

CLEAN TECHNOLOGY



Turning up the power

Government is pinning hopes on clean technology to create jobs and foster new businesses but the incentives for companies to act are changing in hard times explains Sarah Murray.

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As recession starts to bite, some wonder whether the recent focus on clean, green technologies will fade. Paying lip service to green initiatives - so called 'Green Wash' - is arguably easier than sustained, long-term commitment to difficult choices.

For instance massive investments will be needed before a greater proportion of renewable energy can be integrated into the world's power systems. Unlike traditional sources of energy, whose generation plants are located where there is access to transmission lines, renewable power companies have to site their plants where the wind blows or the sun shines.

Fortunately for those who worry that momentum for change is being lost, the pressure for business to take action is growing from legislators while in times of economic difficulty more companies realise that investing in clean technology can not only make their businesses more effective, it can also save them money and offer opportunities to develop new products and services.

Pressure from shareholders, Government and consumers is mounting on business to clean up its act.

Price volatility and geopolitical instabilities in the energy sector mean finding a more stable, diversified supply of energy is critical.

And while the current consumption of alternative fuels remains tiny compared to traditional sources of energy, several renewable sources are becoming part of the mainstream energy supply, with wind power starting to compete with coal and gas in some places and strong solar power industries emerging in US states such as California and New Jersey and in countries such as Germany and Japan.

Entrepreneurs around the world are coming up with innovative new ideas from paving roads with solar panels to turning algae into biofuel.

Accommodating the new forms of energy will mean creating new networks of transmissions lines, some-

thing the administration of President Obama in the US has highlighted, with the economic stimulus bill including funds for the building of electricity transmission lines.

As governments around the world contemplate ways of re-booting their economies, several are examining the potential for "green jobs" to generate employment.

Venture capital and private equity investment has taken off in the past couple of years, rising from an average per quarter of about \$1bn in 2005 to more than \$4bn in the last quarter of 2008, according to VB/Research. As consumers look to business for action on climate change and the environment, there are

also opportunities for companies to tap into the demands of eco-shoppers. And, according to the 2008 report from the UK's Co-operative Bank, the downturn will not dampen the consumer appetite for green and ethical products. The Co-op found that the ethical market in the UK was worth £35.5 billion in 2007, up 15 per cent from £31 billion in the previous year.

This is the kind of news businesses like to hear. For with consumers and governments behind them, forward-thinking companies recognise the potential of clean tech products and services to boost revenues and create jobs, providing a reason for cheer amid the global gloom.

United States policy

The new administration is making changes that will improve clean tech prospects while in Europe new laws are coming in. **page 6**

The Greengobla

The recession creates extra complications for start-ups but one is finding a way forward by offering local authorities huge savings. **page 13**

The Malta connection

A smart power system gives the sunshine island an energy first as it introduces a new way of managing its supplies. **page 12**

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A guide to renewable energy

In Brief

Workable solutions to the problems of harnessing the sea, the wind, the sun and natural products to produce energy have been hard to find. The good news is that systems are now coming into service and teething problems are being solved. We look at UK and world progress in key sectors.

Energy from the sea

The UK Marine renewable energy industry is world leader however the sea remains a vastly under utilised resource, one in which the UK is abundant. Europe holds between 20 per cent and 30 per cent of global tidal resources and the UK holds 50 per cent of Europe's tidal stream resource and 35 per cent of its wave energy resource.

Tidal Energy involves using the large movements of oceanic water to generate electricity. This can be split into tidal stream and tidal flow.

Tidal stream devices harness energy by using horizontal turbines mounted on the sea bed, similar to an underwater windmill.

Tidal flow devices use turbines in a barrages or lagoons to harness the energy from the ebb and flood of the water.

At present there are five tidal energy installations operating in the UK but only Marine Current Turbine's 1.2MW Seagen device, deployed in



Edinburgh based Pelamis Wave Power has built a wave generator off the coast of Portugal

Strangford Lough, Northern Ireland, is grid connected and operating commercially.

Plans to build a tidal barrage across the Severn Estuary are presently subject to a public consultation considering the shortlist of five schemes that

could be deployed. Such an installation could potentially provide up to 5 per cent of the UK's electricity.

Wave Power involves using the movement of the waves on the surface of the sea to harness electricity. A number of wave energy devices are installed across the UK but only Wavegen's 500Kw Limpit device is operating commercially.

Pelamis Wave Power Ltd, an Edinburgh based company, is a world leader in wave generators deployed at sea and have deployed their 2.25Mw wave energy farm off the coast of Portugal. However in February utility giant E.ON made the first ever order for a Pelamis wave generator to be deployed in the UK.

Tidal and Wave energy is a more predictable energy resource compared to wind energy and has a predictable energy schedule. It is also less visual than wind farms but concerns over other forms of environmental impact must be taken into account alongside possible conflict with other sea users such as shipping, leisure, fishing and dredging.

Wind energy

Generation of electricity from wind is now one of the fastest growing sources of renewable energy worldwide.

Wind energy has been harnessed for over 6,000 years, first for powering boats, windmills and wind pumps, and now for generating electricity. Modern wind equipment ranges from small chargers to large multi-megawatt wind turbines, arranged in wind farms supplying power to the electricity grid. Worldwide, there is over 25,000MW of installed capacity, mostly in Europe

and the USA. Recently the EU Council of Ministers indicated strong support for plans for an EU super grid in the North Sea, comprising of an electrical grid of offshore wind farms, as part of the EU Energy Action Plan 2013 to 2020.



Small-scale and on-site renewable energy

On-site Renewable energy installations provide renewable heat and power provision for buildings, developments, estates and communities. Although these technologies are commonly used for on-site power and heat generation they can also be used on a larger scale. Micro wind turbines, ground source heat pumps and air source heat pumps are also used on-site.

SOLAR POWER

Solar power converts sunlight into electricity or heat energy.

Solar Photovoltaic's or PV uses photovoltaic cells to convert daylight into electricity. Solar PV could, in theory, provide 10,000 times more energy than the world currently uses. UK utilisation of this technology is minimal with 8,000 installations compared to 1.6 million in Germany. However the global increase in energy prices and changes in legislation means solar PV is an increasingly more viable option. The UK Energy Act 2008 provides enabling powers to introduce a renewable energy production tariff by 2010. The introduction of a similar tariff scheme in Germany saw the cost of PV installations halve.

Solar thermal uses energy from the sun to create hot water for use in buildings. It is the most prolific renewable technology in the UK



with approximately 90,000 installations currently fitted. Typically panels of a 3-4 square metre area will produce up to 70 per cent of the hot water demand of a three person household.

Solar thermal and PV panels are used on-site for both new-build and retrofit installations. Solar PV can also be used in large arrays of grid connected panels.

BIOMASS AND BIOGAS

Biomass, Biogas and Bio-liquids can provide heating, cooling and electricity across all the size ranges, from space heating stoves through to large power stations. Biomass and Biogas is the term used for organic substances or gases derived from non-fossil animal or vegeta-

ble matter. Biomass is accepted as carbon neutral on the basis that the carbon released in the burning process is effectively equal to that which is absorbed when the biomass is grown (for vegetable matter). The most common form of biomass is wood, which can be burned in the form of logs, pellets or woodchip. Appliances range from 60 per cent to 90 per cent efficient, with varying levels of automation from manual feeding to full automation.

