

The European Commission has warned that EU member states must step up their ambitions in order to meet the bloc’s agreed 2030 energy and climate targets. In an assessment published on 18 June, the Commission said that member states’ national energy and climate plans (NECPs) already represent ‘significant efforts’ — but they fall short in terms of renewables and energy efficiency contributions.

Under EU law, all 28 member states have vowed to meet three climate targets by 2030: cutting greenhouse gas (GHG) emissions by 40% on 1990 levels, boosting energy efficiency by 32.5% and generating 32% of energy from renewables. At present, the draft NECPs suggest that the EU could fall short of both its renewables and energy efficiency goals by 1.6% and 6.2%, respectively.

‘Member States have all produced impressive drafts in a relatively short time, but no draft is perfect,’ said Vice-President for the Energy Union, Maroš Šefčovič. ‘Final plans are due by the end of the year and our recommendations show where more effort is needed: for example, stronger ambition, more policy detail, better specified investment needs, or more work on social fairness.’

According to trade association WindEurope, 15 member states are falling short on their renewable commitments: Belgium, Bulgaria, Cyprus, the Czech Republic, Finland, France, Hungary, Ireland, Latvia, Malta, Poland, Romania, Slovenia, Slovakia and the UK.

The Commission has asked member states to improve their draft plans in several ways. On the energy efficiency and renewable contributions, some countries have been called upon to increase efforts and better exploit their national potential. In addition, EU members have been asked to set ‘measurable, achievable, realistic and time-related’ climate objectives, as well as substantiate the achievement of their national targets with more concrete policies.

‘The Commission’s recommendations highlight the areas where countries need to step up their game, namely permitting, electrification, corporate power purchase agreements, and the repowering of existing wind farms,’ said Giles Dickson, CEO of WindEurope. ‘Member States now know what they have to do — ramp up the ambition and fill in all the policy gaps. The Commission needs to stay on their backs and make sure they get it right.’

Countries now have six months to revise and finalise their NECPs so that they align with climate targets.

Russia debuts new nuclear icebreaker

Russia’s state-owned nuclear energy company, Rosatom, has launched its third nuclear powered icebreaking ship in Saint Petersburg. Known as Ural, the vessel is equipped with two RITM-200 nuclear reactors, capable of generating up to 350 MW combined. The RITM-200 made its global debut on Arktik and its sister ships, Arktik and Sibir. The company says it will later deploy the same reactor type in both floating and landlocked nuclear power plants.

According to Rosatom, Ural and its sisters have been designed to navigate the Northern Sea Route all year round. The Russian government has given Rosatom the lead in developing infrastructure for the route, which runs from the Barents Sea, near Russia’s border with Norway, to the Bering Strait between Siberia and Alaska.

Photo: Rosatom
Global energy investment stabilises after three years of decline

Oil, gas and coal sectors all saw increased global investment during 2018, with few signs of a reallocation to cleaner sources. Global energy investment remained relatively stable in 2018 at over $1.8tn, following three years of decline, according to a new report from the International Energy Agency (IEA).

The World Energy Investment 2019 report shows an increase in capital spending on oil, gas and coal supply. Meanwhile, investment in energy efficiency was stable and renewables spending decreased.

Power was the largest investment sector for the third consecutive year, reflecting the growing importance of electricity, demand for which grew at almost double the rate of growth for overall energy demand in 2018. However, power investment fell by 1% overall due to stable spending on gas in the US and lower solar power and coal investment in China.

The 4% increase in upstream oil and gas spending was driven by a higher oil price, increases in shale spending – particularly in the US – and a focus on shorter cycle projects which limit capital at risk, says the report.

Renewables-based power investment decreased by 1% due to flattening net additions to capacity and the falling costs of renewable technologies, particularly solar power and onshore wind, which experienced 70% and 20% drops in capital costs respectively on 2010 levels.

The most rapid rise in energy investment came from India, which saw a 12% increase from 2015–2018. Renewable spending exceeded that of fossil fuel-based power, supported by favourable policies and the rapidly falling costs of solar power. This swift increase, asserts the IEA, makes India one of three key drivers of global energy investment alongside China and the US.

China, which remained the largest market for energy investment in 2018, saw investment decline by 7%, a change driven by 60% lower spends on coal-fired plants which outweighed relatively high investments in renewables and nuclear power.

The EU saw similar levels of decline, although the share of spending going towards low carbon energy has risen to nearly 60%.

According to the report, there are few signs of the substantial reallocation of capital towards energy efficiency and cleaner supply sources needed to bring investments in line with the Paris Agreement. The IEA suggests that investment in energy efficiency would need to accelerate quickly while overall investment in low carbon energy should more than double by 2030, if we are to meet the goals of the Paris Agreement.
Useful energy services, not kilowatt-hours

When Thomas Edison set up his first central-station electricity system on Pearl Street in Manhattan in 1882, he charged his wealthy Wall Street customers according to how many lamps they had, regardless of whether they were on or off. The customers were paying for access to electric light, the service they actually desired, just as you pay rent or a mortgage for access to your home, whether you are in it or not.

To keep the cost tolerable Edison had to optimise the entire system: steam engine, generator, cables, switches and—of course—lamps. Then, in 1885, came the advent of the electricity meter. Suddenly Edison was selling not electric light but electricity, by the measured kilowatt-hour. From then on, if customers used inefficient lamps, Edison and his competitors benefited, because to get the desired light customers had to buy more electricity.

**Poor system performance**

This perverse incentive to poor overall system performance still prevails more than a century later. What’s worse, it applies to every human activity system—not only to make light, but also to adjust local temperature up or down, to exert force, to move things and to manage information. We call them energy systems, but that misses the point. No one wants ‘energy’. No one wants fuel, or electricity. We want comfort, illumination, exert force, to move things and to ensure that the buildings and their electrical contents, lamps, heaters, chillers, motors and electronics are the best available, to deliver optimum performance.

Whole-system design, planning and investment become straightforwardly good businesses. The system is no longer selling kilowatt-hours. It is delivering the services its users want, as economically as possible, and they are paying accordingly.

The perversion of the fundamental change we need is a change of mind-set—and time is short.

Walt Patterson is an Associate Fellow in the Energy, Environment and Resources Department of Chatham House in London.
May adopts CCC recommendations to end emissions by 2050

Widespread welcome for new ambition to cut carbon emissions to zero, though government retains a credits loophole

The government is keen to see other major economies play their part – it will conduct an assessment within five years to confirm that other countries are taking similarly ambitious action... to ensure that UK industries do not face unfair competition

I
n one of her last acts as Prime Minister, Theresa May announced in June that the government will follow the advice from its Committee on Climate Change (CCC) and eradicate the UK’s net contribution to climate change by 2050, amending the 2008 Climate Change Act in order to tackle the target.

The government had commissioned this advice from the CCC last October – its report was published in May; see Energy World June 2019 for the findings.

The move means that the UK is on track to become the first G7 country to legislate for net zero emissions, with other major economies expected to follow suit. But the government is keen to see other major economies play their part – it will conduct an assessment within five years to confirm that other countries are taking similarly ambitious action, both to multiply the effect of the UK’s lead and to ensure that UK industries do not face unfair competition.

The government has also decided that young people will have the chance to shape future climate policy through a Youth Steering Group set up by the Department for Digital, Culture, Media & Sport and led by the British Youth Council. This will advise government on priorities for environmental action and give a view on progress against existing commitments on climate, waste and recycling, and biodiversity loss.

However, the government said it will retain the ability to use international carbon credits to achieve the target, rather than relying 100% on domestic measures. It says that using international credits will allow the UK to maximise the value of each pound spent on climate change mitigation.

Prime Minister Theresa May said: ‘As the first country to legislate for long-term climate targets, we can be truly proud of our record in tackling climate change. We have made huge progress in growing our economy and the jobs market while slashing emissions. Now is the time to go further and faster to safeguard the environment for our children. This country led the world in innovation during the Industrial Revolution, and now we must lead the world to a cleaner, greener form of growth.’

The report from the CCC and its adoption by the government have been widely welcomed, not least by the business community. ‘UK business stands squarely behind the government’s commitment to achieve net zero emissions by 2050. This legislation is the right response to the global climate crisis, and firms are ready to play their part in combating it,’ said Dame Carolyn Fairbairn, Director-General of the CBI.

Others stressed the obvious need for many years of unmitigated effort required to actually meet the target. Neil Harris, Professor of Atmospheric Informatics at Cranfield University, said: ‘This is a very welcome step by the UK government. The target is rational and achievable and would mean reducing emissions by 3% a year, at their current levels, for the next 30 years.’

While Professor Phil Longhurst, Head of the Centre for Climate and Environmental Protection at Cranfield added: ‘This is an important and achievable target, but what we now need is a plan as to how meet this, otherwise there is a danger that the target will be missed. Which technologies are going to be invested in, which behaviours are we going to try and change and what innovations are we going to back?’

There was also criticism. Dr Doug Parr, Chief Scientist for Greenpeace UK, said: ‘Judging by the headline, this is a legacy Theresa May can be proud of. Judging by the small print, this is a net zero target with a backstop… trying to shift the burden to developing nations through international carbon credits undermines that commitment. This type of offsetting has a history of failure and is not, according to the government’s climate advisors, cost efficient.’

‘This decision fires the starting gun for a fundamental transformation of our economy, added Parr, concluding: ‘It’s now official – in a climate emergency, business as usual is no longer an option.’

The government is keen to see other major economies play their part – it will conduct an assessment within five years to confirm that other countries are taking similarly ambitious action... to ensure that UK industries do not face unfair competition.

Power generation

(A)lmost) no coal on the power system for a fortnight

The record first ever week of coal-free electricity generation in Great Britain – set in early May – has been trumped by the first ever fortnight without coal, which ended on 31 May. According to National Grid, this meant a coal-free GB for 336 hours.

Indeed Britain enjoyed more coal-free hours in May (679) than it did for the whole of 2017 (624), according to trade association RenewableUK. The first ever coal-free day in modern times was in April 2017.

RenewableUK’s Deputy Chief Executive Emma Pinchbeck said: ‘Coal was the backbone of the last industrial revolution – but this old technology is being beaten by wind energy, the powerhouse of our 21st century economy. Renewables are providing well over a third of our electricity today, and this is just the beginning.’

But coal-free does not mean fossil-free – gas-fired power stations continue to supply more electricity into the system than any other source most of the time. Also, some coal-fired power was imported into Britain during the two week period, according to analysis by market data expert EnAppSys.

High carbon taxes in Britain were the key reason why Britain’s electricity system has run without coal for that two weeks, says EnAppSys, but these higher carbon taxes do not apply in neighbouring regions. And, over the two-week period of zero coal, Britain imported a small amount of electricity from coal-fired power stations operating abroad, the majority of this from the Netherlands where coal power stations continue to operate as a result of paying only half the carbon taxes paid within the UK.
Glasgow could become the UK’s first net zero city

Adjacent Whitelee onshore wind farm to host a 50 MW battery storage project

ScottishPower and Glasgow City Council have revealed a bold vision to transform Glasgow into the UK’s first ‘net zero’ city. With Scotland having set itself a target of net zero carbon emissions by 2045, the two organisations say they will start work on a range of programmes to ensure the country’s largest city reaches this target first.

