NewStatesman

Smartening up

Powering the UK's future energy needs through innovation and technology

Charles Hendry
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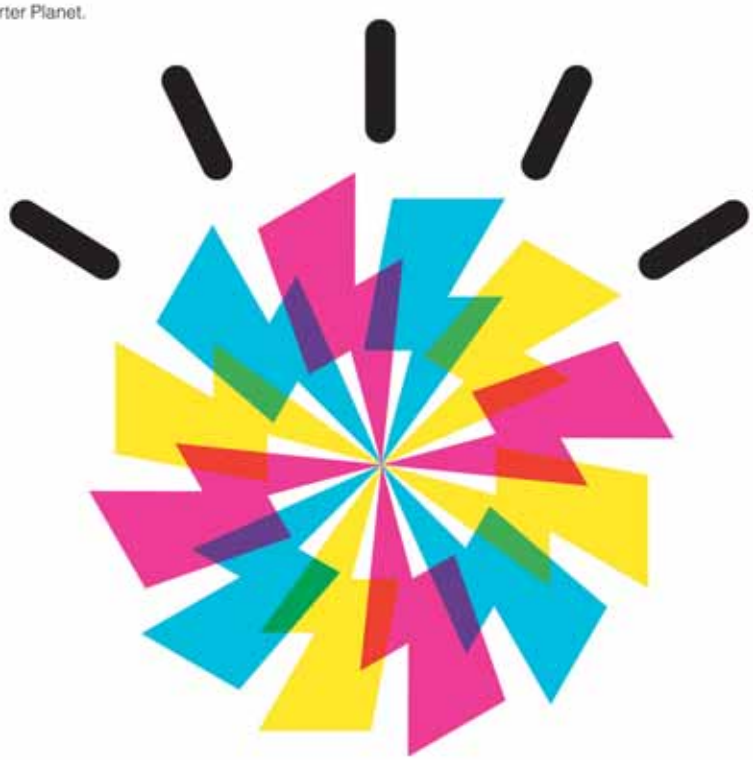
Conversations for a Smarter Planet.



Smart meters for a smarter planet.

Blackouts. Power cuts. Economic recovery at risk. The prospect of not having enough energy to go round is unthinkable. Yet if the UK continues to use energy at the current rate, demand could outstrip supply as early as 2016.

Clearly we have to develop new energy sources, but increasing supply is only part of the equation. A more immediate and cost-effective strategy is to encourage consumers to use less, particularly at times when energy is most expensive to supply. This would also help the energy industry reduce its emissions.

Simply increasing the price of power is unlikely to reduce consumption, but fortunately there is another option. As our world gets more intelligent, interconnected and instrumented, smart meters can give consumers better information about their energy use and its cost, encouraging them to change when and how they use power.

They also give suppliers a way to develop intelligent time-of-use tariffs that encourage customers to delay consumption until demand is low and costs fall. This can help cut energy bills, lessen the likelihood of power cuts, and reduce greenhouse gas emissions – a fantastic win-win-win scenario.

In Holland, IBM works with energy company Nuon on just such a project. In a pilot test of smart meter-based energy management systems in 500 households, energy use is monitored, targets set and usage patterns influenced by various beyond-the meter-services. The next phase of the pilot will also include switching off unnecessary appliances. Anticipated savings average 14% on electricity and 9% on gas – that's around £200 a year for an average household. In another study, participants who responded to real-time prices reduced peak power use by 15%.

The technology for nationwide energy monitoring already exists. When the UK government asked energy consultants Hildebrand to scale up its energy monitoring solution for all UK homes, they worked with IBM's software laboratory near Winchester. Together they created a solution that can collect, store and analyse huge volumes of data – 50,000 data points per second – making it scalable to millions of homes. This enables real-time analysis and optimisation of electricity usage for households – a vital step in making our energy system smarter.

Developments like these will become increasingly important as smart meters and smart grids start to transform the way we supply and use energy. So let's do it. Let's build a smarter planet.

ibm.com/smarterplanet/uk/metering

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Contents

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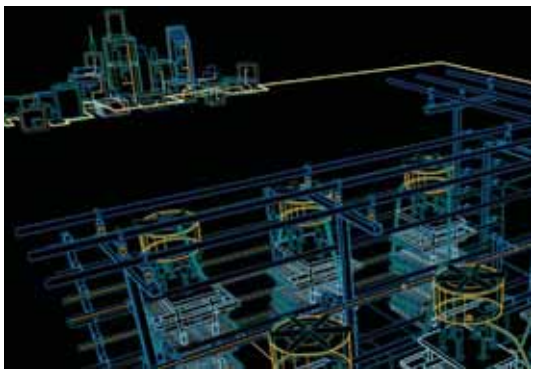


The Smart Grid explained, p8

England's first EcoIsland, p10

Power formula

Modern society is facing a dilemma. Demand for energy is increasing but traditional generation resources are diminishing. A rising number of homes and businesses are producing their own solar and wind power, while decentralised energy storage technologies need to be integrated. And on top of all of this, greenhouse gas emissions need to be dramatically reduced over the next few decades.

How to address these challenges is something many energy, IT and government experts have been investing considerable time and, yes, energy in, and some of the new technologies and business models that are emerging as a result are discussed within these pages.

However, a successful transformation of our energy sector is dependent on all parties working together: the private sector, government and significantly the public. It is the responsibility of us all to ensure a more sustainable future for people and planet.

Articles

This supplement, and other policy reports, can be downloaded from the NS website at newstatesman.com/supplements

COVER ARTWORK BY HENRIK PETTERSSON

SMART THINKING

The UK's energy system is no longer fit for purpose. Drastic changes are required if electricity needs are to be met

Powering ahead

By Jon Z Bentley

The UK energy system is facing a crisis. This is a slow burn crisis, with time for us to act and avoid its worst consequences. Paradoxically, having time to make changes works against as well as for us.

Building the new generation, transmission and distribution assets that we need is a mammoth task, and one that will take years, if not decades, to complete. Changing the ingrained behaviours of an entire country, across multiple generations and cultural backgrounds, will be no quick and easy task. The regulator is getting to grips with the structural changes needed and the utilities are beginning to alter their business processes and refresh the underlying technologies as a result. With all the consequent risks and complexities, the transformation programmes to effect these changes are multi-year efforts. No one involved is arguing for less time.

