All change with low-carbon energy

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Revolution is in the air! Or in the case of sustainable energy, a series of revolutions in low-cost renewable power production, battery storage technologies that hold spare green watts, major "Internet of Energy" efficiency gains and vital innovations with UK and global sales potential.

Energy boost

Carbon-based energy is not our greatest friend. For two centuries. coal, oil and gas have powered industry. Today, their "dirty" legacy is poor air quality, persistent pollution problems and one of our greatest environmental threats – global warming.

Fortunately, there are solutions. A series of exciting developments are coming together "in the nick of time". But to work they need our active participation at a personal, business and industrial level.

Farewell fossil-fuels

Fossil-based energy still underpins many of the transport, heating, lighting and the manufacturing systems that make society tick. In an odd twist, technology based on semi-conductors is increasing the short-term problem; huge backbone computers produce vast amounts of unwanted heat. The answer is likely to be found in new semi-conductor materials that work at, or near to, room temperatures. Meanwhile, the race to develop them highlights the urgent need for innovative energy-related products, services and gizmos!

However, Low Carbon Programme team members are already working closely with regional companies of all types and sizes to review, improve, and some cases replace, existing energy systems for sound environmental and commercial reasons. We'll look at that first and how their work feeds in naturally to the sustainable energy revolution – or revolutions.

First steps … and upwards

A basic energy review is often a good starting point. Firms already working towards – or upgrading – their ISO 14001 (environmental) and ISO 50001 (energy) compliance to international management system standards will already be familiar with the need to identify aspects, linked impacts and well-thought-out mitigation measures needed to maintain continuous improvement.

However, if the ISO concept still seems a somewhat alien, don't worry. You are very welcome to join the programme's ISO 14001 and ISO 50001 masterclasses. Do please contact us for more details.

The first steps are usually quite basic. They can involve switching off lights, unused machinery and constant heating sources. They also include reviewing transport arrangements and waste and procurement policies. In addition, many firms are able to pinpoint inefficient industrial processes that can be improved. Replacing old plant and equipment is often a sound long-term investment.

Importantly, the team can also put you in touch with "green" energy suppliers to benefit from reliable low-cost power – solar and offshore wind sources, plus biomass, hydropower, anaerobic digestion energy-from-waste and the emerging hydrogen economy.

And that takes us to the first revolution.

The world' largest on our doorstep

By happy coincidence, since 6th September 2018 we have had one of the world's largest renewable energy resources almost on our doorstep.

At a cost of £1 billion, and standing twice as high as the Elizabeth Tower – often called Big Ben – which is the highest point of the Houses of Parliament, 87 new wind turbines reaching 198 metres / 623 feet into the sky now form the Walney Extension. They cover a 55 square mile (145km^{2-}) marine site off the Barrow coast roughly equivalent to 20,000 football pitches. Along with 102 exiting turbines, Walney Extension is now officially the world's largest wind farm. Producing 659MW, it can power 600,000 homes. For comparison, the world's second largest is China's Gansu Wind Farm; the Thames estuary London Array takes third place.

Wind and solar prices fall

There has been a dramatic fall in UK offshore wind energy prices over the last half decade. A 2017 report from the Offshore Wind Programme Board (OWPB), which manages the UK seabed for The Crown Estate, showed sector costs had fallen by 32%

from £142/MWh in 2012 to £97/MWh in 2016. Technical advances, larger turbines – 7MW and 8MW turbines are now standard – more competition and lower costs of capital were given as reasons. The Government's 2020 target of £100/MWh was also broken four years early; costs are expected to fall by a further 24% to 30% by 2030. with £57.50/MWh to come. Reuters says the UK's investment in offshore wind since 2010 totals more than £9.5 billion.

Solar is doing well too; installed PV capacity in January 2018 reached 12.8 GW across 939,872 installations, according to the Department for Business, Energy and Industrial Strategy. This is equal to eight new-generation nuclear reactors and can power 3.8m homes – making the case for more nuclear power shakier by the day; not to mention the waste issue!