Glasgow has already established the first Low Emission Zone outside London, while the UK’s biggest onshore wind farm, Whitelee, which is owned by ScottishPower, is on the outskirts of the city. The focus will now turn to other parts of Glasgow’s economy that can be decarbonised, such as transport and heating, as well as continued investment in the electricity grid to support the increasingly low carbon city.

One of the key areas of focus over the next ten years will be electric vehicles. Over 70% of Glasgow’s residents live in flats with no personal off-street parking, says ScottishPower, and this creates challenges to install chargers that can easily and regularly be used by residents. The company is planning a charging system that overcomes this challenge, including workplace and public charging locations. Sites for these locations are already being assessed.

Beyond Glasgow, ScottishPower reiterated its call to speed-up the development of onshore wind across the country.

Speaking at the All Energy Conference held in Glasgow in May, ScottishPower Chief Executive, Keith Anderson, said: ‘It is our hope that this declaration kick starts a race to zero with other ambitious cities, like Edinburgh, because then we will all be winners. The prize is the future of our country and our planet.’

Meanwhile, the Scottish Government has approved ScottishPower plans for the UK’s largest onshore wind farm, Whitelee, to have its own purpose-built super battery on site, in what will be one of the biggest energy storage projects in the UK.

Charged with green renewable power from the site’s 215 turbines, the planned battery storage centre will support the National Grid in maintaining the resilience and stability of the electricity grid, even at times when the wind may not be blowing – a first for a wind farm in the UK at this scale. The battery storage site will be the size of half a football pitch and will comprise 50 MW of lithium-ion battery technology.

Its planned storage capacity makes it the largest windfarm battery in the UK, capable of achieving full charge in less than an hour, says ScottishPower. This means it will be on standby to provide services like reactive power and frequency response to National Grid. The battery will be fully discharged or used in bursts as and when required to keep the electricity network stable by balancing supply and demand.

Wind power

Halfway to the world’s largest, and furthest offshore, wind farm

Half of the 174 offshore wind turbines to be installed at the Hornsea One offshore wind farm are now in place, says developer Ørsted. The site is due to reach completion in the first quarter of 2020, at which point it will become the world’s largest offshore wind farm, and the furthest from shore yet built.

Sited across an area of 400 km² and 120 km off the east English coast, the wind farm will comprise 174 Siemens Gamesa turbines, each rated at 7 MW, and will be nearly double the size of the current world’s largest, Walney Extension, says Ørsted.

But power generation at the site is already underway and the project’s first operational team shift, said: ‘Operating a wind farm this far offshore is unprecedented. We’ve had to think creatively and come up with new ways of working to overcome the logistical and technical challenges of operating a massive power station 120 km from the shore, about the same distance as Grimsby to Leeds.’

David Coussens, Deputy Operations Manager and leader of the first operational team shift, said: ‘Operating a wind farm this far offshore is unprecedented. We’ve had to think creatively and come up with new ways of working to overcome the logistical and technical challenges of operating a massive power station 120 km from the shore, about the same distance as Grimsby to Leeds.’

The Service Operations Vessel for staff operating and maintaining the Hornsea One wind farm, which is located 120 km off the east coast of England

Photo: Ørsted
Electric vehicles

Consumers ‘close to favouring electric vehicles’

The time for electric vehicles (EVs) in the UK is almost here – half of mainstream consumers would likely choose a plug-in hybrid electric vehicle (PHEV) as a main or second household car, or a battery electric vehicle (BEV) as a second car, in the next five years. So says the transport innovation consultant TRL, announcing the results of its latest research, the Consumers, Vehicles and Energy Integration (CVEI) project, completed for the Energy Technologies Institute (ETI).

Another conclusion is that half of mainstream consumers would consider a BEV as a main car if its range increased to 200 miles; increasing to 90% of mainstream consumers if the range was 300 miles. On vehicle charging, the research says that mainstream consumer adoption of BEVs can be encouraged through provision of rapid charging infrastructure every 20 miles on motorways and A-roads. Providing rapid chargers with 150 kW charging rates is also likely to increase adoption.

The results reveal the ‘tipping points’ for when mainstream consumers will be likely to adopt both fully electric vehicles and plug-in hybrid electric vehicles, says TRL. The pace of change will ultimately be dictated by consumer demand.

Dr George Beard, TRL’s Head of ULEV Consumer Research explained: ‘We provided 447 mainstream consumers with real-world experience of using both BEVs and PHEVs for their day-to-day journey needs. By providing this real-world experience, we were able to gather more representative views of mainstream consumers about the extent to which electric vehicles serve their needs.’

Across the trials, data on consumers’ attitudes, perceptions and choices were gathered from surveys, and information was gathered from vehicles and charge points for 584,000 miles of journeys and 15,700 charge events, covering both home and public locations.

The CVEI project was commissioned by the Energy Technologies Institute and led by TRL; other project partners were Baringa, Element Energy, Cenex, EV Connect, The Behavioural Insights Team, EDF Energy and Shell.

New gas-fired peaking plant for Southampton

Energy Assets Utilities is working alongside project managers Stag Energy, and Keekle Power, to bring a 20 MW gas-fired peaking plant online near Southampton. The plant will enable Keekle Power to provide dispatchable power to the local distribution system and fulfil its Capacity Market obligation.

EAU has completed more than 40 such schemes. This latest project involves the design and construction of a particularly complex gas infrastructure, including a 140 m directional drill under the main Southampton railway line, to connect the site to the gas network. Ten gas-fired reciprocating engines will generate electricity for export to the grid.

Gender equality

Disappointing progress on getting women onto energy boards

While there are some pockets of success, efforts to drive up the number of women at senior levels in the energy sector, have led to disappointingly slow progress, according to the Energy Leaders’ Coalition, which had made a public commitment in May last year to improve gender balance within their own companies and the sector as a whole.

Published this May, POWERful Women’s annual statistics on the composition of boards in the top 80 UK energy companies show that:

• women still occupy only 16% of board seats (a marginal increase from 13% in 2018);
• women still occupy only 6% of executive board seats (no improvement); and
• 42% of the companies have no women on their boards at all (a small improvement from 50% in 2018).

The leaders of eight major UK energy companies – between them representing 56,000 employees – are therefore urging a renewed effort. The Energy Leaders’ Coalition – EDF Energy, Good Energy, innogy, National Grid, Ørsted, ScottishPower, Shell and SSE – published a report on its progress in the past 12 months.

The report: Positive Steps to Gender Balance includes a series of case studies showing initiatives that have already been implemented – on tackling unconscious bias in recruitment, attracting and developing talent, flexible working and visible leadership and targets – and looks at next steps to overcome barriers.

Juliet Davenport, Chief Executive of Good Energy, said: ‘I am proud of the positive steps we have made on gender balance and the women who are already benefiting. But all of us on the Energy Leaders’ Coalition recognise that we have much more to do to move from unconscious bias to “conscious inclusion”.’
Power generation company SSE is proposing to close the remaining operational units at its Fiddler’s Ferry coal-fired power station site in Warrington, Cheshire. Following a review, the company has begun consultation with employees and trade unions with a view to closing the station by 31 March 2020.

Fiddler’s Ferry is SSE’s last remaining coal-fired power station. The operational units have a combined generation capacity of 1,510 MW. The company previously announced the closure of Unit 1 at the site in March.

Fiddler’s Ferry has had limited success gaining supply contracts in the government’s Capacity Market auctions, and its current contract will end in September, says SSE. Its financial performance has deteriorated to unsustainable levels, with losses of around £40mn in the company’s last financial year. With a background of national and international policies focusing on promoting lower carbon forms of electricity generation, the economics of coal-fired stations have become increasingly difficult. The UK has committed to ending unabated coal-fired electricity generation by 2025 – just six years away.

SSE employs 158 people at the site and says it will seek to avoid compulsory redundancies where possible. Stephen Wheeler, Managing Director of Thermal Energy at SSE, said: ‘At nearly 50 years old, the station is unable to compete with more efficient and modern gas and renewable generation.’

Off-grid renewables at Hebden Bridge
Renewable energy company Dulas has begun work to refurbish and upgrade the off-grid energy system at the National Trust’s Gibson Mill site, located within Hardcastle Crags, Hebden Bridge.

The National Trust acquired the mill following a period of disuse in 1950 and, in 2005, with support from Dulas, launched a project to make the site entirely energy self-sufficient. Initial work included the restoration and reinstatement of the cotton mill’s original 1926 Francis hydro turbine, the installation of a smaller crossflow hydro turbine, and solar photovoltaic and battery storage systems.

Work to upgrade Gibson Mill’s energy system will include the replacement of the original battery storage system with a new and larger battery bank. The site’s three inverters will also be replaced and reconfigured to satisfy greater peak power demand.

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Photo: Steve Morgan, National Trust

New CCGT on the way at Keadby
Construction work has begun for Keadby 2, a new combined cycle gas turbine (CCGT) power station being developed in Lincolnshire for SSE by Siemens. Main civil works began at the start of April. Siemens and SSE say they are keen to use suppliers from across the UK to deliver the project. The plant is being built as a full turnkey solution by Siemens, which will also provide plant servicing under a 15-year contract.

Once completed, the £350mn station will be the most efficient CCGT on the system, with 63% efficiency, says Siemens. The station will help to provide flexible energy generation capacity to the grid, with the turbine able to reach full combined cycle power in 30 minutes.

Photo: Siemens
Westminster launch for Energy Barometer 2019

The Energy Barometer has once again delivered vital insight into the current state and future of the energy system amid a turbulent year in UK politics. Nearly 500 members from across sectors and disciplines have made their voices heard through the signature UK report from the Energy Institute (EI). The outlook for consumers in an increasingly digital, low carbon energy future is among the chief concerns voiced this year.

The 2019 findings were shared with civil servants, parliamentarians, industry leaders and the media at a launch event in Westminster. The results were presented by the EI’s President Elect Steve Holliday FREng FEI, Trustee Joanne Wade OBE FEI, and Chief Executive Louise Kingham OBE FEI. An evening lecture at the EI offices in London, as well as presentations to UK branches, are planned following the launch.

Now in its fifth year, findings of the survey reveal trends and changing perceptions. Respondents are, for example, increasingly optimistic that the UK can meet its 2050 emissions targets, but raise concerns about how household consumers will fare as the energy transition and data revolution in energy progress.

The results underpin ongoing discussion between the EI, policy makers, the media and the sector on the future direction of the UK energy system.

A new digital format allows readers to fully explore and share the entire data set. Readers are invited to join the conversation and feed back their own views about the results using #EnergyBarometer.

For a summary of this year’s messages, see p22. Read the full report at bit.ly/2JpnJ8V

El branch events – from an offshore wind farm to a gin distillery

The EI’s branch network has organised some exciting visits over the past month – from a visit to the Rampion offshore wind farm off the Sussex coast to the Bombay Sapphire distillery in Hampshire.

In June, the EI’s London and Home Counties Young Professionals Network (YPN) organised a boat trip to the Rampion offshore wind farm, where attendees were able to see the giant feats of engineering up close. Owned by E.ON, the wind farm has 116 wind turbine generators, towering 140 metres in height and supplying enough power to supply 350,000 homes.