However, the very fact we appear to have time on our side presents a real and serious danger, one that we at IBM believe is receiving insufficient attention and urgency. The development of a smart energy system, both the smart grid and a smart energy market, is crucial. A smart grid is one in which IT and analytics are used to maintain the integrity of the system, protect individual parts from damage and change the flows and usage of energy. A smart energy system uses prices and commercial agreements to shift both demand and supply behaviours to the benefit of all participants.

At IBM, we believe this will not result from the current piecemeal developments of new technology nor from the market reforms so far under discussion. The experiments being encouraged by Ofgem under the Low Carbon Networks Fund are well intentioned and will provide useful outcomes, but their time line means they will bear fruit too late. On the current trajectory, we will be faced with trying to knit together disparate and potentially incompatible developments rather than putting in place first the framework within which component level innovation can be left to the market.

Changing the behaviours of an entire country will be no quick and easy task

Our energy system is not a collection of discrete components, each of which must do its own job: turbines to generate power from wind; high-voltage wires to transmit power; meters to measure and report usage; and transformers, power stations, electric vehicles and more besides, each with its own specific purpose. It is a system of systems in which the operation of each part must be connected, integrated and balanced, and which must inter-operate with others: transportation, water and sewerage, city infrastructures, buildings, hospitals and more.

We do not simply require each part of the rebuilt system to operate a little bit better, cheaper and cleaner, though this is a part of the challenge. Neither will it be enough to have the system as a whole work a little more efficiently but in the same way as it does today.

In order to replace as much as a third of our total generating capacity by midway through the next decade, cut emissions by 80 per cent by 2050, scale UK renewable energy to 30 per cent of the total used by 2020 and avoid a doubling or more of energy costs, we will need the energy system to work in a different, smarter way.

Maintaining the equilibrium

Generation is becoming far more distributed, driven largely by the increase in wind farms and the generation from domestic sources such as solar PV. This requires our distribution and transmission system to handle flows of power that are very different from those for which the existing hub-and-spoke topology of the grid was designed. This is not to say that our current system is dumb, far from it, but it will need to become more flexible, dynamic and resilient.

Already, our demand patterns cause difficulties, with peaks of consumption in the morning and evening. Total capacity must be capable of meeting these peaks while at the same time scaling down to the troughs. The present system balances, by and large, by flexing supply to meet de-

Keeping the lights on: smarter ways of producing and managing energy will be of benefit to us all

mand, and it does this by using flexible but expensive and emission-producing fossil fuel plants. It is true we have some so-called "dispatchable" demand and some pumped storage which can be used to alleviate problems and there are some tools that help with system balancing.

However, we will need far more responsive mechanisms, capable of shifting large amounts of power into the lower demand periods. This is because we will face both more intermittent and less predictable supply and demand.

Wind, solar and, in the future, wave generation are intrinsically intermittent and relatively unpredictable. What is more, our dependence on weather systems can at times result in periods of depressed generation from these sources. Tidal generation is more predictable but, depending on the technologies used, is also variable. So, the energy system of the future must be able to deal with these periods of excess and shortage by means of adjusting demand to fit supply and utilising storage methods including batteries and heat storage.

The system as a whole must shift from one which increases supply to meet demand to one which flexes demand to meet supply. Operational constraints demand that we have relatively constant usage of "baseload" generation (nuclear and gas power stations). As a result, we must "shape" demand to meet the fluctuating patterns of renewable generation.

Bridge the gap

We can rely to an extent on people wasting less and using less, particularly at cheaper, "off peak" times. There are tools available here: education so the population better understands the crisis we are in; real-time information on how people can reduce consumption; "nudges" to change behaviour such as default modes of operation; and price signals that indicate when it is cleaner and cheaper to, for example, turn on the laundry. But behaviour change is notoriously difficult to achieve, and the evidence to date is that it will not achieve enough to bridge the gap.

So, a more reliable solution is needed, one which combines the power of market forces and the reliability of automated control within a new arrangement in which there is a win for all: lower bills for customers; lower costs for utilities; less need to burn fossil fuels; and, for our economy, an ability to rely on home-produced renewables rather than imported fuels.

This is what we call a smart energy system. It is why IBM and other companies such as Toshiba and Cable and Wireless have joined forces with energy retailer and network operator Scottish & Southern Energy, community interest company EcoIsland and others to create such a system on the Isle of Wight. This project will develop a range of power solutions within a smart grid and will result in the island becoming energy self-sufficient by 2020. It will bring savings and jobs, and will provide the UK with a route map to the smart energy system we need.

Jon Z Bentley
Smarter Energy Lead,
IBM Global Business
Services, UK and Ireland

REX FEATURES

1974 Initiated a multi-year effort to eliminate the toxic organic compound, polychlorinated biphenyls, from use in its products

1977 Joined the International Environmental Forum at the World Environment Center, a non-profit organisation that advances sustainable business practices

1979 Introduces the first heavy duty, reusable ARBO crate for shipping IT equipment, which are still in use in the electronics industry today

1984 All contractors employed at IBM locations issued with a corporate directive regarding the use of chemicals within their working practices

SMART POLICY

The UK is working hard to find new ways to manage power supply and demand

Maximising our assets

By Charles Hendry

All around us we see the constant evolution of technology. The way we watch television has moved from black and white to colour, to digital and now 3D. The vehicles we drive have changed in shape and size. Even the book is developing into something new – an entire library can now be accessed on one small screen while travelling by public transport. The way we harness and deliver electricity to homes and businesses is also being modified as the 21st century progresses.

The most sweeping changes to the electricity market since privatisation are currently being made. A quarter of our existing generating capacity will shut down as coal and nuclear power stations close over the next decade. Without action, there is a risk of uncomfortably low capacity margins and a higher chance of blackouts.

To ensure we do our bit to tackle climate change while meeting new demands securely and affordably, our new electricity mix is going to be diverse and low carbon. We expect nuclear and renewable sources, such as wind and marine energy, to play an increasing role. This is already bringing challenges for how we manage the electricity grid.