BIOLIQUIDS

Bioliqids are used for heating oils, while biogas can be used for electric generation or feeding into the gas grid.

At present the UK biogas industry is underdeveloped but offers a major opportunity for dealing with the millions of tonnes of organic waste produced each year. A recent National Grid study indicated that upgraded green gas injected into the grid could provide almost half the UK domestic gas heating requirement by 2020.

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Tiger, tiger burning bright: when the bank is nationalised and the taxpayer paying the electricity bill, red, white and blue lights blazing through the night on top of a city tower suddenly look so 20th Century.

Last one out, turn off the lights

Some of the biggest wins in the battle against climate change will be made by taking energy efficiency measures, says Sarah Murray.

When it comes to talk of clean technologies, much attention is focused on developing renewable and sustainable sources of energy but many argue that in the fight against climate change, the easiest and most obvious options—bringing fast results at relatively low cost—are improvements to the efficiency of the systems we already have.

A recent report by McKinsey identifies the potential gains from taking measures to improve energy efficiency. The report

claims that, if all the measures it identifies in the research were taken, the global growth in electricity demand between 2005 and 2030 could be cut from 2.7 per cent per year to about 1.5 per cent.

Some of the areas that hold greatest potential for emissions reduction—such as upgrading aging power generation infrastructure—require government action as well as private sector participation.

However, business has an important role to play too. Measures companies can

take include improving the insulation and efficiency of heating and air-conditioning systems of their buildings, re-designing products and manufacturing processes to consume energy, switching their fleets to hybrid vehicles, and cutting back on corporate air travel.

Here, technology can help. Systems such as Cisco's TelePresence—where high quality surround-sound audio, large plasma monitors and matching décor in different locations—has dramatically improved the nature of virtual communica-

tions, helping companies encourage their executives hit the road less frequently, saving both carbon emissions associated with flying long distance and on the costs associated with air travel.

By optimising heating, ventilation and air-conditioning systems for its customers in over 6,500 buildings around the world Siemens says it has saved them around £900,000 and reduced CO2 emissions by 2.4 million tons.

"It is possible to cut carbon emissions and operational costs at the same time," argues Juergen Maier, Siemens industry sector managing director.

But for green principles to work and generate real cost savings they must be incorporated into every infrastructure within an organisation—from communication to energy, buildings, transport and the manufacturing processes, he warns.

"Instead of focusing on separate financial and environmental strategies, they should drive each other," says Maier. For manufacturing companies, while fuel efficiency in delivery fleets is part of the picture, there is a further step to be taken—by going back to the drawing board. At the design stage, products can be re-configured to consume less energy during the manufacturing process.

"There are simple things like reducing the amount of fixtures and fittings and taking out a lot of different types of materials," says Jenni Rosser, head of the clean design team at Envirowise, a UK government-backed consultancy. "You can identify massive cost saving opportunities there."

Moreover, manufacturers can reduce the energy used when a product is in the hands of the consumer. Marks & Spencer, for example, has worked with its suppliers to come up with a range of clothing that does not require dry cleaning and that can be washed at lower temperatures, conserving energy.

For this to happen, Ms Rosser stresses the need for industrial designers to communicate more regularly with operations managers and production managers. "The designers often not have met the production or marketing people," she says. "But you need to get everyone together looking at the bigger picture so you can identify cost saving opportunities while you're talking about how to make products greener."

With the world's buildings thought to contribute up to 40 per cent of the world's carbon emissions, corporate offices, warehouses and facilities are also prime targets for energy efficiency measures. And while new green

buildings such as Bank of America's Manhattan headquarters have captured the headlines, the real challenge is upgrading existing structures.

"Refurbishment is the forgotten angle around buildings," says Mark Williamson, director of innovations at the Carbon Trust, an independent company funded by government to help accelerate the move to a low carbon economy. Dr Williamson points out that 40 per cent of the buildings that will still be standing in 2050 pre-date the UK's 1985 regulations on energy performance. "So existing buildings are a massive part of the emissions problem and are harder to address than new buildings."

Nevertheless, simple measure can pay off when it comes to improving the energy efficiency of buildings. Tesco, for example, says it has halved the amount of energy used in its stores per square foot by investing in equipment such as energy-efficient fridges and ovens and ensuring lights are not left on and doors are closed to conserve heat or cooling.

"The areas you tackle most quickly are the things that give you the most gain," says David Hitchcock, managing director of CB Richard Ellis's building consultancy. He cites lighting and the opportunity to introduce low energy bulbs and lighting control systems. "That's a quick win without having to think about the building fabric."

At the same time, companies should look for opportunities to introduce new systems into their office and facilities when they are making other changes to the building. "At regular intervals companies may replace equipment or do some re-branding and change the look and feel of the building," says Dr Williamson. "That's the perfect time to identify cost effective ways to improve energy performance."

Moreover, introducing new energy efficient equipment is only part of the process. "There's a big gap between the possible performance of buildings and what we actually find in practice because energy-related systems are often not installed or used correctly," Dr Williamson explains. "So it's not just about the kit—it's about how you use and integrate the kit."

Moreover, introducing new energy efficient equipment is only part of the process. "There's a big gap between the possible performance of buildings and what we deliver because systems are not optimally installed or are mis-used," Mr Williamson explains. "So it's not just about the kit—it's about how you use and integrate the kit."

CASE STUDY: GREEN LIGHT FOR EXPANSION OF ENERGY FROM WASTE GASIFICATION

Advanced gasification technology is set to provide the UK waste industry with a viable alternative to incineration after qualifying for maximum support under the Renewables Obligation.

There are a number of emerging technologies in this sector, but the problem is finding one that is commercially proven and, critically, bankable.

In Europe, UK-based Energos offers the only proven and commercially viable gasification technology capable of generating renewable energy from municipal waste and

post-recycling residue. The company has a nine-year track record and 400,000 hours of safe, ultra low emission operating experience at its six Northern European facilities.

It has just opened the UK's first gasification plant on the Isle of Wight under Defra's New Technology Demonstrator Programme. This is the first time that advanced thermal conversion technology has been applied to a UK municipal waste stream and it is the only such energy from waste process that has preliminary accreditation for Renewables Obligation Certificates.

Energos, part of sustainable power group ENER-G, is rolling out its advanced conversion process across the UK and will start construction on new facilities in Scotland and Lincolnshire later this year—with further developments planned in Merseyside, Derbyshire, and Sarpsborg in Norway.

A typical Energos plant generates 8MW of renewable electricity, sufficient to power 10,000 homes. It is designed to complement recycling initiatives and is a small scale model that can exist at the heart of the community. As such, facilities can be

sited next to energy consumers to ensure heat recovery, or in locations where a heat delivery or district heating system could be developed.

This meets the aims of the new EU Waste Framework Directive that encourages energy recovery, and household recycling rates of 50 per cent by 2020.

Worldwide, governments are seeking workable alternatives to landfill and new sources of renewable energy. This tried and tested alternative to incineration is attracting strong interest.

The answer my friend, is blowing in the wind

Far from being an 'alternative' industry, renewable electricity is booming and new development is starting to outstrip traditional energy sources in Europe and the US, offering opportunities for new jobs and investment. Alasdair Cameron reports.