The EI’s Southern Branch organised a visit to the Bombay Sapphire distillery at Laverstoke Mill in Hampshire. The gin distillery blends a renewable energy and high energy efficiency approach. Low carbon energy is provided by solar PV and a hydro-electric turbine in the River Test, giving carbon savings of 38%. The distillery was awarded the BREEAM Award for Industrial Design in 2014 for its efficient process buildings. The attendees also learned about the distillery’s sustainable approach to crafting and showcasing the gin and, of course, were able to enjoy a drink ‘on the house’.

The EI branch and YPN networks put on events across the UK and internationally – browse upcoming events in your area at energyinst.org/ei-near-me/worldwide

Assurances for a post-Brexit Environment Act

The EI has joined other leading business, environmental, academic and professional groups to publish a shared view of how the UK government’s planned Environment Bill can help ‘put sustainability at the heart of our economic model’ following departure from the European Union.

Published as part of the Broadway Initiative, the assurances set out the key elements needed for a clear and coherent Environment Act that gives society strategic predictability on the long-term pathway for the environment, providing the basis for private and public sector investment in environmental improvement. It will also enable all parts of government to work together better to ensure policies more coherently and consistently encourage good environmental management.

The Broadway Initiative brings together a cross-section of stakeholders and nationally recognised experts to generate ideas and proposals for world leading arrangements to govern the environment after EU exit.

Broadway Convenor, Ed Lockhart said: ‘It’s clear that to improve our environment in any fundamental way we need a legal framework that respects the long-term nature of environmental challenges and their solutions, and enables businesses to factor the environment into their plans and investments from the earliest stage. The Environment Bill is the moment to make sure that happens.’

Led by IEMA, other organisations involved include CBI, FSB, Society for the Environment, Energy UK and Water UK.

View the Assurances for a New Environment Act at www.iema.net/broadway/assurances-2019
Offshore wind health and safety performance improving

Against a backdrop of growing offshore wind energy capacity, the G+ Offshore Wind Health and Safety Organisation’s latest report highlights a decrease in the total number of health and safety incidents among its members last year.

The 2018 Incident Data Report found that high potential incidents – defined as having the ability to cause a fatality or a life-changing injury – were down 13% in 2018 compared to 2017.

The report also highlighted that overall there was a 17% decrease in the lost time injury frequency compared to the previous year. While the overall number of hours reduced by 4% in 2018 from 2017, lost time injuries fell more sharply, reflecting improved safety performance. This improved safety performance was further reflected in the 22% decrease in the total recordable injury rate.

The Energy Institute provides the secretariat for G+ and facilitates its work programme.

Commenting on the report, Paul Cowling, G+ Chairman and Managing Director Innogy Renewables UK, said: ‘2018 has been a positive year for the G+, as our commitment to improve the health and safety in the offshore wind industry with programmes such as our two yearly Safe By Design workshops, have contributed to our ever improving health and safety performance.’

‘Our efforts continue to reduce injury frequency, further internationalise the G+ and increase collaboration with other organisations, in promoting our shared goal of improving the health and safety performance of the industry on a global level.’

The report outlines that the decrease in total incidents occurred as a result of a number of factors, including an improving safety culture through shared lessons learned, improved industry technologies, a focus of attention across G+ members on high potential hazards and continuous improvement of working methods.

For the first time, the report records incidents by their country of occurrence, enabling country specific feedback. Also published by G+, in collaboration with Dropped Objects Prevention Scheme (DROPS), is the DROPS Reliable Securing Booklet for Offshore Wind, developed with equipment suppliers and users to help eliminate the risk of dropped objects within the sector.

While dropped object incident rates declined in 2018 by over 60% when compared to 2017, 59% of these incidents were classified as high potential by G+, representing an important threat to safety and underlining the need for industry vigilance.

View the 2018 Incident Data Report at energy-inst.org/incidentdata2018

View the G+/DROPS Reliable securing booklet for offshore wind at energy-inst.org/droppedobjects

El Honorary Fellow recognised in Queen’s Birthday Honours

The Rt Hon Professor Charles Hendry HonFEI, former MP and Minister of State for Energy, has been recognised in the Queen’s Birthday Honours list by receiving a Commander of the British Empire (CBE) for services to UK trade and investment.

Charles is former Prime Ministerial Trade Envoy to Azerbaijan, Kazakhstan and Turkmenistan, and former Commissioner for the UK Pavilion at Expo 2017 in Kazakhstan. He is currently the President of the Russia-British Chamber of Commerce Advisory Council.

Read more about the Queen’s Birthday Honours list at www.gov.uk/government/publications/birthday-honours-lists-2019
Artificial intelligence (AI) is making its way into the very real world of local energy grids. A number of organisations are now actively developing smart energy grid systems – often based on, or supported by, machine learning technology. These smart local networks – generally devoted to electricity or heat, and occasionally commercial supply – are often operated in a very efficient manner, helping to minimise costs to consumers or reduce carbon emissions.

So, how do smart energy networks work in practice? And what are the key applications of AI and machine learning technology in smart energy generation, transmission and distribution networks?

Flexible network

In the past, the typical approach adopted by large power generators has been to sell as much electricity as possible, often with little regard to whether or not the energy supplied is wasted – or even used more efficiently – by customers. However, against a background of mounting cost and environmental pressures, a growing number of suppliers are investigating the possibility of deploying smaller, greener systems in an effort to promote better outcomes.

Although generally designed to cater to the specific conditions in a local area, a common theme of many such projects is the use of cutting-edge digital and data-based solutions, as well as AI and machine learning technology. One prominent example is the Finnish energy outfit Lempäälän Energia, which is currently working with Siemens on the LEMENE project – a self-contained smart energy system in the industrial district of Marjamäki, Finland.

A key feature of the novel network approach is that operators entering the industrial district are eligible to join the decentralised energy system and actively participate in the local electricity market. Notably, the ‘intelligent’ LEMENE system is flexible enough to participate in external markets or, if necessary, operate as an autonomous energy island.

According to Lempäälän Energia, the system also guarantees the sufficiency of electric power throughout the year by utilising, among other things, renewable energy sources such as solar power and biogas. In particular, there will be a 4 MW solar power plant, gas engine capacity of 8.1 MW and fuel cell solutions providing a total of 130 kW.

Jussi Maentynen, Head of Product and System Sales – Smart Infrastructure, Finland & Baltics at Siemens, explains that the company’s role in the project is to deliver five smart distribution substations (dubbed ‘e-houses’) made up of medium voltage switchgear, distribution transformers and low voltage boards. The switchgears are equipped with Siemens Siprotec5 protection relays and SICAM substation automation units. The network will be built in ring mode and feature advanced protection units, meaning that any kind of grid failures are solved in a short time, and power to customers is secured. The overall operation of the various energy systems is managed by a SICAM Microgrid controller, which Maentynen describes as a ‘powerful brain’ that is capable of running this complex microgrid made up of different energy production units, as well as different types of consumer, including cold storage, shopping malls and industries.

Test bed

As part of its overarching target of performing in an economically efficient manner, securing power supply 24/7 and keeping sustainability in focus, Maentynen also says that LEMENE will be connected to Fingrid’s demand response markets with Siemens DEMS software. This technology utilises information from the microgrid controller, such as forecasts of power production, but also the expected flexibility.
available from generation and consumption, which can then be sold to yearly or hourly markets. According to Maentynen, most of the systems involved in the project are already undergoing factory testing and all equipment is due to be installed throughout summer 2019. Full system commissioning is then slated for early autumn 2019 – with the full potential and capacity of the LEMENE network to be developed in the months and years to come. As part of this process, the network will also enable the implementation and testing of new technologies, including AI. As this is one of the first grid-scale microgrid projects in Finland, it has required a lot of collaboration between many parties. The LEMENE project is also planned to be a test bed for new solutions in the future, and AI technology could bring new aspects to the operation of the system, Maentynen explains. Although the existing systems and processes are already very highly automated, AI could potentially help grids to become more resilient against potential failures and help microgrids to become more sustainable, he adds.

**Energy Demonstrators**

Elsewhere, the UK government has recently awarded funding to four local energy system demonstrators to focus efforts on how AI or machine learning technologies can best be employed to optimise local systems and develop novel ways of supplying heat, power and mobility. This, as well as to show how new ways of trading supply and demand at a micro-level might work to make better use of the system for everyone.

The initiatives, supported via the government’s Industrial Strategy Challenge Fund, include the Local Energy Oxfordshire (LEO) project, which will showcase a local energy marketplace using new intelligence in the local networks and will be operated by a range of competing market players and suppliers.

As part of the scheme, low carbon energy projects in the surrounding area will be able to integrate operations with the local marketplace – in the process fostering the optimised use of local resources, balancing supply and demand across power, heat and transport and smoothing load on the network through peer-to-peer trading.

A second project, called Superhub Oxford, will demonstrate how stress can be taken away from local networks by enabling access to the national grid system as a means of providing electrical heating to local properties and fast charging for electric vehicle fleets. It will also employ AI-based grid response services through the use of a novel flow battery to create an income stream – in the process helping to facilitate an investable business model.

Meanwhile, in the far north of the UK, the ReFLEX Orkney scheme aims to demonstrate how a system generating excess renewable energy output can be optimised at a local level. In doing so, the project team will install an AI-based virtual energy system platform to optimise supply and demand across heat, power and mobility. This will be achieved, so the scheme’s operators say, through micro-trading of the flexibility available in heat pumps, heat storage, batteries, electric vehicle charging and hydrogen production for ferries and buses across Orkney.

**Artificial intelligence**

For Professor Stephen McArthur, Head of the Institute for Energy and Environment at the University of Strathclyde, the key to understanding applications of AI in energy systems is to picture the technology as a collection of different algorithms and approaches that attempt to mimic human-like intelligence to solve a range of problems.

McArthur claims that machine learning – a branch of AI based around the idea that systems can learn from data and identify patterns – will be particularly valuable in the energy sector. The technology will likely be able to help network controllers to improve maintenance procedures and enable the timely replacement of critical and expensive equipment – by increasing the ability to predict failures, anticipate faults and accurately estimate remaining useful life. Generally speaking, this can be achieved by using machine learning and statistical analysis of the increasing volume of monitoring data being gathered from plant items across the industry.

According to McArthur – who has been deploying AI solutions in the energy space for 25 years – machine learning can also be harnessed for transmission and distribution operation. This is chiefly because of the increasing volume of network monitoring, from power quality monitoring devices, active network management schemes and phasor measurements. ‘We can learn examples of situations where either faults can occur, power quality can be reduced, or constraints on the network are breached. This would allow corrective control action to be taken under these circumstances,’ he explains.

‘This leads into the next area of AI that is important – distributed intelligence and autonomous control. Once we have data, and analytics that extract what we need from it, we can start to make improved control decisions,’ McArthur adds.

**Managing real-time complexity**

Although the drive towards active network management has already started, McArthur predicts that the real-time complexity created as we add electric vehicles and home energy systems into the mix can also be tackled through AI decision making and optimisation algorithms.

In his view, this function will become increasingly important as distribution network operators become distribution system operators and, in the context of projects such as LEO, could then be extended to decision making across multiple energy vectors. ‘We can take all of the layered data, machine learning and AI-based decision making outlined above and ultimately deploy analogous concepts inside the home, or a community or local energy system,’ he says.