It is absolutely vital that we find ways to harness, deliver and store electricity that makes the best use of our assets. This is what the concept of smarter electricity systems is all about, including the smart grid, smart meters in every home and small business, a competitive retail market, technological developments in key areas such as electricity storage, and greater interconnection to allow us to buy and sell electricity with other countries.

Smarter working will help meet our energy needs

The coalition government has ambitious plans for the electricification of domestic transport (see page 13) and heating. This poses challenges for the grid, but also opportunities. Clearly if everyone comes home and charges their electric vehicles in unison there could be a major surge. But with innovation, householders could effortlessly and cheaply charge overnight, helping to balance demand.

Storage of electricity – in the form of batteries, pumped hydro or even heat – is already important. However, technological advances could allow it to play a much bigger role in the future. We may see storage being used at a range of scales, even down to local level. For example, a community group may invest in storage so they can save the power produced by their solar panels to charge their cars.

The UK government is taking action now. The *Electricity Market Reform White Paper* set out our high-level strategy for the future networks and system flexibility, and committed to a more detailed electricity systems policy paper next year. And we helped set up Smart Grid GB, a forum that provides leadership and expertise to inform decisions about smart grids and their potential impact.

Innovation will be crucial as we seek a smarter way of managing our electricity. We want the UK to lead the world in this field. To facilitate this, we are providing funding, including Ofgem's Low Carbon Networks Fund, which will provide £500m over the next five years to support smart grid trials. The Department for Energy and Climate Change's (DECC) Low Carbon Innovation Fund provided £2.7m to eight smaller smart grid projects, while the Office for Low Emission Vehicles has held a competition for pilot electric vehicle infrastructure projects worth £30m.

As we seek to decarbonise the energy system, it is vital the grid works effectively to deliver power to homes. Smarter systems will be vital to achieving this. ●

Charles Hendry is energy minister at the DECC.

GETTY IMAGES

1990 Prohibited ozone-depleting chemicals, polybrominated biphenyls and polybrominated diphenyl ethers and heavy metals from use in product packaging

1991 Founded the IBM Engineering Center for Environmentally Conscious Products, which supports new product development

1991 Established the annual IBM Chairman's Environmental Award to recognise IBM organisations for their environmental leadership

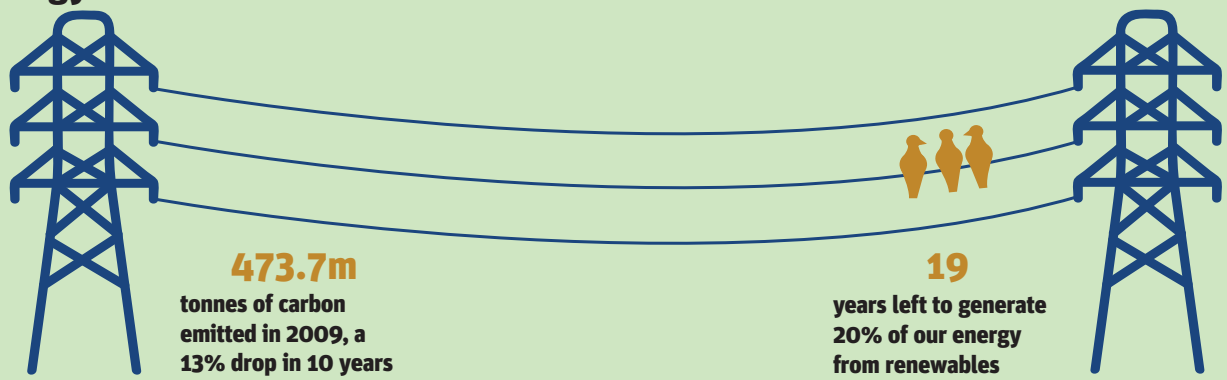
1991 Launched the IBM Corporate Excellence Awards, which aimed to recognise IBM staff for their environmental innovations and ideas

FACTS AND FIGURES

Supply and demand

In numbers, the story of Britain's energy use

Energy Outlook



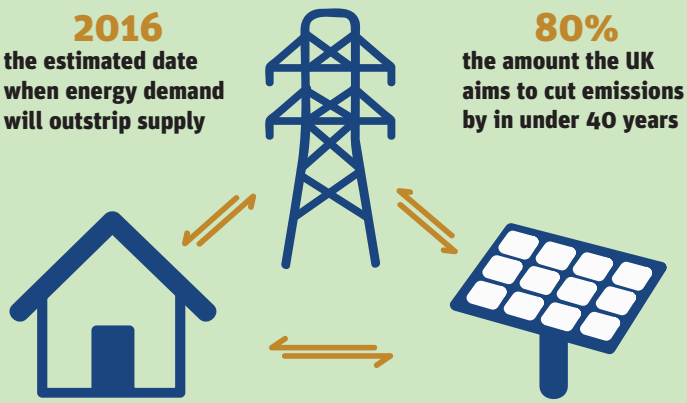
473.7m
tonnes of carbon emitted in 2009, a 13% drop in 10 years

19
years left to generate 20% of our energy from renewables

Smart Energy

2016
the estimated date when energy demand will outstrip supply

80%
the amount the UK aims to cut emissions by in under 40 years

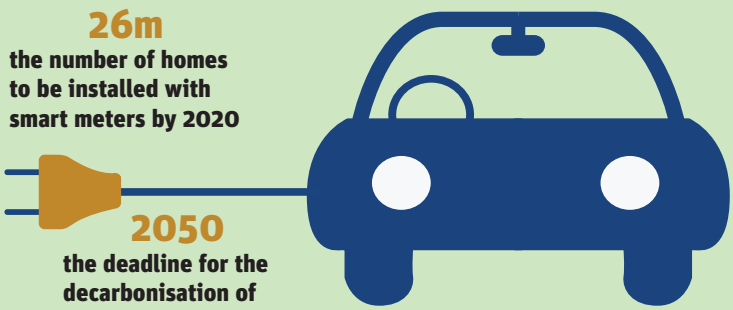


60%
the amount energy bills could rise in the next ten years

250,000
the number of jobs a £5bn injection in smart grids could create

Smart Cars

26m
the number of homes to be installed with smart meters by 2020



50%
the amount the Isle of Wight aims to cut fuel bills via its smart grid

2050
the deadline for the decarbonisation of road transport

0.03%
the proportion of car owners who have switched to electric

KRISTINE OMANDAP

1989 Established goal to eliminate CFCs and carbon tetrachloride from all its products and manufacturing processes by the end of 1993