Not consequential, was how the chairman of the world's largest oil company, ExxonMobil, described renewable energy in 2005. It is true that even then he seemed behind the times, but his remarks reflected an attitude that was still common in mainstream energy circles. Just a few years on and the situation is radically different. According to industry analysts New Energy Finance, global investment in new renewable energy reached an impressive \$155 billion in 2008, and politicians on both sides of

the Atlantic have been singing its praises as other industries collapse.

'It is encouraging to see that clean energy investment was so strong in 2008, despite everything going on in the world economy,' said Michael Liebrich, ceo of New Energy Finance.

Of the huge resources flowing into renewable energy, 62 per cent was for new assets such as solar installations, waste-to-energy plants and, especially, wind farms. So rapid has the development of wind power been that in 2008 it became the single largest source of new electricity installed in both the EU and the USA.

In pioneering countries like Denmark and Germany wind energy respectively accounts for around 20 per cent and 7 per cent of total electricity production, while at its current rate the USA will construct an additional 90 GW of new wind by 2020, theoretically enough to produce 70 per cent of UK electricity demand. Nor are the United States and Europe the only areas of rapid renewable growth. India and China have established themselves as some of the biggest adopters of these technologies, and have also started to emerge as major suppliers of renewable energy equipment.



The wind beneath my wings: by 2020 there could be 400,000 people employed in the UK wind energy business.

Alongside wind, solar too is booming, growing at an average rate of more than 25 per cent per year since 2000, thanks to a range of policy initiatives in Spain, Germany and the United States.

Even the traditionally conservative International Energy Agency (IEA) has begun to take the sector seriously, with some impressive growth forecasts.

According to Ralph Sims, senior renewables analyst at the IEA, 'our scenarios are showing 35 per cent of electricity from renewables by 2030, with most growth taking place in the OECD.'

The European Wind Energy Association estimated that more than 150,000 people were employed in the European wind energy sector, with this likely to rise to 377,000 by 2030.

'Most scenarios show significant growth over the next decade. Governments are realising the benefits. Things will move quickly,' said Ralph Sims.

Even in the United Kingdom, which has been slow to adopt renewables, more than 4,000 people currently work full time in wind energy. With experts here estimating that the sector will grow more than tenfold by 2020.

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Obama's stimulus package will promote clean energy development while in the UK there is nothing explicit but hopes are rising.

US changes tune

Support programmes for clean technology are springing up in the United States while in Europe they are making progress, reports Alasdair Cameron.

Few places greeted the election of President Obama with as much relief as the boardrooms and offices of the world's clean energy developers and researchers.

The Bush years had been hard to take. His refusal to engage with climate change held the US back for nearly 10 years.

The will-they-won't-they drama surrounding the yearly extension of the Production Tax Credit (one of the US's main renewable energy support schemes) created huge uncertainty in the market, with implications for the entire global industry.

The world-renowned National Renewable Energy Laboratory (NREL) was decimated in the early years of the Bush administration and has only now rebuilt itself. The fact that in the last two years the US had once again emerged as a world leader in some clean technology fields is testament to what more could have been achieved with a supportive government.

Now, at last, a change is in the air. One of President Obama's first acts after election was to declare that science would once again be at the heart of the US administration and his recently approved \$787 billion stimulus package contains important measures to promote the green economy.

'The US is keen to take the leadership of these technologies, as Germany has done for the last decade. They can see there are long term benefits to these investments,' said Ralph Sims, Senior Renewables Analyst at the International Energy Agency.

Despite some differences the House and Senate versions of the US stimulus were surprisingly aligned on the need to support clean energy, with more than \$90 billion spread across a number of programmes, including energy efficiency, renewable energy production tax credits, transmission grid upgrades and manufacturing. 'This bill is a critical down payment on long-term policies

needed to meet the President's ambitious renewable energy goals, enhance America's energy security, grow our economy and reduce global warming pollution,' said Greg Wetstone, senior director of the American Wind Energy Association.

But Obama's stimulus package is just one of a number of recent measures designed to promote clean energy development.

In Brussels, the EU has finally approved the ground-breaking Renewable Energy Directive, which sets a legally binding target of 20 per cent of total energy from renewable sources by 2020.

'It is an historic agreement,' said Christian Kjaer, ceo of the European Wind Energy Association. '20 per cent of energy means 33 per cent of electricity from renewables by 2020, up from 15 per cent today,' he continued.

Though the Renewable Energy Directive sets binding targets for the European Union as a whole, it is up to each member state to fulfil its individual quota, and so the horse-trading is underway to determine the exact cuts each country must make.

In particular there has been resistance to the Directive in many Eastern Euro-

pean countries who are worried it could constrain economic growth, although there has also been some support.

Former Romanian president Emil Constantinescu said that Romania had 'ambitious' renewable energy objectives but pointed out steps needed to be taken in order for it to succeed.

'It is necessary to canvas public opinion, to educate the people and to create sufficient economic and financial stimulus in order to induce a change in the people's behavior in favor of the long term use of renewable energy over conventional energy,' said Mr. Constantinescu.

In the UK, which has so far been slow to wake up to renewables, there have also been interesting moves. 2008 saw the introduction of the landmark Climate Change Bill, making an 80 per cent reduction in carbon emissions by 2050 a legal requirement, while on more than one occasion Gordon Brown has spoken about making the North Sea 'the Saudi Arabia of wind' – a reference to Britain having some of the best wind power resources in the world.

To this end, the government has increased the support available to offshore wind farms and marine renewables, both key future areas where the UK leads the world, while at the end of January the it released reports suggesting that there was scope for another 5000–7000 offshore wind turbines (on top of the 7000 MW already approved).

'There is nothing explicit in the UK's economic stimulus package for renewables as yet, although the support for car manufacturing could have some welcome knock-on effects for the renewables sector. However we're expecting further developments and more detail to emerge in the coming weeks,' said Gaynor Hartnell of the Renewable Energy Association.

With the UK's recent economic strengths beginning to look like weaknesses, the Government is under pressure to provide a vision for the future, and expectations in the clean energy sector are high that it is finally realizing that it must do more to help this industry.

Facilitating clean tech

Anne McIvor on the United Nations Environment Programme.

The United Nations Environment Programme (UNEP) addresses global environmental issues – of which climate change is one of the largest.

UNEP works with the commercial financial sector to provide investors with information around cleantech. One of its roles is to monitor where capital investment is going. It publishes "Global Trends in Sustainable Energy Investment" annually. According to the report, clean energy and renewable energy investment totaled some \$148 billion in 2007. 2008 numbers are not yet available but early indications show a decline of around 4 per cent. Given the state of the global economy, it appears inevitable that investment will decline again this year. However, Virginia Sonntag-O'Brien

from UNEP's Energy Branch is optimistic that the decline should not be too severe. Indeed, she anticipates a recovery in some sectors, notably solar, where overcapacity is bringing down prices and making the technology more widely available.

Much of the impetus this year is set to come from government stimulus packages. According to Paul Clements-Hunt, who heads the UNEP finance initiative, a global partnership between the UNEP and the financial sector, the clean/green or low carbon elements of government stimulus packages around the world amounted in value to some \$68 billion at the end of December. Clements-Hunt points out that these figures don't include the Obama stimulus package. UNEP

FI sees its role as facilitating policy co-ordination and will be working toward optimizing the value of this funding, to ensure that the benefits reach beyond the national level.