In the coming years, McArthur believes that one of the main challenges to implementing smart energy networks is that energy companies do not, traditionally, have the skills and experience to deploy the software and control advances coming from AI innovations. This is coupled with the fact that there is a significant journey between proving that AI works in principle and embedding a solution in a business-as-usual context.

‘Also, it is an iterative journey of deployment, evaluation and improvement. This requires not just AI innovation, but data engineering, software engineering, commissioning and so on. McArthur says. ‘The energy sector does not have large groups with these skills and abilities. Some are starting to build them, but it is an added cost on top of the key technical staff they need for their day to day operation.’

Andrew Williams is a freelance writer.
GRID CONNECTIONS

Work needed to complete Europe’s grid harmonisation

I n March, the European Parliament approved new EU-wide electricity market rules designed to increase consumer choice, boost access to renewables and cap power subsidies. This package of legislation has since been hailed by the European Commission as a new dawn in the creation of the bloc’s much-vaunted Energy Union.

While the rules are significant — and they remove administrative and legal barriers between the national power systems and markets of the 28 EU member states — they do not ultimately create the seamless electricity system that the Commission wants. For this to happen, more work is required to forge these countries’ national grids into one unified system, with pinch-points between national borders removed so that power can flow more freely in technical and capacity terms.

Synchronising Europe

As for the technical synchronisation of European grids, an important step was taken in May, when the European Network of Transmission System Operators (ENTSO-E) announced that an agreement was now in force to allow the grids of Estonia, Latvia and Lithuania to operate under the same technical standards as 26 countries elsewhere in continental Europe, which form Europe’s largest grid bloc. The Baltic states want this integration to happen by 2025.

As it stands, their grids are part of the post-Soviet BRELL system, which also includes Russia and Belarus, making them dependent on a control centre in Moscow and supplies from the Russian electricity system.

The Baltics, all part of the EU since 2004, have already taken steps to link their grids with their fellow member states, with asynchronous connections through the LitPol Link between Lithuania and Poland; the NordBalt link between Lithuania and Sweden; and Estlink 1 and 2.

between Estonia and Finland.

Studies and plans are being developed to ensure enough power interconnections are in place to make this change a success, and that includes shoring up the effectiveness of existing links with Russia and Belarus. A special consideration is Kaliningrad, the Russian exclave bordering Poland and Lithuania, whose grid is currently synchronised with Lithuania’s, a situation that would change from 2025. An ENTSO-E note said a possible AC or modern HVDC interconnection between Kaliningrad and Poland is to be investigated, which would boost power stability in the region.

The move would expand Europe’s dominant continental power grid regional group. Ukraine and Moldova are currently working to synchronise their grid with the technical standards of the 26-strong bloc — and there are additional plans to link it to the grids of Libya, Egypt, Jordan, Lebanon and Syria. But outliers remain. Britain — whose status as a future EU member state remains uncertain — operates its own grid that is not synchronised with the continent, although it has significant, and ever-expanding, interconnectors.

On 31 January, a new 1 GW interconnector with Belgium came online, following a 1 GW connection launched in 2012 with the Netherlands and an older 2 GW link with France. There is also a 1 GW connector with Northern Ireland, which operates its own independent grid with the Republic of Ireland.

Also, a separate Nordic group of synchronised grids covers Finland, Sweden, Norway and the island portion of Denmark (including Copenhagen). Meanwhile, Cyprus and Iceland remain electrical as well as geographical islands, though Malta has an interconnector to Sicily.

Peak demand

However, the key investments underway that will make this network of power connections work are in capacity. The European Commission has long-standing targets to ensure that EU member states have interconnectors to other countries that can supply 10% of peak demand by 2020 and has added a new target of 15% by 2030.

In a November 2017 policy paper, the Commission admitted that many member states had work to do if they wanted to hit those targets. Of these, it stated Britain, Spain, Poland (and predictably Cyprus), would miss the target by 2020 – although Bulgaria, Germany, France, Ireland, Italy, Portugal and Romania, while below 10% in 2017, would likely deliver. All these countries would have additional work to do if they wanted to meet the 15% goal.

While some nations have significantly higher interconnection rates already (for instance Lithuania’s 88%, Luxembourg’s 109% and Slovenia’s 84%), the EU has continued to invest in and promote infrastructure developments that boost cross-border transmission capacity.

A key method for achieving this is through the EU’s Projects of Common Interest (PCIs) programme, the named developments of which currently have access to €5.4bn from the EU’s Connecting Europe Facility (CEF). This fund, which is designed to encourage private investors to sink cash in alongside public money, will be renewed with
The 26 - Europe’s dominant continental power grid regional group

Albania, Austria, Belgium, Bosnia & Herzegovina, Bulgaria, the Czech Republic, Croatia, peninsular Denmark, France, Germany, Greece, Hungary, Italy, Luxembourg, Montenegro, the Netherlands, North Macedonia, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Switzerland and Turkey

Iceland is listed, which is the subject of ongoing consultations between the two governments and anticipated recommendations from a UK-Iceland energy taskforce. Iceland remains outside the EU, but as a member of the European Economic Area (EEA), can participate in the CEF.

Smart grids
As for the smart grid projects – which have been subject to a separate consultation – the new draft list includes using smart grid technologies to bring greater efficiency to the power interconnections between Croatia and Slovenia, including the 400 kV TESLA loop, which links to other European countries. The problem is that power connections between Croatia and Slovenia were built when they were both part of Yugoslavia and were not designed to be operated by two national transmission groups.

While they have collaborated closely since securing independence in the 1990s, they have decided that smart grid tech will help them handle this power transfer work more efficiently, notably by tackling overvoltage problems.

Another smart grid project listed also suggests using new tech to improve interconnection collaboration – in this case between Czech Republic and Slovakia – both part of Czechoslovakia until 1993. A smart grid project listed called Danube InGrid would bring new tech to power exchanges between Slovakia and Hungary. And a smart energy data project called Data Bridge would exchange electricity information between Estonia, Latvia, Lithuania, Denmark and France.

As can be expected, the costs of these projects, especially collated, are high. The total projected investments going forward from 2017 for 105 electricity-focused EU Projects of Common Interest, as estimated by the EU Agency for the Cooperation of Energy Regulators (ACER), was over €49bn.

Looking ahead, ENTSO-E is laying the technical and regulatory groundwork for closer integration of European national grids, notably leveraging these new connections to create a predictable market in energy transfers. This work implements EU regulation 2017/2015 on electricity balancing, which mandated an EU-wide set of technical, operational and market rules to govern these cross-border electricity sales.

Even within synchronised grids, clear technical rules and procedures are needed to ensure that predictable amounts of electricity are available when it is needed and can be delivered in an efficient and effective manner. As a result, ENTSO-E has released more detailed guidance for consultation, including on how bids to offer balancing power capacity must be framed and submitted, with a goal of releasing final rules by December.

Frequency limits
The importance of ensuring that this technical harmonisation and capacity augmentation was highlighted by an incident on 10 January, when the frequency of power supplied via the continental Europe grid dropped to 49.8 Hz from its standard 50 Hz. While that might not sound like much, this was the largest deviation since a fall to 49 Hz in 2006. Should this regional grid’s frequency drop to 47.5 Hz (or rise to 51.5 Hz) all connected generation and devices would automatically disconnect – causing major supply disruptions.

In this case, said an ENTSO-E note, reserves from across Europe were quickly tapped and some industrial customers in France lost supplies (they had contracts allowing this to happen), bringing the frequency back up to normal levels. It had been caused in part by problems affecting four interconnectors between Germany and Austria.

Commenting in Brussels in May on the importance of solidifying Europe’s collective grid, Laurent Schmitt, ENTSO-E secretary general, said: “The next energy system will be one of innovation to connect physical infrastructures across sectors, geographies, communities and consumers to ensure alignment of physical constraints with real-time market transactions. Grid operators are key in enabling this transformation towards a system of systems that keeps the lights on at least possible cost for customers while mitigating climate change.”
How to achieve more resilient power systems

There is tremendous growth in renewables plus storage energy systems, particularly for islands and microgrids, around the world. But it’s the software controlling the system that is really key, writes Risto Paldanius.

Modern grid challenges must be met and resolved with modern grid technologies. This simple statement is incredibly complex to put into practice, given the hurdles that system operators, power producers and the wider electricity industry are facing. Our energy systems must be upgraded to ensure resilience and reliability and to save energy and costs, but there are clear challenges in doing so.

Full, 100% renewable energy goals are being established by regions, states and countries at a rapid pace worldwide, putting further pressure on stakeholders to reassess our current energy systems. Utilities are integral for meeting these ambitious targets. Fortunately, there are strategies and technologies that can address barriers and make modern, resilient, 100% renewable energy systems a reality.

Greensmith Energy has deployed over 70 grid-scale energy systems across nine countries, and now that we’re integrated within Wärtsilä’s operations, we’re accelerating our reach into an expanding global market. Our GEMS software for energy management and storage systems is helping utilities navigate market uncertainty and reach clean energy targets. From our work in the field, we’ve identified a number of challenges the industry is facing, along with best practices and real-world projects that offer insight for the path forward.

Energy management as well as batteries

The energy storage market has experienced explosive growth in recent years, largely due to the falling costs of batteries and innovative ways of deployment. Analysis of the levelised cost of energy (LCOE) by Lazar indicates that energy storage costs have declined by 74% since 2013 and are projected to continue a steady 8% decline per year through the mid-2020s. Experts anticipate this level of growth will continue over the next few decades, bolstered by $620bn in new energy storage investments by the year 2040.

These trends are heartening because falling prices will be a significant factor in driving energy storage adoption at scale, but the impressive investments cannot go to batteries alone. Energy management software technology is also necessary for efficient and effective hybrid systems and can help energy producers offset the need to build new fossil-intensive infrastructure.

In order to achieve our energy storage objectives (lower costs and emissions, easy integration with existing systems), energy management software platforms that enable revenues from multiple applications, while monitoring and optimising hybrid systems, are an essential part of the solution. The consensus among utilities, installers and other industry players about the importance of incorporating smart systems to manage hybrid grids is captured by one expert noting that: ‘Solar only goes so far, solar-plus-storage goes much further and solar-plus-storage plus smart devices goes even further.’ This sentiment applies equally, if not more, to hybrid systems that include thermal, renewable and storage assets.

Upgrading aging infrastructure

Grid operators and managers understand that existing infrastructure will not run effectively or efficiently forever, and that replacement resources need to be cost-effective while decreasing reliance on fossil fuels. Any new additions or replacements must also be integrated within existing systems without interrupting operations.

Taking a phased approach is one solution – adding new technologies and generation assets in steps can alleviate cost concerns and still meet near and long-term grid needs. An active Wärtsilä project on the Caribbean island of Bonaire is a proof point for how this approach can work – see box: Bonaire.

Adopting new technologies

Grid-scale battery storage has the potential to completely overhaul our current energy systems. Significant technical advancements have been made in recent years, and vendors tend to roll out new energy storage products every 12-18 months. These constant technology

Bonaire

At the beginning of 2018, Wärtsilä and ContourGlobal Bonaire were awarded an integrated 6 MW/6MWh energy storage project contract for the Caribbean island of Bonaire. The engineering, procurement, and construction hybrid energy project includes both the hardware (batteries and inverters) as well as GEMS, the AI-powered software platform that monitors, controls and optimises hybrid energy systems.