1989 Issued corporate policy to minimise the use of, and ensure proper care of, any required or unavoidable use of laboratory animals for research or testing

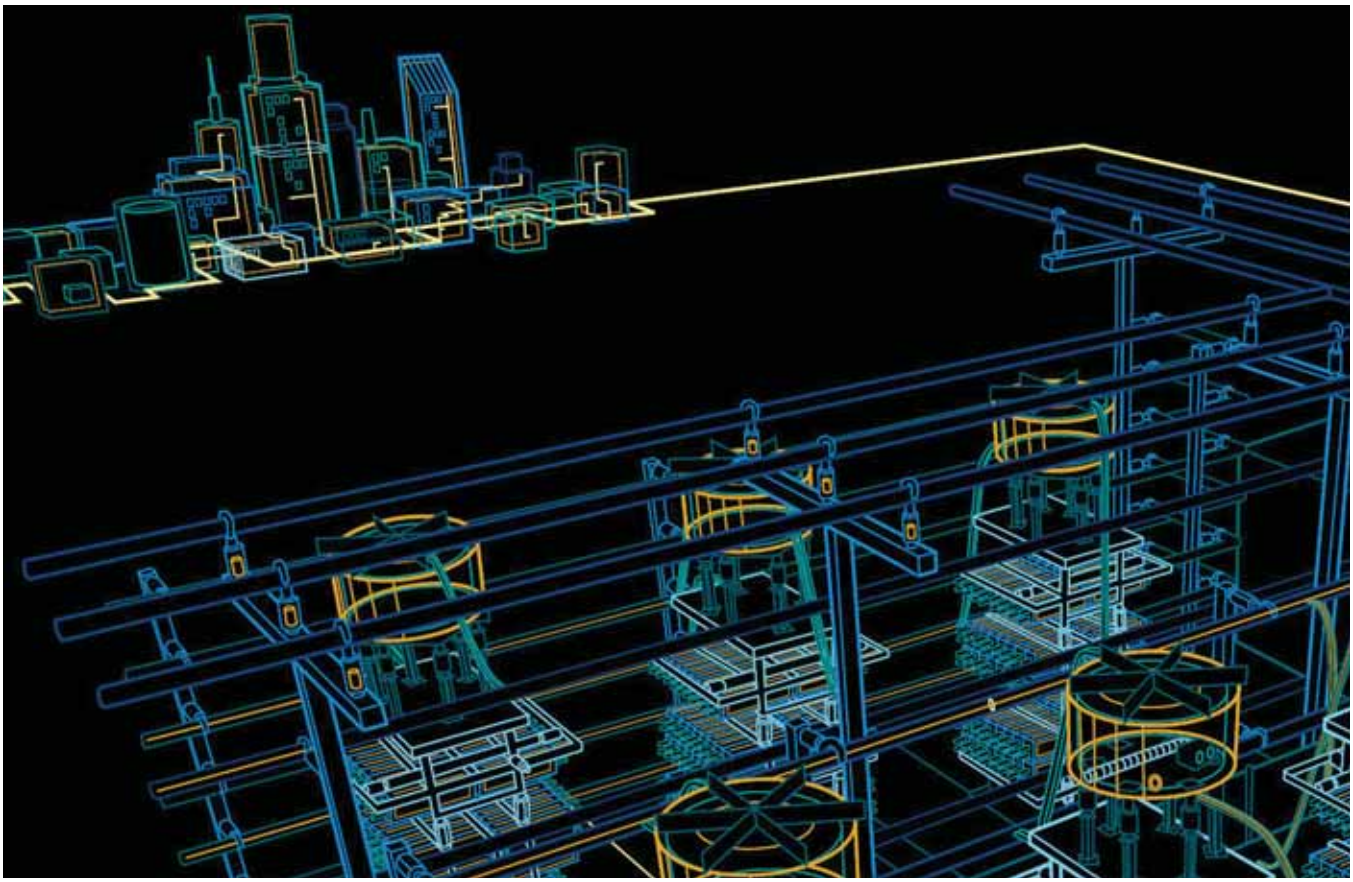
1990 Issued corporate packing design guide to provide suppliers with the IBM's environmental requirements for product packaging

1990 Published the first *IBM and the Environment* report, which laid the foundations for its annual corporate environmental reporting activities

SMART SYSTEMS

Bright young thing

By Becky Slack



Innovation and technology are behind advances in the way we generate and consume energy

What is the smart grid and what are the challenges facing its implementation?

Blackouts, power cuts, restricted working hours; not since the 1970s when the three-day week was introduced to conserve coal has Britain faced the prospect of rationing energy use. Yet many of the UK's industry experts are warning this could be a reality as we continue to soak up power at a rapid rate; current estimates cite 2016 – just five years away – as the time when demand will outstrip supply.

Hindering this situation further is the archaic infrastructure. Our centralised grid was designed to distribute power in one direction only, and not to manage the dynamic flow of uninterruptable supply as it is required to today. The UK is not alone in this. Globally, grid inefficiencies result in the loss of enough electricity every year to power India, Germany and Canada for 12 months.

The power industry therefore faces major challenges if it is to effectively meet the energy requirments of the future, particularly if World Energy Outlook predic-

ABB INC.

1991 Announced the IBM Environmental Research Programme, which awarded $16m to 14 university and research institutions around the world

1992 Received the US President's Environment and Conservation Challenge Award, which recognises the public and private sector's work in this field

1992 Instituted a methodology to correlate hazardous waste and production, which was initially used at IBM's US sites, but is now in place in all of its offices

1993 Eliminated CFCs, carbon tetrachloride and 1,1,1-trichloroethane from use in manufacturing processes and prohibted them from IBM products

tions of a 30 per cent increase in demand over the next 25 years is correct.