While the research undertaken by the organization is high profile, in terms of resources, the largest portion of UNEP's efforts are targeted towards emerging markets and developing countries. Cleantech offers significant potential to contribute to energy security and job creation but it is often difficult to roll out cleantech projects in developing countries. There is much progress in the larger emerging markets such as China, India, Brazil, however many barriers remain to the uptake of renewable energies around the world. One role of

the UNEP is to get the finance community more engaged in developing cleantech market opportunities.

Basic issues such as grid connection can be a challenge to rolling out renewable energy in developing economies. However, cleantech can offer scope for countries to by-pass centralized approaches and to move to a more distributed electricity generation model from the outset. For the UNEP, an important focus is bank engagement in developing countries. UNEP's Eric Usher points out that "Conventional fuels such as kerosene or wood fuels are pay as you go; in contrast, renewable energies such as solar panels require an up-front investment that few households can afford to pay for on a cash basis. The question is how to get banks financing these technologies."

Rolling out clean technologies around the world presents many challenges. The UNEP team are optimistic, however, that cleantech will contribute to economic recovery, in the developed world – and to economic development in emerging markets.



In China they have set tough targets on energy waste but here as in other parts of the world governments are finding it hard to turn good intentions into good results.

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Chinese whispers

Regulatory incentives and other government initiatives are critical in helping build new industries in the clean-tech sector, says Sarah Murray.

After a bruising year in which clean energy stocks fell by more than 70 per cent from the start of 2008, the WilderHill New Energy Global Innovation Index recovered by more than 45 per cent, something analysts at New Energy Finance say could be attributed to the "Obama bounce".

Whether or not the recovery of the index – which tracks the performance

of 88 clean energy stocks worldwide – was due to the inauguration in the US of President Obama - who has stressed his commitment to clean energy - government carrots and sticks are seen as instrumental in kick starting clean-tech industries.

And while debates continue over the merits of the various mechanisms deployed, most agree that government regulation plays a criti-

cal role in stimulating investments in clean technology.

"Its importance cannot be understated," says Mike Rosenberg, professor of strategic management at Spain's IESE Business School. "Government has a very clear role in direct subsidy or in putting in place mechanisms that create some kind of penalty costs for the undesirable effects of some of the traditional technologies."

In the energy sector, the range of regulatory tools deployed is wide. In the US, production tax credits give power generators tax breaks to invest in developing renewable energy sources. In recent years, these were set only for short periods of time, leading to uncertainties and boom-bust-style investment patterns.

However, they were renewed as part of the financial rescue package passed in October.

"Getting the market signals right and thinking long term has been a huge missed opportunity [in the US]," says Joel Makower, co-founder and principal of Clean Edge, a research and publishing firm focusing on clean energy markets and technologies. "Now for the first time, we have investment tax credits for wind and solar that go beyond one year – that's a big deal."

Elsewhere, feed-in tariffs – which guarantee a rate for energy derived from wind or solar sources for a specified period – have proved successful, particularly in Germany, where they have helped foster a strong solar power industry.

"The feed-in tariff from an energy development point of view is incredibly attractive because it's a fixed, known price for a long period of time," says Jonathan Johns, head of renewable energy at Ernst & Young. "These are long-term investments, so it's predictable and investors know what they're going to get."

However, subsidies can backfire. Many argued, for example, that the incentives given to US farmers to produce corn-based ethanol led to the development of a fuel that generates as many emissions as it eliminates and which, by turning over agricultural land to its cultivation, pushed up food prices.

Other mechanisms deployed by governments include Renewable Obligation Certificates (Rocs), used by countries such as Italy and

the UK. Purchased from renewable power generators, the certificates demonstrate that suppliers are deriving a required proportion of their energy from renewable sources such as wind or solar power.

Energy efficiency can also be encouraged by government incentives, says Louise Kingham, chief executive of the Energy Institute. "We have seen reductions in VAT and calls for the removal of VAT altogether on energy efficient products, for example."

Government targets can also send signals to business. In China, the government has set tough goals, aiming to reduce energy wastage by 20 per cent by 2010. It also wants 15 per cent of its power needs to be met by wind, solar and hydropower by 2020.

"We've got very well intentioned government officials," says Peggy Liu, founder of the Joint US-China Cooperation on Clean Energy, a non-governmental organisation working to accelerate China's adoption of clean technologies.

"We're tackling the problem in a completely different way – a way that makes sense in the Chinese context," Ms Liu adds. "That message doesn't get out to the western world but in fact China has become one of the most progressive countries in energy policy in the last two years. The China of today is not the China of yesterday."

Targets and incentives are not restricted to the energy sector. In the UK, requirements for buildings to have energy performance certificates provide incentives for owners and managers to upgrade the efficiency of insulation and heating and air-conditioning systems.

"That is a real opportunity for businesses and will be a point of differentiation in the immediate future," says Paul Toyne, head of sustainability at Bovis Lend Lease UK, the project management and construction company.

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Of course the real advantage of working with SmartestEnergy is the highest level of customer support throughout the whole of the energy supply chain. Our customers have direct access to a range of Energy Trading products and services, tailored to each individual requirement; whilst dedicated and experienced Account Managers together with the support of an expert operational team ensure that our customers receive service second to none.

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British projects come of age

There are plenty of sound economic reasons to invest in sustainable projects and businesses not to mention the positive effect on the environment, says Andrew Hore.

Whether green advocates like it or not, cash needs to be found for projects to be developed so they have to attract investors.

Ali Naini of Turquoise Capital says of potential sustainable investments: "It has got to make sense - it can't just be because it is a good idea".

It is not as simple as you might think to define sustainable. B&Q gained a lot of publicity back in 2006 by adding wind turbines to its product range. Little more than two years later it stopped selling them because in some cases they used more electricity than they produced.

“True sustainability is a broader concept than just building a wind turbine”

"Many companies now mention sustainability/eco-/renewable, but it is only a PR phrase", says Hadley Barrett of sustainable projects investor Oxford Sustainable Group.

"They do not consider sustainability from a 360 degree viewpoint. True sustainability is a broader concept than just building a wind turbine, bolting on a solar panel or building an energy efficient or passive house."

The interests of investors, customers and suppliers do not have to conflict.

A good example of a business where they have all come together is Wiltshire-based renewable electricity supplier Good Energy Group. No other UK company obtains 100 per cent of its electricity from renewable sources.

The company also generates some of its own electricity requirement.

Juliet Davenport is the driving force behind Good Energy. She worked on energy policy for the EU before starting the business, which has built up a consistent record of profitability.

Good Energy has more than 500 independent electricity generators supplying it with electricity. Many of these generators have only been able to finance the development of their projects because Good Energy provided a power purchase agreement that helped them to obtain bank finance.

Good Energy is even reviving the UK's oldest wind farm. The Delabole

has proved invaluable in its move into waste treatment and renewable energy generation.

Peter Mills, the commercial director of NES, says that in the late 1990s the management took a trip to the US to see the waste treatment technology on offer. "We realised that there was an opportunity to get into the sector early", says Mills. The landfill business was sold and the cash reinvested in the new operations. This was a brave thing to do but it is paying off.

Mills emphasises that NES finds technology that is close to market. It does not take on the risk of developing entirely new technology.