The energy storage system will enable Bonaire, part of the Netherlands Antilles, to increase its use of wind and solar resources and will integrate multiple generation assets, including all of the island’s existing power generation assets, energy storage, wind and solar. A phased approach allows time for system operators to add new hybrid solutions, spread out costs, and leaves room for new technologies to come online. This addresses cost concerns and means that the system can continue to operate as efficiencies are improved through new additions.

For Bonaire, Phase One involves GEMS managing and optimising the operation of all existing generation assets on the island, reducing the need to curtail abundant wind resources. With Phase One now complete, the project has increased dramatically, putting the island back on the path to achieving its ambitious renewable energy targets – goals that were put in place when a diesel power plant was destroyed in a fire in 2004. The ability to now balance and seamlessly switch between thermal, wind and energy storage assets has already increased grid stability and renewable penetration, and offset diesel engine constraints.
improvements present some uncharted territory, but also opportunities for early adopters. A large number of these systems have been operated as pilot projects to test applications, rather than running as full-scale mission-critical resources. Innovative technologies are always going to feel more risky for stakeholders, but they are key to helping the power sector modernise and can be adopted with confidence if certain parameters are met. Stakeholders can help to future proof energy storage and management systems through a three-step process:

• installing a flexible controls architecture;
• planning the right approach to augment battery capacity; and
• tracking ongoing operation with a flexible warranty.

There is a lingering concern that continued innovation in the energy sector will mean today’s battery technologies could become stranded assets in the future. We take a future-proofing approach to projects with the GEMS platform to ensure that the storage and integration investments made today continue to optimise value and performance in the future.

Addressing intermittency

The sun doesn’t always shine and the wind doesn’t always blow – this is an argument that has been made countless times both within and outside of the industry. And yes, even with impressive technology developments over the last decade or so, we have yet to develop a resource that can actually control the weather. This means renewable energy intermittency is important to address for every type of grid. Islands are especially vulnerable to blackouts and often rely on expensive fossil fuel imports to maintain reliability, which is why they have emerged as innovators in developing systems that address intermittency issues. The island of Graciosa is another case study, that shows how energy storage and integrated software controls can modernise a system, with lessons that can also be applied to mainland systems – see box: Graciosa.

Risto Paldanius is with Greensmith Energy, a Wärtsilä company.

ESOS CPD Training Package

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Module 4: Energy Saving - Motors and Drives
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For more info, please visit:
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ESOS Toolkit

This toolkit can be used by Lead Assessors working on an in-house or consultancy basis or by others undertaking ESOS work.

Graciosa

Graciolica Lda and Greensmith Energy are developing an integrated power system on the island of Graciosa in the Azores, off the coast of Portugal. In order to take a hybrid approach to island grid energy generation – combining wind, solar, energy storage and thermal generation – each component of the system must function at its best. The GEMS platform works as the system optimiser to monitor and control resources. The hybrid system will use Graciosa’s abundant renewable energy resources to their greatest potential.

Once complete, the Graciosa Hybrid Renewable Power Plant will include 1 MW of solar and 4.5 MW of wind power, together with 6 MW/3.2 MWh of energy storage. GEMS software will manage the plant, automatically optimising energy generation based on load patterns and weather forecasts, increasing the use of renewable energy while improving the reliability of the island grid.

The project will reduce the island’s reliance on petroleum imports and significantly decrease greenhouse gas emissions. The local utility EDA anticipates the project will boost renewable energy consumption from 15% to 65% once the plant is fully operational, and eliminate the need for 17,000 litres of diesel per month.
Will the UK really go ‘net zero’ by 2050?

Reaching net zero emissions by the middle of this century will require serious investment in both R&D and behaviour change – but getting policymakers to commit could be the biggest challenge of all. Jennifer Johnson reports.

In the final weeks of her premiership, Theresa May sought to establish a legacy beyond Brexit and enshrined a significant carbon reduction promise into UK law. Now, in line with the recommendations issued in May by the Committee on Climate Change (CCC), the country will pursue a target of net zero greenhouse gas (GHG) emissions by 2050. The legislation comes in the form of an amendment to the Climate Change Act of 2008 and was introduced in Parliament on 12 June.

While no other member of the G7 group of industrialised nations has set a target this ambitious, environmental groups have warned there are critical loopholes in the UK’s plan for decarbonisation. Namely, the fact that it allows for the potential use of international carbon credits to get to net zero by mid-century. At an energy policy debate hosted by the EI on 22 May, Chris Stark, Chief Executive of the CCC, stated that these tactics should be used only as a last-ditch resort.

‘We think it is sensible, and indeed necessary, for the UK to reach net zero through domestic effort,’ he said. ‘We should only use these international carbon credits as a fallback – and the main reason for this is that they’re really expensive. If the world is doing what it needs to do to correct climate change, there won’t be many of these credits around.’

However: ‘Using international credits within an appropriate monitoring, reporting and verification framework is the right thing to do for the planet, allowing the UK to maximise the value of each pound spent on climate change mitigation,’ said a statement from Downing Street.

Policy pushback

The Prime Minister’s net zero announcement comes at a time of growing public awareness of the urgency of climate change. Protesters from the activist group Extinction Rebellion famously blockaded major roads across London during the Easter period – leading to thousands of arrests and widespread disruption in the city. Millions of children have also walked out of classrooms across the world as part of the school strike for climate movement, which was started in August by Swedish teenager Greta Thunberg.

Despite this momentum, the government has recently been toying around with its longstanding climate commitments. In fact, in early June, ministers decided to use the UK’s past overperformance in emissions reductions to relax agreed emissions limits up to 2027. Over the course of the country’s second carbon budget period set by the CCC – which stretched from 2013 to 2017 – the UK emitted 384mn tonnes of carbon dioxide (CO2) less than its stated cap of 2,782mn tonnes.

The Chancellor of the Exchequer subsequently requested that 88mn tonnes of the remainder is carried forward so that the country can breach future carbon budget limits in line with projected economic growth.

Granted, the UK outperformed on its first carbon budget, which was in place between 2008 and 2012, as well as its second. At present, it’s on track to roughly align with the third (2018–2022) but is likely to miss its fourth and fifth targets, according to projections from the Department for Business, Energy and Industrial
Strategy (BEIS). This has serious implications for being able to reach net zero emissions by the middle of the century.

**What will it take?**

In its report, the CCC states that it will be ‘technically feasible but highly challenging’ to realise its zero-GHG ambitions by 2050. Reaching such a large-scale target is contingent upon the creation of a long-term policy framework that facilitates change across all sectors of the economy. It’s also dependent upon the deployment of low carbon technologies, some of which are still very costly or in early-stage development.

The CCC splits decarbonisation methods into three groups: core options, further ambition options and speculative options. The first category is made up of so-called ‘low cost, low regret’ technologies and strategies that would most likely have been used to meet the UK’s previous 80% decarbonisation-by-2050 target.

The further ambition options include carbon capture and storage (CCS) in industry, as well as an expanded use of heat pumps and hydrogen for domestic heating. This scenario will also require all cars and vans to be electric by 2050, and for the majority of heavy goods vehicles to be electric or hydrogen powered.

But these two categories are not enough, and some speculative technologies will likely be deployed to reach net zero by 2050. According to the CCC report, the combination of core and further ambition options will lead to a 96% reduction in GHG emissions – meaning that some savings will be needed from as-yet-undeveloped options.

These could include more radical shifts in land use; the extensive use of emerging technologies to remove CO2 from the air and store it underground; or the use of carbon-neutral synthetic fuels produced using algae or renewable power. However, the CCC says that the 4% gap to net zero could also be reached with the deeper rollout of further ambition options.

‘What we said is that now is the right time to set that net zero target and, crucially, that it’s technically possible to do that now with existing technologies and existing consumer behaviour,’ said Stark.

**Zero carbon heating**

Decarbonising heat for the UK’s buildings will be one of the biggest challenges in achieving net zero emissions. Currently, around 75% of the country’s heating demand is met by natural gas, with 8% from oil and the rest from electricity. The deployment of the CCC’s ‘further ambition’ options for heating would result in 4mn tonnes of CO2 emissions in 2050 – and requires the rollout of technologies including heat pumps, hybrid heat pumps and district heating in conjunction with hydrogen, as well as improved levels of energy efficiency.

While it’s long been suggested that gas boilers could be replaced with hydrogen alternatives, the switchover would require an expensive and comprehensive infrastructure overhaul. Regardless, the CCC recommends that by 2035, almost all replacement heating systems for existing homes should be low carbon or hydrogen ready. To align with zero-emission ambitions, the country’s share of low carbon heating must increase from just 4.5% today to 90% in 2050. However, most hydrogen is currently produced via the process of steam-methane reforming, which creates hydrogen and, more problematically, CO2.

**Capturing carbon**

If hydrogen is going to be one part of the UK’s route to net zero, CCS must also be used to clean up its environmental footprint. It has also been suggested that carbon capture could be deployed to clean up heavy industrial processes that will prove difficult to electrify with renewable power. In a separate report on hydrogen published late last year, the CCC recommended that significant volumes of the gas should be produced in ‘clusters’ by 2030 to help the sector scale up.

‘We need CCS for all sorts of reasons, but basically it gives us options,’ Stark told attendees at the energy policy debate. ‘It opens up the option of hydrogen, for example, and it allows us to look at how we can decarbonise industry. CCS is a necessary precondition of the kind of transition that we’re talking about in our net zero report.’

As of 2018, only 18 large-scale CCS facilities were in operation around the world – with an additional 25 under development. Previous efforts to build a carbon capture facility in the UK have floundered due to a lack of funding and policy support. But a newly-announced venture in the north of England could set a different precedent. In late May, Drax Group, Equinor and National Grid Ventures announced they’d agreed to work together to see how a carbon capture, usage and storage (CCUS) network, and a hydrogen production facility, could be built in the Humber in the mid-2020s.

While the companies have revealed little in the way of concrete details, they have vowed to explore the opportunity to scale up the existing bioenergy carbon capture and storage (BECCS) pilot at Drax Power Station. They’ve also said they will look toward the potential development of a large-scale hydrogen demonstrator within the Drax site by the mid-2020s.

According to a statement from Drax, the partnership ‘could lead to the Humber becoming the world’s first net zero carbon region and home to a new world leading hydrogen economy.’

**Pricing it up**

The CCC expects that a net-zero GHG target can be met with an annual resource cost of up to 1–2% of GDP to 2050. This is the same cost as the previous expectation for an 80% reduction from 1990. However, some officials appear to be hesitant about allocating significant sums of government money to the energy transition.

In a recent letter to Theresa May seen by the Financial Times, Chancellor Phillip Hammond warned that cutting emissions to net zero by 2050 will cost the UK more than £1tn.

According to Hammond, this means that less money would therefore be available for other areas of public spending, such as schools, police forces and hospitals. The CCC has estimated that reaching net zero could cost £50bn per year, while BEIS has put the figure at £70bn.