What is to be done about this? The answer, it is believed, lies in digital intelligence, which will reduce outages and faults, manage demand in real time and enable the integration of clean energy sources such as wind and solar. This new way of working is called the smart grid.

As its name suggests, this is clever technology. The smart grid can be linked to thousands of power sources, and as well as sending energy out it can receive it too, enabling the better capture of power created through domestic use of renewables.

In the background, data is collected and analysed so more effective decisions can be made. Customers will be able to see how to consume energy more efficiently (IBM says smart grid projects are already helping people save 10 per cent on their bills); distributors and retailers will be able to make informed decisions on how to manage demand and delivery, particularly at peak usage times; and society as a whole will know more about how to preserve the environment. The smart grid also has the potential to boost the economy; around 250,000 jobs could be created from a £5bn investment, according to the London School of Economics.

This system has many supporters across the energy sector, ICT companies, government and environmental groups. Smart Grid GB, the national smart grid champion, describes it as "an evolving concept where technology will lead the way to a more efficient and interconnected network", something that it believes will play a central role in ensuring the future competitiveness of the UK and help it be more sustainable.

A key component of this new system are smart meters. Installed into homes, these meters provide consumers with information about their energy use and its cost, which can then be used to inform decisions about when and how to use power. For example, by highlighting how electricity is more expensive during peak hours, customers may choose to run household appliances at cheaper times of the day, saving them money.

An example of the positive impact this system can have comes from the Mediterranean island of Malta. In 2007 its government realised the country was facing a serious energy challenge. All of its electricity was generated by imported fossil fuel while its power and water supplies were inextricably linked: electricity was used to power the desalination plants which supplied over half the island's water.

A pioneering five-year project was introduced that saw utilities and companies, including IBM, working together to create the world's first smart grid. It included the installation of 250,000 smart meters to monitor usage, identify water leaks and electricity losses, set rates, and reward those who consume less power.

According to IBM, the project "enables better insight into usage patterns, demand management and energy efficiency, and allows the utilities to start tackling commercial and technical losses."

In addition, carbon-intensive fuel is being replaced with sustainable energy sources, while citizens have been empowered to make better usage decisions.

Current estimates cite 2016 as when demand will outstrip supply

Elsewhere, other countries are also looking to make the most of such technologies, the UK included. In 2008 it was announced by Lord Hunt that smart meters were to be installed in all of the nation's 26 million homes. It is a popular idea; the current government is so keen to press ahead it has fixed a 2020 deadline for completion of the programme.

However, while this initiative has been welcomed, the speed of the rollout presents a number of challenges for the energy and IT sectors, says industry body, Intellect. "This is a tight timeframe for an enormous project and the implications of smart-metering and billing are vast."

It has identified a number of challenges, including: inter-operability between meters, ie, all smart meters must be suitable for use by all suppliers; the means by which data is communicated; and the important issue of keeping vast quantities of sensitive customer data secure.

The other concern is whether consumers will act accordingly. Speaking at the Gridwise Global Forum in 2010, Samuel J Palmisano, Chairman of IBM, said that although the adoption of advanced analytics was making the energy system more efficient, productive and responsive, until consumers "embrace their more active role as full participants in a truly networked, multi-stakeholder system", the full potential for the smart grid will not be realised.

His view is backed up by a report from the analyst company, Ovum, which identified two areas of customer engagement which it believes will be critical to the success of smarter energy systems: early stage acceptance and long-term behavioral change. Neither will be possible, it says, without increased involvement from regulators, governments and consumer advocacy groups.

"Without the correct incentives or a regulatory framework, consumers who do not change their consumption habits will increase utilities' profits, which is a strong incentive for utilities not to drive consumption reduction schemes. This will do little to convince consumers of the benefits of smart meter deployments," said the report's author, Stuart Ravens.

Independent research also adds weight to this view. The University of East Anglia found that although smart meters have an initial effect on energy use they are subsequently ignored, while Ofgem reported that despite customers having had a choice in the company they purchase electricity from for over ten years, 60 per cent have opted to remain with the same provider, even if cheaper alternatives are available elsewhere.

The vision of transforming an entire energy value chain to a smarter way of working is a bold one. However, it is clear that if it is to be achieved more attention needs to be paid to the consumer. In the words of Ovum's Ravens: "If consumers do not use the data from smart meters to amend their consumption over the long-term, smart meter projects will fail." And that, if energy predictions bear out, could ultimately be no good for anyone.

1993 Prohibited the use of the toxic organic compounds polybrominated biphenyls and polybrominated diphenyl ethers in IBM products

1993 Established the IBM Directors and Corporate Governance Committee with the role of reviewing IBM corporate responsibility

1993 Issued the first IBM engineering specification on baseline environmental requirements for parts and assemblies provided by suppliers

1994 Helped establish the SWICO Electronic Recycling System in Switzerland – the world's first comprehensive national recycling system for electronic products

Support from business and consumers is key to achieving environmental goals

Sustainability now

By Lauren Stern

How can customers be persuaded to think about sustainability when making purchasing decisions? Do they need to be nudged or pushed into action? Do they even care about the environment?

All of these questions and more were up for discussion at the recent IBM Start Sustainability Summit, which brought together leaders in business, academia and the NGO sector to tackle many of the complex issues around sustainability and sustainable lifestyles. These challenges range from finding new ways to make tedious steps such as insulating the home more interesting, right through to large, national infrastructure issues.

Research presented at the Summit would suggest the imperative for sustainable action is strong and both businesses and consumers have a desire to make a difference. Almost three quarters (73 per cent) of British adults consider sustainable living to be important to them, according to a YouGov survey of more than 2,000 adults. However, 36 per cent are confused about what they should and shouldn't do to help the planet.

Meanwhile, research from Start, a national initiative inspired by HRH, The Prince of Wales, to promote and celebrate sustainable living, found that although just under half (49 per cent) of those surveyed believe they themselves (ie the general public) are ultimately the most responsible for encouraging others in the UK to live more sustainably, a quarter (25 per cent) feel it is the responsibility of the government, and one in six say it should be the role of businesses (17 per cent).