Mills believes that the knowledge base built up in the older business has been a positive for the new business. The ability to deal with local authorities and agree long-term waste supply contracts helps to underpin the investment in plants.

Doug Coleman, the chief operating officer of renewable energy group EnergyMixx, also believes that the company's experienced, multinational management team is a great help to the business.

EnergyMixx is currently focusing on the Italian market because it has the most attractive energy tariffs in Europe. EnergyMixx does not stick to one type of technology.

Coleman is interested in choosing the right technology for the right circumstances. He also believes in co-locating a number of technologies so that they can better utilise a particular site. For instance, solar for the daytime and wind for the night, possibly combined with hydro-based pump storage. "Synergistic linkage between renewable sources is a key to the future", says Coleman.

wind farm commenced operation more than two decades ago. The old turbines are being replaced with more efficient new ones. Electricity generation carries on and the phased upgrade should be completed in 2010. The wind farm will then be able to power 7,500 homes.

More than 25,000 homes and businesses already obtain their electricity from the company.

Good Energy shares are traded on the Plus-Quoted market in the UK and it has around 1,700 individual shareholders - 90 per cent of them are also customers.

EXPERIENCE IS IMPORTANT

New Earth Solutions has its origins in a landfill business and that experience



Picking green winners: the ideal investments make money and also provide a more sustainable environment

they can be profitable without subsidy but he believes that technological advances will make that happen.

PAYING OFF

Some clean tech projects and businesses are achieving excellent returns.

Oxford Sustainable Group has developed a 30MW biomass project in the Baltics which Barrett says has achieved a return of more than 100 per cent per annum. Another of its projects is a polyfunctional development on the Romanian Black Sea coast, which includes retail, hotel, commercial, residential and energy components. This is achieving a return of 58 per cent per annum.

Not every projector business will make these kinds of returns. Clean tech is like any other business. Not all investments will succeed. However, there are undoubtedly many opportunities to make money and provide a more sustainable environment.

Just like Eco Warriors do not need to feel guilty about making money from clean tech, private investors should not think that investing in cleantech is a way of subsidising the world. Cleantech is just like any other investment opportunity and has to be judged in those terms.

LEGISLATION

Legislation is a major driver of many projects, which may be good ideas but might never take off without that legislative push. This is particularly true in areas such as waste treatment.

Taxes, such as landfill tax, can also provide impetus for a market. There is diminishing landfill capacity, but the real short-term impetus for finding alternatives in the UK is the increasing landfill tax. Without the tax, the type of waste-to-energy and composting treatment plants designed and operated by NES would be much dearer than landfill.

Mills says it is now getting to the point where landfill, with the additional tax, is becoming dearer.

Subsidies also help to make investments profitable as can trading in carbon credits that can come with a project.

Coleman says that renewable energy sources "have to close the cost gap with conventional generation" so that

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Investing in green ideas

Recession may have made clean tech investors more cautious but the appetite for sustainable projects remains strong, says Sarah Murray.

Worsening conditions in the financial markets and lack of credit have had an impact on the clean-tech sector, with shares – particularly those of solar power and biofuel companies – taking a battering last year. The WilderHill New Energy Global Innovation Index, which tracks the performance of 88 clean energy stocks worldwide, fell more than 70 per cent in value from start of 2008 to its low in November.

Nevertheless, interest in the sector is still strong. While investment levels over the last two quarters of 2008 were down on the earlier part of the year, during the fourth quarter, the average was \$4.3bn, some 30 per cent ahead on 2007 levels, according to VB/Research, a firm that has been covering clean technologies and renewable energy since 2005. “Investment levels in comparison to any other sector have held up,” says Douglas Lloyd, chief executive of VB/Research. “The market is more cautious on valuations and management teams but it remains excited.”

Peter Linthwaite, managing partner of CT Investment Partners, which advises Carbon Trust Investments, believes that the long-term drivers behind clean-tech investing remain strong. “First, technologies that have been worked on for 40 years are getting to the stage of commercial application,” he says. “Secondly, all large companies have got the story in terms of the need for greater efficiency in energy consumption and thirdly, you’re seeing more regulation in a wide range of areas in favour of green policies.”

Alternative energy remains a major focus of venture capitalists and other investment funds. And a February survey of alternative energy investors and analysts found that, despite the global economic downturn, there was measured optimism in the sec-

tor. Fifty per cent of respondents to the survey – conducted by Waggener Edstrom Worldwide – the global communications agency, expected alternative energy stocks to outperform the broader markets in 2009.

Investors in the clean-tech sector range from specialist venture capital companies such as the US’s RockPort Capital Partners to companies that include clean-tech investments in a broader portfolio such as Amadeus Capital Partners and Balderton Capital in the UK or Kleiner Perkins Caufield & Byers, the leading Silicon Valley firm, which has a prominent green tech initiative.

Multinational companies are also part of the investment picture. Virgin Green Fund, part of Richard Branson’s Virgin Group, focuses on those working in the renewable energy and resource efficiency arenas and funds the expansion of companies that are deploying proven technologies.

CASE STUDY

Companies using a system devised by UK-based GreenRoad Technologies are not only reducing accidents but also cutting their carbon emissions. The system uses a combination of in-vehicle hardware, tailored algorithms and web applications that continuously rate and so help improve driving, which cuts fuel use.

With individual drivers using the system shaving fuel consumption by up to 10 per cent, companies with large fleets can generate substantial emissions reductions.

GreenRoad’s system – which is already being deployed by companies such as Metroline, the UK bus company, and T-Mobile, the mobile phone operator – is just one of a huge range of innovative ideas designed to address climate change and conserve natural resources – while also making money. And despite the global downturn, many believe that the clean-tech sector still holds potential for both start-ups and their investors.

“In terms of making a successful business, you have to find a way to help your customer and in this case it’s helping them saving money as well as having a positive environmental benefit,” says Pat Burtis, who leads clean-tech investing at Cambridge – and London-based Amadeus Capital Partners, which is backing GreenRoad Technologies.



Algae rhythm: Carbon capture company Origo Industries is feeding carbon to algae which generates biofuel and after it is used the carbon is fed back to the algae in a virtuous circle.

Among Virgin Green Fund’s companies are Metrolight, a Tennessee-based enterprise providing energy efficient lighting to industrial, commercial and municipal clients, and Gevo, a Colorado-based company that is developing and commercialising advanced biofuels made from sustainable resources such as cellulosic sugar.

General Electric – whose Ecomagination initiative, launched in 2005, is funding the development of environmentally sound technology in everything from aircraft engines to light bulbs – is also putting money into companies with innovative ideas.

Through its GE Energy Financial Services unit, for example, it is among the investors backing Advanced Electron Beams, whose technology – deployed by traditional manufacturers – uses electrons to initiate chemical reactions or break chemical bonds more efficiently than existing thermal and chemical approaches.

The range of focus followed by clean-tech investors is as wide as the technologies being developed. Some are putting their money into companies with ideas and technologies that tackle climate change by turning to renewable fuel sources while others are investing in enterprises that are finding ways to lower carbon emissions through energy efficiency.

And as well as proven technologies and alternative energies that are moving into the mainstream, such as wind and solar power, clean-tech investment money is also being directed towards cutting edge ideas.