Now, the government must determine the price of global climate leadership – and whether it’s willing to pay the bill in the long term. And with three decades to go, successive governments will also have to make net zero a priority. This isn’t just a matter of domestic spending – it’s an issue of global leadership.

‘The richer developed countries need to go further and faster and quicker,’ Stark emphasised. ‘And if we do that, there is at least a chance that we can meet the IPCC’s temperature threshold of 1.5°C, as difficult as that may be.’
Brexit rises to the top of member concerns

The EI’s Energy Barometer 2019 was launched on 20 June, gauging the views of over 470 UK energy professionals from the institute’s membership.

The 2019 edition of the Barometer is the fifth in a series of publications designed to enhance the role of energy professionals and their expertise in the public debate about energy. This year’s report covers views on energy policy, investment, prices and emissions targets, as well as introducing new sections focusing on flexibility, digitalisation and domestic consumers. After collecting data over five years, the EI Knowledge Service has also been able to highlight trends in the opinions of energy professionals, adding a new layer of depth to the analysis.

Brexit limits bandwidth
Brexit has risen to become the biggest challenge facing the energy industry, according to EI members. Despite the UK voting to leave the European Union three years ago, the process remains mired in uncertainty and has been delayed amid parliamentary deadlock.

EI members consider political machinations in general to be a challenge for the energy industry; they worry that the public mistrusts government and lack confidence in the political system in general. Politicians must find a way to balance the immediate needs of constituents while working with industry to develop a robust, long-term energy strategy.

Brexit was frequently mentioned in conjunction with perennial concerns about energy policy, markets, economics and competition, as well as security of supply and the risks around investing in new energy infrastructure. Those surveyed are concerned that government focus on Brexit has reduced the time and effort dedicated to tackling fuel poverty, building efficiency and replacing ageing infrastructure. This is despite an update to the Clean Growth Strategy and the release of nuclear and offshore wind sector deals over the past year.

Policy, investment and emissions targets
As seen in previous years, EI members hail energy efficiency as an effective, cheap and low-risk method to aid in the decarbonisation of the UK economy. In addition, renewable electricity (particularly offshore wind) is supported as a positive measure to reach emissions targets at least cost.

The current investment climate and energy policies are considered supportive for energy efficiency and increasingly favourable for renewables, contrasting with the delivery of new nuclear stations and carbon capture, usage and storage (CCUS) technology. The pessimism surrounding nuclear may be linked to the closure or suspension of several UK nuclear projects over the past year, including newbuilds at Wyfla and Oldbury.

There has been a steady increase in optimism since 2015 that the UK can meet its long-term emissions reductions goals. Falling costs of low carbon technologies are seen as a main driver towards a sustainable, low carbon economy. However, there remains work to be done in decarbonising heat and transport, and EI members are divided about the economic impact of striving for net-zero emissions by 2050.

Flexibility, digitalisation and the role of domestic consumers
Flexibility is an increasingly important part of the UK energy network, enabled by improved storage and demand-side response. Energy professionals see strong growth potential in battery storage and encourage incentivisation of further flexibility development; however, they recognise that this is dependent on political will.

Many EI members are digitalising their operations and indicate that digitalisation could allow for improved integration of intermittent renewables on the grid. This may prove to be key if the mass electrification of heat and transport is relied upon for reducing carbon emissions. EI Associate Members – those in the first five years of their careers – are much more likely to have embraced digitalisation than older, more experienced Fellows.

Over half of those surveyed flagged up increasing public awareness and pressure as a driver of decarbonisation. Nevertheless, EI members think that UK domestic energy consumers strongly prioritise low bills over ensuring their energy is low carbon, calling into question how energy providers can incentivise their customers to contribute to decarbonisation. There is scepticism that new benefits in the energy system will be passed on to consumers – instead, energy service providers and third parties are expected to benefit the most from the data revolution.

Barometer goes digital
This year, the Energy Barometer is making the jump to a digital format and will be primarily accessible as an online report. This new format allows for a more dynamic report, including video content, interactive graphs and the ability to explore five years’ worth of data.

The report launched against the backdrop of the UK government declaring a ‘climate emergency’ and the recent Committee on Climate Change report recommending an increase in the pace of decarbonisation by cutting net UK greenhouse gas emissions to zero by 2050. It is more vital now than ever that government, industry and policymakers utilise the wealth of experience and expertise that EI members provide through the Energy Barometer.

For the full report, media coverage and other EI policy engagement activities, visit energyinst.org/barometer
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Developing a smart grid for a low carbon Ireland

As it stands, Ireland is not on course to meet its mandatory emissions reduction and renewable energy targets for 2020. In order to align with European directives for carbon emissions, the country needs to address this key issue—and quickly.

Thankfully, there is a significant consensus among Irish citizens and stakeholders on the importance of transitioning to a low carbon economy, and the government appears equally committed to this transformation. The country is now aiming to get back on course with its mandatory emissions and renewable energy targets through a process of technological advancement.

The Dingle Peninsula, on Ireland’s west coast, has been selected to be a test bed for this new era of green electrification.

A new initiative in the region is currently exploring how a ‘smart’ grid could integrate within the local community—setting a precedent for the rest of the country.

Rural innovation

Dingle—a rural community of approximately 11,500 people—is an ideal place to try out new energy ideas as it’s isolated from a major population centre. The Peninsula is also representative of the highly dispersed population of Ireland, with an economy primarily based on tourism and agriculture.

Using this as the basis, the Dingle Hub, a local enterprise centre, spearheaded the ‘Transition Dingle Peninsula 2030’ (TDP) project. In turn, the Electricity Supply Board (ESB) of Ireland has implemented the ‘ESB Network Dingle Plan’ in co-ordination with the TDP. This project will investigate how Ireland can transition to a low carbon energy system while supplying affordable green energy to homes and businesses.

To date, the ESB has rolled out small numbers of community solar schemes, controllable e-car charge points, battery storage options and electric heating solutions, among other efforts.

These varied projects have initially been implemented on a small scale through the use of community ambassadors, who test...
out expensive new technologies at a relatively minimal cost to themselves. This approach also allows energy providers and technology companies to study how these technologies are used in practice and gauge the extent of uptake within the community.

Cutting emissions
Agriculture is the dominant economic activity in Ireland, and thus on the Dingle Peninsula, and currently accounts for 33% of the country’s total greenhouse gas (GHG) emissions. A reduction in agricultural emissions would significantly help Ireland meet its GHG goals and to achieve rapid decarbonisation. Therefore, the Dingle TDP has begun the process of developing biomethane capture technology in cooperation with Gas Networks Ireland to not only reduce GHG emissions from the sector but also provide a stable supply of gas for the network.

Ireland’s gas supply has three points of entry. The Corrib gas field supplies 60% of the country’s gas demand, the Kinsale gas field supplies 5% and two interconnectors to the UK provide the remaining 35%. It’s unlikely that a new gas supply will be developed before 2030.

Biogas from renewable sources has the potential to supply up to 20% of Ireland’s gas demand. In 2017, Ireland had the highest potential for biogas production per capita in Europe and could, in theory, achieve total production of 13 TWh per year by 2030. The TDP will provide a framework for expanding development and the study of distribution of injection points.

Along with helping to encourage the advancement of the programme, the TDP will also look into challenges in planning and permitting anaerobic digesters. It will also explore issues with public acceptance, scale and cost of infrastructure, as well as gas quality control. Through its combined approach – working ‘top down’ with energy providers as well as ‘bottom up’ with public working groups and community engagement – the TDP’s plan allows stakeholders to symbiotically achieve their goals and outcomes.

The success of these initiatives will not only be determined by technological advancement, but by the take-up of clean energy technologies by the community. Ultimately, the initiatives in Dingle will create a better environment both ecologically and socially, where qualified graduates can find local employment in a thriving and innovative energy sector.

Meanwhile, the peninsula’s future energy, housing agricultural and transport needs will be met through efficient, low carbon solutions.

John O’Brien is a Senior Financial Analyst with ElectroRoute and the Chair of the Republic of Ireland YPN.

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Agriculture is the dominant economic activity in Ireland, and thus on the Dingle Peninsula, and currently accounts for 33% of the country’s total greenhouse gas emissions.
Flexible power purchasing with storage

How about buying renewables and operating your own energy storage facility? Here, Scott McGregor suggests that businesses can navigate volatile energy markets with innovative power purchase strategies.

We’re only halfway through, but already 2019 can be seen as a transformative year for the UK energy sector, and cost-saving, low carbon energy supply options have never been more abundant.

It has been a big year for clean energy. Buoyant carbon prices in the EU Emissions Trading Scheme are squeezing carbon intensive energy providers’ margins and a number of aggressive decarbonisation measures are on the horizon. The Committee on Climate Change (CCC) recommended a net-zero emissions target for the UK by 2050 and the government moved to adopt the target.

The rapidly declining cost of renewable generation is now demonstrably pushing conventional thermal generation out of the UK supply stack and opening up a whole host of new business models based on commercial energy users generating, storing and using their own self-generated renewable energy.

Solar and onshore wind are already among the cheapest forms of energy generation in this country and market forces are pushing businesses to adopt flexible, decentralised assets that can capitalise on increasingly volatile wholesale energy markets.

Today, a third of UK business are generating their own power – we’re entering the age of the commercial energy ‘prosumer’.

Solar generation with battery storage

Power purchase options

Solar and wind power purchase agreements (PPAs) have been around for some time now and have been instrumental in driving the development of renewable energy projects. Lightsource BP announced recently that it was going to deploy more than 300 MW of utility-scale solar farms backed by PPAs in the UK, and momentum is picking up again after a few years of slowing down.

Behind-the-meter PPAs are being explored by many commercial businesses to lock in prices and reduce their exposure to high commercial energy costs by allowing firms to buy the energy generated by their financed renewables for a fixed cost per unit.

However, solar-only PPAs such as these only guarantee your prices whilst the panels are generating. Excess solar and wind generation is creating volatility – increasingly pushing the price of electricity down towards zero during the daytime, due to oversupply, and pushing up prices during evening peaks when solar generation is low. This could result in a commercial business locking in prices over the long term which are above daytime wholesale rates and remain exposed to peak evening prices.

So how do businesses access cheap renewable generation without becoming exposed to volatility? The key is integrating heavy cycling energy storage into the PPA offering, enabling firms to install 2–3 times as much renewables as before and increase its use by storing excess generation during daytime (when wholesale prices are relatively low) and using it at peak times (when wholesale prices are higher).

This new form of integrated solar + storage PPA gives customers a 24/7 offering, backed by their own solar generation and certified green power from the wholesale market, made possible by utilising their own energy storage infrastructure installed on-site. This new PPA model gives firms the ability to lock in their prices for 25 years with 100% renewable energy, whilst reducing their exposure to volatility and gaining certainty in a constantly evolving market.

Shifting energy landscapes

An Economist Intelligence Unit survey at the end of 2018 surveyed 450 senior executives from energy-intensive industries, including manufacturing, transport and logistics, hospitality and retail, and found that there’s a profound shift taking place in the energy market.

A third of companies are already producing at least some of their own electricity through on-site generation. Businesses in the retail sector are well ahead of the trend, with almost 40% generating their own energy, the majority opting for solar.