The power of partnership

Additionally, just over a third (34 per cent) said a simple idea to help them live more sustainably from a company whose products they already buy would make them more inclined to try the idea than if the government suggested it. However, if multiple companies came together with a set of ideas, this number rose to almost three in five (57 per cent), highlighting the power of collaboration to tackle this important issue.

This idea of companies working together was one which was explored at the Summit, along with other ways in which UK marketers could take a lead on the enormous challenge around changing a deeply entrenched consumerist and throw-away culture to a more sustainable, resource-conscious way of living.

This is a hot topic being discussed all over the world as businesses grapple with the radical transformation needed to remain profitable yet sustainable businesses over the long term. The sheer size of this task was certainly recognised at this Summit. "Sometimes it seems more of a challenge than reaching outer-space," said Joey Tabone, chief executive of Start, in his address to delegates.

IBM's chief executive, Stephen Leonard spoke ardently to the room about the kind of planet we want our future descendants to inherit. He also argued for need to create economic value at the same time as creating real value for society and a positive impact the environment.

Part of the role of the Summit, however, was to provoke this group of influential people into thinking outside their comfort zones. This task was fulfilled by Tim Smit, founder of the Eden Project. "I want everyone at this conference to get a

GETTY IMAGES

1997 Awarded the US Environment Protection Agency's Best-use-of Stratospheric Ozone Protection Award, which celebrates environmental work

1998 Received the US Environment Protection Agency's Climate Change Protection Award, which recognises innovation and technical achievements

1998 Awarded the Grand Prize in the globally recognised, Japanese Environment Agency's Environmental Action Plan Award

1999 Became the first company to manufacture a personal computer using 100 per cent recycled resin for its major plastic components

The Eden Project's Tim Smit wants people to "get a bit more angry" about the environment

bit more angry and take action... we have a 15-year window to address the challenges facing our planet." He believed that companies working collaboratively offers the biggest opportunity to change current customer behaviour.

A morning plenary debate with British Gas, Procter & Gamble (P&G), Eurostar, ASDA and The Marketing Society focused on the consumer marketing campaign concurrently launched by Start on the same day as the Summit (1 November 2011), called Start Today. This groundbreaking campaign encouraged people throughout the UK to "do more with less", and be more aware of their resource use. Each of the participating brands championed a simple sustainable behaviour that their consumers could relate to and immediately adopt. This covered everything from sustainable food choices and the joys of exploring on foot, through to easy ways to start saving energy and creative ideas around re-using and sharing.

The plenary looked at the role of brands in influencing consumers and creating demand for new, sustainable products and services. "Make sustainability tangible – give people the tools, and the enthusiasm will follow," was the advice from Will Orr, marketing director at British Gas. Roisin Donnelly, corporate marketing director at Proctor & Gamble, advised, "Consumers will accept no trade-offs in quality and price when looking at sustainable products." Meanwhile, "Pollute France with just your French," was the new approach to sustainability advertising led by Emma Harris, director of sales and marketing at Eurostar.

Changing behaviours

However, perhaps the most important function of the day was to give the group of over 200 influential people the opportunity to get their thinking caps on and work together. Some 20 facilitators were trained up by IBM to work with delegates on identifying the major "behaviour change" barriers faced by consumers in their sector and how those barriers could be overcome. IBM and Start then challenged these groups to come up with creative and innovative ideas for change – with just three minutes to do it. After 180 seconds of industrious silence , an incredible 903 ideas had been generated – a very impressive five ideas a second.

Each table spent the remainder of the session discussing them and proposing their favourite three. Across all the tables, the most frequent concepts were to engage with individuals and communities – particularly the young – and make it innovative and fun; recognise and reward – or tax and penalise, for example, tax relief or tax credits, rewards for recycling, no VAT on repairs, recognition of "heroes" and "green knights"; create a common measure and language with clear communications, for example, "kite mark" and "five a day"; and provide visible, easily understandable metrics on performance.

The teams at IBM and Start have committed to exploring these ideas for new opportunities to accelerate a social and economic transformation based on the principles of sustainability. Together with the group of leading brands that are supporting the Start initiative, they will continue to drive the agenda forward and provide important opportunities for real collaboration on creating a smarter planet. No one organisation can do this alone. ●

Lauren Stern is the account manager for Start at Business in the Community

2000 Helped the World Wildlife Fund create its Climate Savers programme, which aims to encourage businesses to voluntarily reduce their emissions

2000 Became a charter member of the World Resources Institute's Green Power Market Development Group, which aims to build markets and demand for renewable energy

2000 Was the first IT company to join the Pew Environmental Center of Global Climate Change Business Environmental Leadership Council

2002 Became a charter member of the US Environment Protection Agency's Climate Leaders programme, which helps develop corporate climate strategies

With the help of industry experts, the Isle of Wight is aiming to become England's first carbon neutral island

Paradise in the making

By Stephen Stead

The Isle of Wight is known for many qualities: its outstanding beauty, 13 award winning beaches and 500 miles of footpaths through unspoilt scenery, making it a favourite holiday destination for many. What it is not so widely recognised for – for the time being at least – is its pioneering approach to sustainability. It is, or at least it will be, with the help of several partners, a smart community – England's first EcoIsland.

At a time when many commentators struggle to define what a smart grid is, the prospect of describing a smart community is an even more daunting task.

The concept of a smart community has not been dreamt up by clever young things in marketing to enable organisations to cross-sell a wider selection of their portfolio. Instead it can be considered as a community that exploits technology to provide cost and efficiency benefits. In the main, it is becoming increasingly aligned to one specific societal need – that of energy sustainability.

With electricity demand expected to increase and with intermittent power sources, such as wind and solar, forming an ever greater part of our energy mix, a balance is required between demand and supply at all levels, from the national transmission grid through to local distribution networks that deliver electricty to our businesses, homes and schools. It is achieving this equilibrium, combined with the drive to decarbonise our energy value chain, which is fundamentally at the heart of most emerging smart communities.

This required demand and supply balance could, of course, be left to the systems operater, National Grid. It is, after all, its job. However, given the target of generating 30 per cent of our power from renewables by 2020, plus the even more onerous ambitions beyond that, the key question remains, what will National Grid balance renewables with?