In the US, for example, Solar Roadways believes that roads could be used to collect and store solar energy that

could be used in homes and businesses. A scheme from Climos, a San Francisco-based start-up, envisages distributing across the oceans iron powder, which encourages the growth of plankton that store carbon and would sink to the ocean floor, sequestering the carbon.

While recent years have seen the emergence of dozens of innovative ideas for new forms of energy, energy storage and energy efficiency, Mr Lloyd believes that really edgy technologies and concepts will, in the worsening economic climate, struggle to get off the ground without clear business plans.

“However, there are a lot of very clever businesses out there,” he says. He cites the example of Cheshire-based Origo Industries, a carbon capture company that is developing algae-based technologies.

“They’re using the carbon they’ve sequestered to feed the algae, which allows them to generate biofuels, and when the biofuels are used, the emissions are captured and fed back in to feed the algae in a virtuous circle,” Mr Lloyd explains. “That’s an example of a company that has looked for multiple ways to generate revenues, which is critical, and an example of the innovation out there in third generations biofuels sector.”

PROMOTIONAL FEATURE

Waste today, energy tomorrow



With over 30 per cent of the UK’s power station capacity set to close by 2020 we need to build new generating capacity urgently.

Wind, wave and solar have a vital role to play in the energy mix but waste also provides a valuable local and secure resource. Sending waste to landfill is no

longer sustainable. It is expensive and polluting. However, residual waste has the potential to generate 10-15 per cent of the UK’s power, making energy from waste a compelling alternative.

At Advanced Plasma Power (APP) we have developed the Gasplasma process, an innovative combination



of existing technologies to transform waste into a very clean hydrogen rich gas. This ‘syngas’ can be used in gas engines, turbines and fuel cells to produce power as well as a chemical feedstock for liquid fuel production.

Unlike existing thermal processes, Gasplasma incorporates a plasma arc process that not only cleans the gas and destroys pollutants like dioxins, but also simultaneously vitrifies the ash into a recyclable aggregate. This results in minimal residues and very clean emissions.

Plasma processes have traditionally required significant power input but

using it in combination with a fluid bed gasifier, dramatically reduces the power required. This allows up to 70 per cent of power from an APP plant to be exported, achieving industry leading efficiencies.

An APP plant offers a commercially viable, local scale and clean solution to dealing with household waste with a low environmental and carbon footprint. It will provide steady, base load power and cost less than conventional waste facilities.

Andrew Hamilton
www.advancedplasmawaste.com

Downturn opportunities for the industry big boys

Jon Mainwaring looks at how the credit crunch is set to drive consolidation within the clean tech sector.

The clean technology industry may be a sector destined for huge growth over the coming decades, but it has not been immune to the recent credit crunch. No matter what method you use to measure it, clean tech is suffering a downturn.

Share prices of listed clean tech companies were badly hit during 2008, as demonstrated by the sharp falls seen last year in stock market indicators like the Dow Jones World Sustainability Index (down 43 per cent) and Germany's ÖkoDAX clean tech index (down 62 per cent). Initial public offerings were also down, with London's Alternative Investment Market – a key destination for small clean tech companies from around the world in recent years – seeing only two clean tech IPOs last year compared with 18 in 2007.

According to a recent report from consulting firm PricewaterhouseCoopers, the credit crisis has affected mergers and acquisitions in the renewables sector. Although the number of M&A deals increased from 207 in 2007 to 234 last year, the consulting firm says the value of such deals fell from \$43.4 billion in 2007 to \$26.8 billion in 2008 (a fall of 38 per cent).

That the average size of an M&A deal in the renewables sector has fallen sharply, while the number of deals has increased, suggests bigger players in the industry are taking advantage of the weakness of smaller companies that are having problems arranging debt with banks or equity with investors.



Richard Brook's gateway2investment programme aims to help early-stage firms to find equity investors.

"There's not as much money washing around now as there was 18 months ago," says Ronan O'Regan, a PwC director with responsibility for energy and utilities. "So I would say that the bigger players who are less capital constrained are in an advantageous position."

One set of beneficiaries of the credit crisis should be traditional engineering groups that want to make strategic moves into clean tech. An example occurred last year, when German industrial giant Robert Bosch bought Ersol Solar Energy – a manufacturer of solar cells.

But the clean tech industry's own behemoths will also be looking to snap up bargains among the junior companies within the sector, according to solar industry expert Ted Sullivan.

Sullivan, who is an analyst for US-based Lux Research (www.luxresearchinc.com), points out that even before the credit crisis the solar industry had been suffering from oversupply. This oversupply was a result of an "arms race" as solar cell and module manufacturers competed to install capacity.

Although a correction in the solar industry had been expected for some time, it has in fact been more aggressive due to the economic crisis. "The financial crisis has exacerbated the situation. It's eliminated financing for [solar] projects globally," says Sullivan.

Consequently, Lux Research is expecting solar cell and module capacity to overshoot demand by twofold in 2009, which will precipitate a shakeout that will eliminate all but the top players in the sector.

Sullivan expects the solar industry's larger companies – such as BP Solar, First Solar, Q Cells and SolarWorld – to take a lead in consolidating the sector. "You're going to see a lot more M&A activity from those players," he says.

But because of oversupply within the solar industry these larger companies are going to be mainly focused on buying businesses with next-generation technology, such as thin-film solar cells, rather than acquiring more manufacturing capacity. "There is no value in making an acquisition for capacity alone at this point," says Sullivan.

Smaller firms that rely on existing crystalline solar technology are likely to suffer further, according to Sullivan. "If you are a crystalline player that's not profitable and has a weak balance sheet, you should be very worried indeed," he says, also pointing out that smaller companies within the sector will not be able to run to the bank. "While banks are willing to lend to the top 15 [solar] companies in the world, smaller companies are going to have problems getting financing because they have no track record."



Ted Sullivan, of Boston-based Lux Research, expects a shakeout in the solar sector that will eliminate all but the top players.

One organisation that aims to help small, clean tech businesses is gateway2investment. Focused on companies within the Greater London area, g2i runs an investment readiness programme for businesses seeking equity investment and also introduces these businesses to investors. Richard Brook – a director of early-stage technology investor E-Synergy, which helps run the g2i programme – agrees that small clean tech companies can no longer rely on banks as a source of funding.

But since equity investors are also thin on the ground at the moment, Brook says most current discussions involving clean tech entrepreneurs seeking an "exit" for their businesses are about how to position their firms for a trade sale. "Companies faced with what happens when they run out of money are looking to their partners and customers," says Brook. "Who knows? You might get picked up by one of your clients."

Businessmen with clean hands

Anne McIvor talks to the players risking time and money to back the clean tech revolution.

Unlike the youth dominated 'dot com' or web 2.0 industries, clean tech is attracting talent from across the generations. One challenge is finding business expertise.

Stephan Decher of Clean Capital notes that, "technology and technologists that often have been 'hiding in drawers' for decades are now coming to the fore". The technologists, Decher continues, "need to team up with experienced business leaders to fulfill their entrepreneurial dreams".

Juliet Thompson, managing director of Nomura Code Securities, says that "some of the new clean tech CEOs come from the oil industry", mentioning Hamish Curran, who founded cellulosic ethanol biofuel company TMO Renewables.

Ron Pernick and Clint Wilder discuss how clean tech is embracing "capital, business, and technological innovation" in their book, *The Clean Tech Revolution*. So who are

the entrepreneurs risking time and money to back this revolution?