The survey also found that more than two-thirds of companies are investigating ways to increase the amount of electricity they generate on-site – and the driver for this ambition was down to cost as much as climate. For many companies, particularly in energy-intensive industries, it makes good business sense to generate at least some of their own energy.

Volatility in the wholesale energy market has become a fact of life which is here to stay. However, large energy users need to start seeing volatility as an opportunity more than a threat. Flexible energy storage infrastructure enables companies to take control of their energy procurement, avoiding the highs and targeting the lows in
energy pricing throughout the day. Real value can be found in enabling commercial and industrial-scale energy users to take far greater control of their energy procurement strategies to benefit from price volatility. This translates into large cost savings at low risk for businesses where electricity costs make up a significant proportion of their operating costs.

Out with the old
The energy sector is undergoing a fundamental change. As more renewable generation comes onto the grid, we anticipate the wholesale price of energy will regularly fall to or below zero for large parts of the day by 2030. The prospect of these changes can be daunting for businesses, but it is also an opportunity to capitalise on first mover advantage to emerge with serious cost savings by innovating through the use of flexible power purchase options that are now coming online.

Businesses are rushing to drive down costs by generating energy on-site. Large-scale renewables and energy storage have reached a tipping point of commercial viability in the UK to the extent that businesses can hedge their energy supply against rising prices and take advantage of increasingly volatile markets with the combination of renewables and ‘proper’ energy storage.

With volatility set to increase in coming years as energy markets adapt to the low carbon energy transition, a flexible PPA with integrated energy storage is one attractive option for businesses that want to ensure full control of energy purchase, whatever the weather.

Scott McGregor is the CEO of redT. In March, Statkraft and UK-based energy storage company, redT energy, launched the country’s first integrated solar and storage product, fully financed under a PPA model. Designed specifically for UK commercial and industrial energy users, the supply secures low-risk, long-term savings and hedges against rising commercial energy prices. The solution enables UK corporates to save on energy bills annually for the next 25 years with no upfront costs, and to switch to 100% renewable energy supply. By integrating energy storage, firms can store excess generation and install and use up to three times more solar per site as a result, says redT.
Purchasing strategies for business – understand risk and complexity

Skilful energy purchasing can be difficult. Buyers need to assess risk, obtain good advice and benchmark their performance, as Robin Hale and Don McGarrigle write.

For some of us, the energy market is quite new. Others that have remained active in the market for two or three decades will remember who Sid was, when the ‘pool’ was formed and when complexity meant Excel spreadsheets. Some things don’t change over time, but for many navigating electricity and gas tenders for their organisation, the perfect contract is seen as a ‘holy grail’ – something that remains always just out of reach.

Getting it right is never about just a one-shot deal, and good terms on one contract don’t necessarily equate to the same next time round. Understanding the market, regulatory changes, supply constraints, outages, delivery and political and economic viewpoints have become an important part of gauging the risk.

Ask yourself how up-to-date you are with topics such as:

- How will the Targeted Charging Review impact on price?
- What will happen to Triads?
- How will the focus on renewable technologies and the move away from fossil fuel generation impact over the next decade?
- What’s the future for LNG?
- What about Interconnector flows?

Not forgetting Brexit and a possible general election.

Trying to soak up all this information is tantamount to wanting to find a padded cell. There are always surprises beyond your control and not everything reacts to supply and demand or as per economic predictions.

Appetite for risk

So, what should your strategy be? This all comes down to your appetite for risk. Whenever you lock-out a contract you are embracing risk, as you cannot predict with complete certainty what the future will do. Whether your risk strategy is to embrace a three-year fixed contract or leverage your volumes based on a flexible product, it is only after it has happened that you can determine the success of your decision.

On the one hand, locking-out your whole portfolio is the riskiest of all. Whereas a flex contract based on smaller trades should keep you within current market margins, usually beating the average.

In a fast-moving energy market timing is everything. The market is becoming more and more volatile, with prices down one day and up the next. Some considerable percentage swings can easily be encountered as the availability of wind generation, LNG deliveries and changes in temperature all add to short-term price drivers. The ability to move quickly to secure a position is therefore vital. With a plethora of information, real time data and expert opinion available to make informed decisions.

Even with all this, the task isn’t over. You’ve decided on your approach to risk, used in-house expertise, outsource it to those who undertake purchasing across a whole client base, or a mix of both. From independent consultants to fully-fledged third party intermediaries with a large team –many options are available.

In-house or external advice?

Linking into the risk is who provides your advice. This is important. You will need to consider whether to simply use in-house expertise, outsource it to those who undertake purchasing across a whole client base, or a mix of both. From independent consultants to fully-fledged third party intermediaries with a large team –many options are available.

Technology also has its part to play. Should you consider online trading, using AI, aggregating with other companies or peer-to-peer options? Relevant for right now is de-centralisation and your strategy for decarbonisation. But perhaps that is a topic for another article.

Even with all this, the task isn’t over. You’ve decided on your approach to risk, used in-house or external expertise to tie down the best deal and given due consideration to what that means. But have you made the right choice? Whilst you can track against the market, what about against other companies? How can you improve for the next round?

Guidance and tools for this important task is part and parcel of keeping ahead of the curve. Getting client references in the same sector as you when engaging consultants is important, as is gaining as much information on how well you are performing against your peers.

Flexible procurement

Our recently established benchmarking service has seen our members submit trades (prices and volumes) into our monthly reporting service for both gas and electricity. This identifies how well the decisions stack up.
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- Produced water treatment
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- Fluid transport and reservoir and biofilm modelling
- Microbiology of carbon capture and sequestration
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against your organisation as well as against the market. It can help provide certainty in your business decisions, ease any concerns from your board or simply confirm that your installed expertise (in-house or otherwise) have put you on the right track. It can also reveal if you need to sharpen your pencil a little more.

For example, the Figure 1 shows how a company changed its purchasing strategy (in this instance gas) from one of annual renewals to a three-year rolling arrangement.

In the one-year arrangement they purchased flexibly, buying month-ahead products, so exposing themselves to short-term issues which drove prices upwards. In 2017/18 their purchasing strategy was one of the highest in our benchmarking exercise.

However, in 2018 they changed the strategy to a longer-term flexible arrangement with tranche purchasing when prices troughed. Their performance greatly improved from being a high quartile participant in 2017/18 to a low quartile participant in 2019/20.

One can never be sure until the 2019 seasons are finished whether this was indeed the best strategy, but if targets are set and a good risk management policy is in place to deal with rising costs, the benefits can be greatly enjoyed. As shown, the service and the graphical representations can be an invaluable management tool demonstrating to the board that its energy purchasing is achieving best practice, or to support a call to rethink a future strategy if needed.

Stay ahead of the curve

However you undertake your purchasing strategy, never underestimate the importance of keeping up-to-date. Seeing what is available in terms of guidance and support and questioning current and future decisions is just as important. Your strategy should be under continuous development, which in turn also means those supporting it.

If you are a major purchaser of energy, take the time to build a network of peers. Attend industry events and find out if your advisers are doing the same. Come and ask us (MEUC), the Energy Institute or other energy sector associations your questions and find out if how we can help.

Get more involved and grow your network. Garner useful information and secure your invite for one of our energy user conferences or roadshows where our members network, share their experiences, discuss relevant topics and gain expert insight from sector specialists.

Robin Hale is the Chief Executive and Don McGarrigle the Energy Pricing Adviser at the MEUC.

The MEUC is an independent corporate membership organisation supporting major energy and water using companies in industry, commerce and the public sector. We assist these organisations in buying, managing, understanding and reducing energy, carbon and water consumption costs.
International standards promote good practice

Too many companies still view energy management as an afterthought, but following local and international standards can help them see the light, writes Keith Nuthall.

The Carbon Trust defines energy management as the systematic use of technology and management practices to improve the energy performance of a given organisation. To frame and operate such policies, it’s necessary to tap banks of data, as well as human expertise. Fortunately, these resources are available through international, regional and national technical standards, which are not only growing in importance, but are also regularly updated to take account of technical progress.

The use of such standards is beneficial in guiding planning and risk mitigation strategies in energy management. Simply put, when energy companies, their customers and suppliers use international, regional and national standards to guide their operations and products, there will be fewer nasty surprises. Utilising this advice will also make it less likely that energy companies and their customers will dodge the development of energy management policies.

This, notes the Carbon Trust, is a problem. “The management of energy is often neglected, even though there is considerable potential to save energy and reduce costs. Rising energy prices, climate change legislation and the need to be environmentally responsible all require effective energy management,” it says in its energy management guide.

Inside the ISO

Helpfully, integrated sectors such as the power and gas industries – as well as regional bodies including the European Committee for Standardization (CEN) and American National Standards Institute (ANSI) – often dovetail standards with those of the International Organization for Standardization (ISO), based in Geneva, Switzerland.

The key ISO standard for energy management is ISO 50001, which supports organisations across all sectors to use energy more efficiently, through developing energy management systems. Released only last year (2018), ISO 50001 provides guidance on how to develop policies for more efficient use of energy; fix related targets and objectives; use data to better understand and make relevant decisions; measure the results; review how well the policy works; and continually improve energy management.

All of this is a new area of focus for ISO, which established a technical committee (TC 301) on energy management and energy savings in 2016. Since then, the committee has been busy developing ISO 50001 and other standards – spawning working groups dealing with narrower subjects. Any ISO standard is developed by technical committees charged with producing standards for a focused area of an industry, along with linked sub-committees and working groups.

Key sub committees regarding energy management include an ad hoc group developing advice on net zero energy systems, where a building’s on-site renewables generate as much energy as the facility consumes. Working groups include expert teams on energy data, terminology, financial evaluation and more.

Unlike most sectors, the knowledge that can be drawn from ISO sectors can also be combined with that of another global standards body – the International Electrotechnical Commission (IEC), which develops standards conformity assessment guidance for all electrical, electronic and related technologies.

Just like fellow-Geneva-based organisation ISO, the IEC has specialist committees which develop technical guidance. And while it does not have a specific energy management committee, it has expert committees that are associated with knowledge that makes these policies work better – such as committees on cable management; power systems management; and the management of network assets in power systems.

ISO and IEC standards are supposed to dovetail with standards created by regional and national standards organisations, whose guidance can reflect the demands and requirements of industries in their regions and countries. The most prominent regional systems are developed by Europe’s standards organisation CEN, which writes guidance for 33 countries comprising most EU.
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'C Rising energy prices, climate change legislation and the need to be environmentally responsible all require effective energy management.'

Carbon Trust

nations, barring most former USSR states. However, the three Baltic states – Estonia, Latvia and Lithuania – are members.

CEN member countries are bound to implement CEN standards as their own national standards. The organisation goes about developing standards in a similar way to ISO. Its work is steered by the CEN Technical Board, and it also has technical committees, subcommittees and working groups charged with standard development. They are made up of national standards organisation representatives and try to reach a consensus on what should be included in these European standards.

As ISO does, CEN has a technical committee on energy management, or specifically on ‘energy management and energy efficiency in the framework of energy transition’. Again, in parallel with ISO, the CEN works closely with a specialist European standards body for the electrical sector, the European Committee for Electrotechnical Standardization (CENELEC) – and indeed the energy management committee is a joint CEN/CENELEC committee.