Renewables are, by their very nature, intermittent and unpredictable; extensive periods of depressed generation can be followed by excess production. Currently, at times of peak demand, alternatives such as dirty diesel, standby oil-fired power stations, or other equally unattractive options are employed. However, the majority of these are both expensive and bad for the environment.

Coupled with this is the problem faced by the distribution networks. These were not built to cope with either the levels or patterns of generation and demand connected to them. Nor were they built to handle the concept of local generation, such as solar and wind, feeding power back up lines which were only designed to have power flowing down them.

The residents of the Isle of Wight believe they may have found the answer to some, if not all, of these challenges. They have embarked on an ambitious programme of change that aims to turn their home into "the ultimate EcoIsland", a region of England with the lowest carbon footprint by 2020. Central to its success are its partners which are looking at innovative ways of using technology to create a sustainable environment.

Intelligent systems

For example, Toshiba and IBM are working with the island and other companies to develop innovative ways in which demand and supply can be managed and controlled in order to maximise potential use of renewable power sources – something it is hoped will reduce emissions and waste, while at the same time cutting the Isle of Wight's fuel bills by up to 50 per cent.

Elsewhere, other initiatives include providing energy storage and clean fuel production in the form of hydrogen, installing solar power generation and heat pumps across community centres and social housing, a geothermal plant to generate energy from the hot water aquifer deep below the island, and a "Waste to

1994 Established the company's network of Global Materials Recovery Centers for IT product reuse and recycling to help reduce waste

1994 In partnership with nine other companies published the Public Environmental Reporting Guidelines for voluntary corporate environmental reporting

1995 Began publicly reporting the amount of IT product waste recovered and recycled annually by the company and its various sites around the world

1995 Was one of the first three manufacturing companies to participate in the US Department of Energy Voluntary Green Gas Emissions Reporting programme

GETTY IMAGES

EcoIsland: The Isle of Wight aims to be a beacon of best energy practice in England

Energy" scheme that aims to eradicate landfill completely.

Alongside this, facilitating solutions such as Toshiba's Energy Management Systems are being introduced. These bring intelligence into energy consumption as a means of optimising usage and improving efficiency. For example, the Home and Building Energy Management Systems can dim lights in empty rooms, delay the warming of a hot water tank or pause air conditioning. Meanwhile, Community Energy Management Systems collectively bring this capability together with distributed generation and storage devices to ensure the energy balance is maintained, while Micro Grid Energy Management Systems align this communal generation and load control with the underlying grid performance to ensure security of supply is maintained.

This is achieved, in part, through the Negawatt, which provides hypothetical negative energy consumption by reducing usage at a given point in time. As energy prices rise, as reliance on intermittent generation increases and network constraints become more prevalent, the Negawatt will provide a significant balancing tool and will, somewhat ironically, become a key part of our energy mix.

The above should enable the island to become energy self-sufficient, and will provide the rest of England with an action plan to its own smart energy systems.

That said, while much progress is being made, the aforementioned technologies are just enabling mechanisms. The real key to sustainability is the engagement of individuals, companies and communities.

For the Isle of Wight, this came in the form of the EcoIsland Partnership, a vibrant, enthusiastic entity that provided the focus, the heart and the drive to get this project off the ground. It was this partnership that brought the stakeholders together behind one common goal: to ensure the sustainability of the island while at the same time making a contribution to the low carbon aims of England as a whole.

Without partnerships of this nature, a smart community will not exist. Yet with current responsibilities for carbon reduction, security of supply and energy balancing spread between local authorities, National Grid, network operators and commercial organisations, one has to ask if EcoIsland will be a one-off, as it is currently less than certain as to where future community champions will originate. ●

Stephen Stead is business development director, Smart Community and Solutions at Toshiba International

1995 Eliminated the use of hydrochlorofluorocarbons in development and manufacturing processes and prohibited their use in products

1996 Signed the first MoU with the US Environment Protection Agency to voluntarily report details of the company's perfluorochemicals emissions

1997 Introduced the Corporate Standard for Environmentally Conscious Design, which must be applied to all IBM products across the board

1997 Began publicly reporting the environmental expenses versus the estimated savings related to IBM's environmental programmes

GETTY IMAGES

Electric vehicles such as this one have a key role to play in the decarbonisation of the economy

2003 Participated in the Carbon Disclosure Project, the largest database of primary corporate climate change information, every year since its inception

2003 Was the first company to report on the recovery of, and recycling of, £1bn worth of technology products and product waste

2005 Received the top ranking in the Environment Index, as published by UK charity, Business in the Community, for the fifth consecutive year

2006 Established its second generation emissions reduction goal, building on results from 1990 to 2005, when 4.3 billion kWh of energy was saved

SMART CARS

Will electric vehicles ever realise their full potential?

The long road ahead

By Becky Slack

The UK government's commitment to reducing carbon emissions is well documented. Through a range of measures – with the caveat these measures must be practical and affordable – it is hoped an 80 per cent reduction in emissions will be achieved by 2050.

Meeting this objective will be no mean feat and will require all industries to participate, including the transport sector, which will need to be almost entirely decarbonised over the next four decades. The fact only 0.03 per cent of cars on UK's roads are electric shows how far there is to go before this will be achieved, however.

To help promote uptake of ultra-low emission vehicles, such as electric, plug-in hybrid and hydrogen-fuelled cars, the government has announced £500m of funding, including purchase incentives, for example, up to £5,000 towards the cost of a car; exemption from London's Congestion Charge; and £30m towards the cost of electric vehicle (EV) charging infrastructure around the UK.

Maximum impact

There are a number of issues which many believe need to be resolved before the full potential of EVs can be met. What impact will the increased demand for electricity have? Where will cars be charged if owners don't have off-street parking or need to refuel away from charge points? And do the environmental benefits really stack up?

Addressing the issue of increased demand first, this is something the government, energy and IT companies hope will be resolved by the smart grid (see pages 4, 7 and 8 for more on this). "The ability to scale-up new infrastructure as vehicle numbers increase, and to ensure consistency and security of supply, is to be of critical importance," said IBM in its white paper, *The Shift to Electric Vehicles*. For example, the ability to manage thousands of individual payments will be key.