As a result, in April 2018 the UK was able to go for three days with zero coal-power, a number that will continue to rise. March figures showed that renewables account for nearly 30% of energy output; the UK now meets more than 50% of its energy needs from renewables on an increasing number of days. In fact, we are well on way to this figure rising regularly to 100%. At that point, will we be forced to stop generating? Fortunately, no, due to another energy revolution.

Energy storage

We can continue to generate from renewables when the going is good if we take full advantage of the recent rise and rise of advanced battery technology.

Batteries are set to change our lives. Not AAA pocket-sized batteries. But batteries large enough to store the spare renewable energy needed to iron out peak-time grid fluctuations at one end of the scale, and small enough at the other to hold locally-produced green home and business energy.

Just two years ago, modern battery technology barely existed. Today, the challenge is to find out how energy storage innovations can be introduced successfully to individual homes, streets, neighbourhoods, schools, hospitals and other public buildings – the residential areas and town centres where the grassroots low-carbon revolution is changing the behaviour of individual people.

Some traditional power stations are turning themselves into modern energy centres. Tilbury B power station in Essex could build a 100MW battery as part of its conversion from 'dirty' coal to a gas-firing and evolution into the Tilbury Energy Centre. Yorkshire's Drax generates some 6% of Britain's electricity and has plans to construct a 200MW industrial-sized battery to add operational value and flexibility as it adjusts its bio-mass burning strategy.

On an intermediate-scale, 49MW batteries have been built by Centrica at the old Roosecote power station site near Barrow and EDF at West Burton power station in Nottinghamshire. Statera Energy's has its "49.99"MW Pelham battery storage project near Bishop's Stortford in Hertfordshire.

Innovative battery technology is also central to the Government's new road transport policy based on a long-range, fast-charging electric vehicle (EV) revolution.

Smart energy

And then there is technology. Technology supports the energy revolution(s) in three key areas – decarbonisation, decentralisation and also digitisation. Millions of homes and businesses with roof-top solar panels and micro-wind-turbines will in future be able make, store, use and sell their own low-cost green energy. Many will use smart appliances too, such as washing machines that can be programmed to switch themselves on/off when energy demand is low and cheap, often at night.

The Internet of Energy (IoE) is the link that will make it possible for them to trade their spare energy at peak times when demand and prices are higher to the national grid and fast-emerging local energy grids. Similarly, if necessary they can buy energy when prices are low.

Making connections to the system, managing millions of new small supplier/buyers efficiently and in parallel maximising new opportunities in the vast quantities of energy data from so many new sources and smart devices, underlines the critical role of digital technology.

Hydrogen economy

The hydrogen revolution is also gathering speed. Hydrogen itself is not a primary energy source per say but an energy carrier – it has to be produced or isolated before it can be used as a combustible fuel or in fuel-cells. However, whichever way hydrogen is used to produce electrical energy, its only by-products are safe water and oxygen.

Again, very fortunately for us, a major development is taking place in the North West where hydrogen on a commercial-scale is being stripped out of the methane source known as natural gas.

What happens to the carbon? It will be sequestered permanently underground in one of the UK's first Carbon Capture, Utilisation and Storage (CCUS) projects. Earlier this year, energy and industrial strategy minister, Claire Perry, made a point of stressing the UK's urgent need for a workable CCUS technology that can not only help to meet the UK's ambitious 2050 carbon reduction targets but also has significant export potential.

The project being pioneered by HyNet includes the development of a new hydrogen pipeline. The company says the North West is an ideal location because its concentration of industry, technical skill base and unique geology "offers an unparalleled opportunity for a project of this kind".

Dyson award for urban wind turbine

Small is beautiful too. A new-type of low-cost turbine developed by Nicolas Orellana and Yaseen Noorani at Lancaster University to capture wind from any direction has won the UK's 2018 James Dyson Award. Their highly-flexible O-Wind Turbine fitted to the side of buildings is designed to work in swirling winds for cities struggling to provide renewable energy for expanding urban populations.

Unlike tall wind farms out at sea that only capture horizontal wind, the O-Wind can capture multi-directional winds around large buildings and other complex infrastructure.

As Yaseen Noorani explains, "If we could find a solution that caters for the half of the world's population who live in cities, we could give these people an opportunity to generate their own energy and contribute to the environment".