Its guidance is more focused than the ISO standard, zeroing in on energy efficiency (for instance, benchmarking, savings calculations and definitions); and energy audits (such as on transport and auditor competence). Looking ahead, it is drafting standardised methodology for valuing energy-related investments, for instance.

In the UK, the national standards body BSI (British Standards Institution) also develops standards, which may also feed into ISO and CEN standard development. A good example here is BS ISO 50001:2018, which draws on the basic ISO energy management standard. There are also energy audit standards that mesh with similar European standards – BS EN 16247-2:2014 on energy audits for buildings, for example.

US dominance

Probably the most influential national standards body however, is the USA’s ANSI, whose guidance often inspires ISO standards. It is, however, organised differently from ISO and CEN. It does not assign such an important role for permanent subject-based technical committees. It follows a looser structure, with standards being developed by around 200 accredited standards framers, representing organisations from the private and public sectors.

These groups work together to develop American national standards (ANS) and voluntary national standards, although their work is carefully screened by a network of cross-industry committees and forums before being authorised. This system has produced a wide range of American standards guiding the energy sector.

ANSI has published an energy systems analysis and management manual, developed with the USA’s Sheet Metal and Air Conditioning Contractors’ National Association. It provides an overview of energy-related business opportunities for commercial, residential, and institutional buildings, helping contractors, building owners and operators, facility managers, and system designers with tools to evaluate an existing facility for energy savings potential.

Taken together, the work of international, regional and national standards organisations, offers a collective database of good practice and expertise that clearly offers significant aid to energy companies, their customers and suppliers when planning energy management initiatives.
Sustainable energy for developing countries

Winners of the annual International Ashden Awards come from parts of the world where efforts are being made to find new ways to use energy sustainably. And they are ensuring that, as we push towards net zero, we leave no-one behind. It’s crucial that those who need it most have access to the clean electricity that will save lives, bring joy and alleviate poverty.

SMV Green Solutions — winner of the International Ashden Award for Sustainable Mobility
SMV Green’s vision is to provide affordable, clean and safe mobility for both drivers and users of rickshaws in India, eliminating the drudgery of driving a cycle rickshaw by facilitating a switch to electric propulsion. It does this by providing a ‘one-stop-shop’ for drivers that covers financing, vehicle supply, licensing/permits, money management training, road safety training, and post-sales service. More than 1,100 e-rickshaws have been sold so far.

Finance is provided at around 7% interest, and drivers pay a 10% deposit and the balance over 24–30 months. Training is given to help prospective drivers save for the 10% deposit, but for those where this is impossible, funds from the UK Department for International Development are used to help.

SMV Green offers two battery options: lead-acid or lithium which, while more expensive, is able to deliver a longer range. For those that choose lithium, the lifecycle cost is lower, and they can also access the battery swap service, where for a modest charge they can swap their depleted battery for a freshly charged one in just five minutes.

SMV Green is supporting the poorest and most marginalised people to own and operate e-rickshaws, in particular women who would otherwise have had little opportunity for satisfying work and a fair wage. Drivers can afford to charge passengers less than the typical auto-rickshaw fee while still making a good income. SMV Green uses an all-female team to recruit women owner-drivers, who often find their lives are transformed by owning an e-rickshaw.

Compared to conventional auto-rickshaws, both drivers and passengers benefit from the reduced noise and elimination of local pollution, and carbon dioxide emissions will also be reduced as the Indian electricity grid is decarbonised in future.

EQuota Energy — winner of the International Ashden Award for Sustainable Cities and Buildings
China has seen an unprecedented shift to urban living over the last few decades, accompanied by a boom in construction. But, as in other countries, there is often an energy ‘performance gap’ in these buildings, resulting in significantly higher energy use than designed. Addressing this requires an understanding of where the problems lie but, while a large quantity of data is available from smart meters and building management systems, it is not often harvested and analysed.

EQuota Energy works with commercial buildings such as hotels, offices, shopping malls and factories to gather such data and analyse it to enable savings to be made.

The harvested data is transferred securely to EQuota’s cloud computing facility, where intelligent software is used to process it. The first stage is ‘disaggregation’, where data from smart meters is broken down to identify individual pieces of machinery switching on and off, which is achieved by making use of data from other sources in the building and by the software learning from experience in other buildings.

The second stage is analysing the disaggregated data to identify where energy is being wasted, where the building’s environment is not ideal, and where maintenance is required. The results of the analysis are presented to the client through a dashboard that allows them to explore the information and see where action is required.

EQuota is now managing over 3mn m² of floorspace, delivering annual energy savings worth over $7mn to its clients and saving over 110,000 tonnes of carbon dioxide each year. Clients have also reported improved indoor environments, with better humidity control and lower pollution levels.
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Minimising energy costs is important, right?

But how do you know you’re getting the best advice? That you’ll save money, not waste your time? If only you could get honest expert advice, someone to show you what to do, perhaps even manage it for you.

Search the RPEC database at www.energy-inst.org/rpec
RESHAM SUTRA – Winner of the International Ashden Award for Powering Business

Silk production is the largest generator of rural employment in India, after agriculture. Cutting imports through more local production of silk could create millions of rural jobs, but there are major barriers to this. Techniques used for silk reeling and weaving are inefficient and arduous, meaning workers in the industry, mostly rural women, are limited in what they can produce.

Now, Resham Sutra designs, manufactures and commercialises machines for silk yarn and fabric production that are up to ten times as energy efficient as pre-existing options – and most are solar-powered. These machines help operators improve productivity, income and health by replacing the harmful process of thigh-reeling as well as the inefficient and unreliable motorised machines that are useless during frequent power outages.

The company marshals an ecosystem of finance providers, NGOs and government partners to ensure the machines are affordable and supply chains run smoothly. The machines are mostly distributed through partners, who bring part or total funding, or help facilitate other financing. Over 70% sales to date have been eligible for a government subsidy, which Resham Sutra often helps to facilitate. One key to Resham Sutra’s success has been recognising that technology is only part of the solution to boosting rural livelihoods. They have also built in holistic support for their customers, helping them access raw materials and find markets for their products.

REEEP – Winner of the International Ashden Award for Financial or Business Model Innovation

Nearly 70% of Zambians, 11.8mn people, live without modern energy access and grid extension to rural areas is technically and economically unfeasible. Decentralised clean energy solutions can offer a reliable, clean and affordable alternative and people are willing to pay for them. The $22mn Beyond the Grid Fund for Zambia (BGFZ) provides incentives to de-risk companies’ entry into, and expansion within, Zambia. It is implemented by the Austrian NGO REEEP, with funding from the Swedish International Development Agency. The aim of BGFZ is to bring energy access to 1mn Zambians by 2021 and, in the long term, to kick-start a sustainable market for clean energy services in the country.

The fund has the principal of ‘reaching the last mile’ at its very core, closing the viability gap for reaching geographically or economically challenging parts of the country and incentivising companies to serve areas that would otherwise not represent viable markets.

The fund requires companies to demonstrate that they are able to provide a set level of energy service for their customers, for the long term. Their technology solutions must come with stringent quality and warranty guarantees and long-term service contracts. Four companies are currently contracted under BGFZ, offering solar home systems, solar micro-grids and clean cooking solutions.

The customers of the companies operating under BGFZ have access to energy services such as lighting, mobile phone charging and better access to information and communication via radios and TVs. Micro-grid connections are supporting a range of small businesses from barbershops to small cinemas, and around 1,200 local jobs have been created in operations, sales and marketing.

SISTEMA.BIO – Winner of the International Ashden Award for Clean Cooking

Sistema sells a prefabricated modular biodigester package that includes a suite of biogas appliances and connections. Easy to install and use, the patented biodigesters receive organic waste and transform it into renewable biogas and a powerful organic fertiliser.

Sistema enables farmers to utilise animal waste in a way that creates gas for cooking and heating water, as well as providing a source of organic bio fertiliser. With a biodigester, farmers and their families that previously had to live with the smell and flies associated with having piles of manure on their farms, can now live in a healthier, more sustainable environment. Biogas burns with a clean flame, only producing carbon dioxide and water residue, so families are able to cook in a smoke-free environment.

Customers pay for their digester monthly, at a cost roughly the same as what they were spending on
India’s Karuna Trust is incorporating good energy practice into its healthcare work

A biodigester turns animal waste into gas for cooking and fertiliser

India’s Karuna Trust is incorporating good energy practice into its healthcare work

Reducing urban temperatures in Medellin, Colombia

Karuna Trust – winner of the International Ashden Award for Sustainable Energy and Healthcare

Over a billion people around the world use health centres and hospitals where electricity is absent, intermittent or poor-quality, yet reliable energy can transform healthcare, creating better services that reach more people. India’s Karuna Trust has given staff and patients the power to deliver modern healthcare using affordable, sustainable energy.

The Trust’s approach creates systemic change rooted in the needs of local communities, and gives clinical staff the skills and resources to tackle energy issues in their buildings. The most marginalised patients benefit most – no longer having to travel long distances for specialist care, or risk power cuts mid-treatment.

Karuna Trust now gives free primary healthcare to more than 1.5mn people in rural areas of five Indian states, places which experience power cuts for at least two hours every day. It manages 62 primary health care centres, 19 of which are powered by solar PV systems.

Led by doctors and health professionals, the trust works with local people and government to create public-private partnerships. These turn failing government clinics into providers of top-quality healthcare.

The integration of sustainable energy and energy efficiency measures have been an important part of the clinics’ transformation. The Trust has worked closely with the SELCO Foundation to pilot solar-generated electricity systems. It also improves energy efficiency and patient comfort with clever building designs, incorporating natural lighting and cross-ventilation.

Beyond the health centre walls, sustainable energy has allowed Karuna Trust to reach further into rural communities. Solar-powered eye clinics in shipping containers serve remote towns and villages that have never had access to these services before. Maternal health workers are equipped with ‘solar back-packs’ holding essential lighting and equipment so they can provide quality care in the field.

Alcaldía de Medellín – winner of the International Ashden Award for Cooling for People

As global temperatures rise and heatwaves become more common, outdoor heat can become more uncomfortable and dangerous in many countries. This is exacerbated in cities, where expanses of concrete and tarmac cause an ‘urban heat island’ effect as they absorb the sun’s heat, adversely affecting people’s health.

Colombia’s second largest city, Medellin, has introduced an urban greening programme called ‘Green Corridors’ to improve biodiversity and reduce the urban heat island effect within the city. By installing beautiful and functional greenery, the city is adapting to climate change and improving the quality of life of its residents.

Medellin has focused on creating ‘corridors’ along 18 roads and 12 waterways. The corridors are including improving appearance, reducing the urban heat island effect, increasing biodiversity and reducing air pollution at the same time. The cooling effect is due to evapotranspiration, reduced radiated heat from solid surfaces, and shading.

The programme has improved and created 65 ha of planting in the city’s waterways and 6.2 ha on its roads. More than 8,000 trees have been planted (comprising 72 carefully selected species), along with more than 350,000 shrubs.

Corridors are designed to mimic a natural forest situation, including stratifying the layers to ensure there are low, medium and high plants to encourage fauna. There are also carefully selected taller trees which are planted to ensure that when they are fully grown, they will provide the maximum amount of shading and cooling.

Reducing urban temperatures in Medellin, Colombia
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