Advances in technologies will also serve to answer questions around the practicalities of recharging. Already EVs can be charged from domestic powerpoints, but compatible battery systems will enable retailers, garages and breakdown companies to assist with refuelling.

A 40 per cent benefit in CO2 savings could be made per family

However, as with so many of the ideas for smarter energy systems, one of the real challenges will be to shift people's mind sets. The current "fuel-and-forget" mentality will need to change so drivers are mindful of the distance limitations of EVs (currently about 100 miles per "charge"). Warning signals, just as those provided by a fuel gauge, will also help.

Finally, the environmental issues: There has been much debate about how EVs may simply shift emissions from the road to the power station. However, this view is countered by the Department of Transport, which says a 40 per cent benefit in CO_2 savings could be made when comparing an EV with a typical family petrol car over the full life cycle, while "larger reductions can be realised over time if the UK moves to lower carbon sources of power generation". This is partially achieved by EV's potential to reduce greenhouse gases extending to other pollutants, including particulates from diesel smoke and brake dust from friction braking.

Another indirect environmental benefit of EVs is that once "hooked up" to the smart grid, these vehicles could become a "vast ready-made repository for energy", particularly for intermittent sources such as wind power, which currently cannot be easily stored. Success, however, will be dependent on the right architecture, plus the ability to deliver systems integration on a scale that has not been seen before.

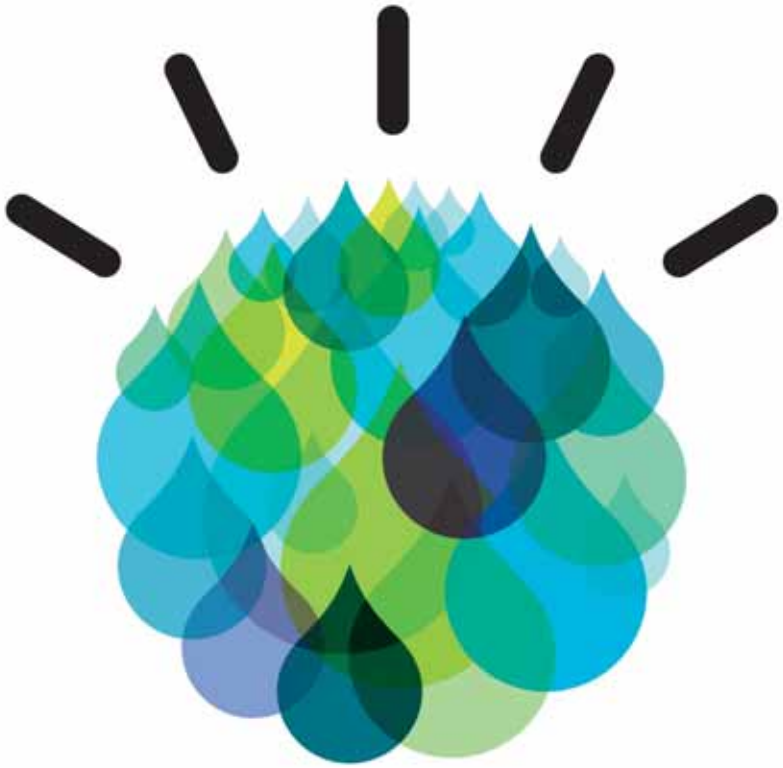
Getting the EV strategy right has huge implications for the UK – not only for the environment, but for the economy and society as a whole. The key to its success will be the energy and transport sectors' ability to respond at speed and at scale. Failure to do so may prevent turning that vision into reality.

2007 Prohibited the use of polyvinyl chloride in IT system enclosures and banned the use of tetrabromobisphenol A as an additive flame retardent

2007 Stopped using perfluorooctane sulfonate and perfluorooctanoic acid in new IBM manufacturing, development and research processes

2008 Initiated and launched the Eco-Patent Commons with the World Business Council for Sustainable Development, Nokia, Pitney Bowes and Sony

2010 Established the requirement that all IBM suppliers set environmental goals and management systems, and disclose their performance



Smart water for a smarter planet.

Around 70% of our planet is covered by water. But less than 3% is freely available as fresh water, and its uneven distribution brings floods to many, while leaving a third of the world without clean drinking water.

Despite the UK's reputation as one of Europe's wettest places, climate change figures suggest a 15% fall in river flows by 2050. Add the 3,500m litres leaking daily from our ageing infrastructure, and 2m of us could be without a reliable supply for many months each year.

This is serious - just to meet current demand, the water industry collects, treats and supplies 17bn litres a day, while processing 16bn litres of wastewater. Meanwhile, a growing population is expected to need 5% more water this decade - 15% more by 2030 - and even more investment in waste water treatment, asset repair and replacement.

Fortunately, we can address these challenges. In a more intelligent, interconnected and instrumented world, we can manage water like the complex ecosystem it is; we can make water smart.

Technology can bring together regulators and environmentalists, water companies and consumers. Sensors and domestic meters can instrument the existing infrastructure, providing a single, real-time view of water quality, availability and usage patterns.

This will help consumers use water more smartly and cheaply, and enable water companies to predict and optimise changes in supply and demand.

With advanced weather forecasting, topographic modelling and predictive analytics, we could anticipate flood, drought or pollution. We could say how urgently we need to respond, which areas might be affected, and which tactics to employ.

Smart water is already happening in Galway Bay, where overlapping communities such as industry, tourism and government agencies are working together through the SmartBay sensor system that gives real-time, online information to stakeholders in the Irish maritime economy.

In Israel, IBM is working with water authorities to use the 27,000 meter readers in one city to create a smart water system for its 100,000 inhabitants. Data, collected every 15-minutes and continuously analysed, can reveal over-consumption, leakage and metering problems at city-controlled institutions. Water users can modify their usage, and the authorities, using forecasting algorithms based on the usage patterns the data reveals, can plan for future needs.

By making water smart in ways like these, we can make our water industry more effective, secure supplies for the future, and respond to extremes of weather. So let's do it. Let's build a smarter planet.

ibm.com/smarterplanet/uk/water