Beyond biofuels, the oil industry is also providing entrepreneurial talent to offshore renewables.

Take Steve Remp, who founded AIM listed Ramco in 1977. Remp "... recognised the offshore wind opportunity as a natural progression from the offshore oil and gas industry", according to Dean Cooper of Ambrian Capital, who attributes Ramco's success to Remp's "ability as an oil and gas consortium builder".

Ian Hatton also came from an oil background before founding Eclipse, one of the first companies to transfer offshore oil and gas expertise into offshore wind energy, in 1999.

Irish entrepreneur Eamon Conneely has transferred his property development skills to offshore renewables. Expertise in planning consent processes has been critical in driving forward Conneely's wave and

tidal energy interests and attracting funding from major utilities. William Dick, who originally founded one of Conneely's wave energy investments, Wavebob, fits with Decher's description of a 'technologist' who has brought on board business talent. Wavebob now works with Swedish utility giant Vatenfall.

Utility companies are directing their cash reserves towards offshore renewables. Last year Scottish and Southern paid £1.1 billion for wind energy generator, Airtricity, which had successfully carved a niche for itself in onshore wind; in offshore renewable, the utilities intend not to miss out on the opportunity and to become involved from the start.

Mungo Park of Innovator Capital considers the "quasi philanthropist" investment of family offices to be one of the unique things about clean tech.

There were only a few family offices that invested in biotech, but the risks were high, in both financial and social terms. Park says that increasingly today's generations of family offices care about the environment. "These influential families

are genuinely interested in putting substantial resources to work in developing environmental technologies," he says.

Backing from Ireland's Roche family was key to Airtricity's success. Founded in 1997 by Eddie O'Connor, the Roche family (through NTR) acquired 51 per cent of Airtricity in 1999 for €6 million. Michael Naylor of executive recruitment firm Forrester Partners says "the family office will again come to the fore of next generation renewables". Naylor emphasizes the role of the 'operational partner' – such as Jim Barry at Airtricity/NTR.

Families such as the Goldsmiths recognise the need for a strong team to manage their money. Ben Goldsmith was a founding partners of Wheb Ventures which has recently strengthened its team. Goldsmith has brought in funds from likeminded investors, including the Rothschild and Bamford (JCB) families. Meanwhile, the Breninkmeijer family (C&A) is behind Good Energies – the lead shareholder in Germany's Q Cells, the world's largest solar cell manufacturer.

US IT entrepreneurs are actively getting behind clean tech. Bill Gates' private investments firm, Cascade, has invested in algae biofuel company Sapphire Energy. And shareholders in electric sports car company, Tesla Motors, include Google co-founders Larry Page and Sergey Brin, former eBay president, Jeff Skoll, and PayPal founder, Elon Musk – who is Tesla's chairman. Established Silicon Valley venture capital funds such as Kleiner Perkins (linked to Al Gore) and VantagePoint Venture Partners are allocating growing sums to clean tech.

Clean tech is creating entrepreneurs around the world. Barney Gray of Hanson Westhouse mentions Li Xian, who recognized the opportunity to "turn scrap polysilicon into solar grade wafers for the photovoltaic industry" and founded ReneSola, now listed on AIM and NYSE. Closer to home, Jeremy Leggett, founder of Solar Century, might be best described as a "social entrepreneur". A former Greenpeace campaigner, Leggett set up the charity SolarAid and has authored several books on climate change. Leggett's background as an eco campaigner may be the exception rather than the rule.

But it is clear that the clean tech revolution is throwing up opportunities in many areas – and entrepreneurs from all backgrounds are getting involved.

Clean trains, planes and automobiles

The search is on for ways to combat the double challenge of CO2 emissions and air pollution from vehicles. By Anne McIvor.



The Tesla Roadster electric sports car (above) has a 244 mile range. Emissions from road transport account for 93 per cent of the total CO2 waste in the EU but cutting the level risks increased toxins in the air.

Henry Ford's Model T, developed in the early 1900s, was designed to run on ethanol and electric trams were commonplace in the 19th Century but cheap fossil fuel meant the transport industry came to depend heavily on petrol, diesel, jet fuel and bunker fuel.

The result was air pollution and growing emissions of CO2. These twin challenges are being addressed by alternative fuel technologies ranging from algae biofuels to batteries for electric vehicles - technologies to clean up fossil fuels and technologies for more efficient materials for building cars and planes.

Jamie Borwick, deputy chairman of the British Lung Foundation and founder of electric van manufacturer, Modec, makes the point that: "The challenge of dealing with air pollution - a major contributor to lung diseases - is important, as well as the question of climate change".

An upside of the Modec van, which is specially designed to accommodate the battery, is zero emissions of health-threatening pollutants such as NOx or particulate matter (PM10).

The CO2 emissions depend upon the source of the electricity used to charge the battery.

Smart grid technologies are being developed by companies such as V2Green of Seattle, which can convert the battery of an electric vehicle or plug in hybrid into an energy storage

device, drawing down energy from the grid at off peak times and releasing it back when demand is high.

Battery range has been a challenge for electric vehicles, limiting the electric car market to date to small vehicles for short journeys within access of a charging infrastructure.

Storage technology is moving ahead. The Tesla Roadster electric sports car has a range of 244 miles per charge, due to a lithium-ion energy storage system.

Range is less of a challenge for delivery vans working within a defined route. The Modec offers an impressive range of up to 100 miles, depending on the battery pack.

Biofuels may return to favour with the passing of the Renewable Energy Directive by the EU.

Biofuels may be more appropriate for air transport, where the infrastructure challenge is less acute: there are many fewer airports in the world than petrol stations.

The search is on to find a sustainable biofuel feedstock to be refined into jet fuel on a large scale.

Large vehicles such as trucks and buses pose a particular challenge. The requirement to meet low emission zone standards is being addressed by many cleantech companies, such as Clean Air Power, whose Dual-Fuel™ technology permits natural gas to be used as a fuel in diesel engines.

The race is on to build more efficient vehicles and use more efficient fuels: clean tech is on to meet the challenge.

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It's time for change... ...less landfill, more renewable energy!

Waste and energy are global problems.

In the next 10 years, to meet EU obligations, the UK alone must:

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The ENERGOS waste gasification technology provides:

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The ENERGOS technology is the proven leader in its field with 400,000 hours of operating experience on its seven existing European projects. This fundamentally clean energy recovery technology sets new emissions standards for residual waste disposal.

ENERGOS often works with partners to develop and operate small/medium scale energy from waste facilities.

ENERGOS - investment in a cleaner future



Malta leads in energy

A new grid will improve the island's system. By Sarah Murray.

It is not often that Malta hits the headlines beyond the travel pages of weekend newspapers and glossy magazines. However, the island state has recently been the centre of attention with the announcement that it is to embark on the world's first nationwide roll out of a smart grid, bringing information technology to bear on the country's utilities management.

In a 70 million euro deal with the Maltese National Electricity and Water Utilities, a consortium led by IBM will, over the next five years, design and implement a system that will use data and communications technology to manage electricity and water use.

"It's the first integrated water and electricity utility smart grid implementation, which adds to the scope and complexity of the project," says Guido Bartels, general manager of global energy and utilities industry at IBM.

Part of the problem is that, without monitoring technology to control the flow of electricity, demand during peak hours forces utilities to turn to their back up generation plants, which are generally older, dirtier and less efficient and often need to be kept on permanent standby.

Better management of power demand could reduce or eliminate the need for these "peaker" plants because smart grid technology, which

allows consumers to monitor their energy use closely, means utilities can introduce price incentives that encourage people to run their washing machines or driers at off-peak times, evening out demand across the day.

"Managing the demand side offers an enormous opportunity to get a lot smarter about how we use generation versus just generating more," says Scott Lang, president and CEO of Silver Spring Networks, a California-based start-up producing smart networking products designed to boost utilities' efficiency.

"The smart grid is an enabling platform for the integration of everything



Malta nights: a consortium will install a smart network.

from ranging from energy efficiency, demand management, integration of renewables and eventually of electric cars," says Mr Bartels.

"If you want to leverage all these energy technologies and opportunities, you need a much smarter and more efficient grid than we have today," he added.

CASE STUDY: THE FUTURE OF LOW CARBON HEATING

An overhaul of the way residential buildings are heated is needed, says Katie Crabb of the Energy Institute.

While many have focused on initiatives such as low energy light bulbs, the real culprit in the waste stakes is heating with almost three quarters of all energy use going on space and water heating.

Heat pump technology has been used around the world for decades and Mitsubishi Electric has developed this technology to produce Ecodan – a neat unit that could prove acceptable to the environmentally savvy customer who wants to actively make a contribution to the reduction of their carbon emissions. Ecodan upgrades naturally occurring energy from

the air and uses this to provide domestic space heating and hot water which could play a significant role in achieving zero carbon homes.

Launched in September 2007, Ecodan has already performed beyond expectations, delivering an average 50 per cent reduction in emissions and a 41 per cent reduction in running costs against a gas boiler. The most modern efficient gas boiler has an efficiency of around 93 per cent, losing 7 per cent during the combustion process, so for every 1kW of energy fed into a gas boiler, you achieve less than 1kW of heat output. With the majority of 5-10 year old boilers currently in use, the average efficiency could be 80 per cent or even lower.

As a mover of heat energy, Ecodan offers efficiency levels of 300 per cent or more as it is able to gather over 70 per cent of the heat

energy it needs from the surrounding air. This means that for every 1kW of energy used, it will deliver 3kW or more of energy. It can extract this free heat energy even when the outside temperature drops to -20C. Installing Ecodan can help housebuilders achieve Level 3 of the Code for Sustainable Homes. VAT is already reduced from 17.5 per cent to 5 per cent on heat pump installations and air source heat pumps are likely to be added to the Energy Saving Technology List, which will give end users grant assistance.

Significantly quieter and smaller than previous generations of heat pumps, Ecodan uses a sealed vapour compression cycle similar to a domestic refrigerator to exchange heat (or energy) between the outdoor air and the water supply. Unlike

previous air source heat pumps, Ecodan's carefully developed control system is specifically designed to provide hot water to either underfloor heating or traditional radiators in properties with appropriate levels of thermal insulation.

In November 2008, Mitsubishi Electric received the Energy Institute* Technology Award – celebrating innovation and excellence in energy. The launch of Ecodan is part of Mitsubishi Electric's Green Gateway Initiative which points the way towards a reduction of 3 million tonnes of CO2 per year by 2016. Further details are available at www.greengatewayinitiative.co.uk

*The Energy Institute is the leading professional membership body for the international energy industry, visit www.energyinst.org.uk/eiawards to find out how to enter this year's EI Awards.

PROMOTIONAL FEATURE

Academic powerhouse for Scotland

The Energy Technology Partnership (ETP) is an alliance of Scottish Universities, currently engaged in world class energy related Research, Development and Demonstration (RD&D).



With around 250 academics and 600 researchers, the ETP is the largest, most broad based power and energy research partnership in Europe, with key strengths across a range of energy technologies, including:

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- Marine Energy
- Power Systems and Networks
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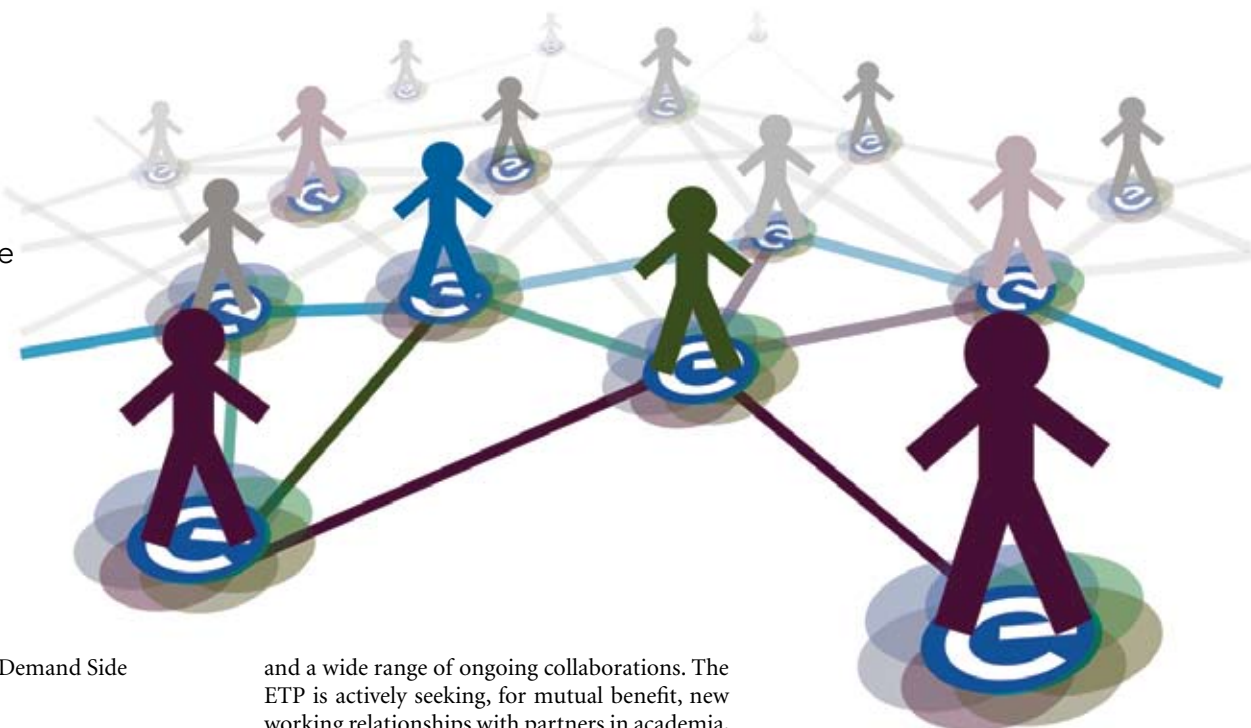
- Built Environment and Demand Side Management
- Bio-Energy
- Oil and Gas
- Carbon Capture and Storage

The ETP has a strong track record in the delivery of RD&D excellence and is actively engaged in numerous UK and international partnerships. We also have well developed links with industry

and a wide range of ongoing collaborations. The ETP is actively seeking, for mutual benefit, new working relationships with partners in academia, industry and elsewhere, both nationally and internationally.

Please contact us if you would like more information on our work and to discuss the potential benefits that working with the ETP might bring to your own organisation.

Find out more: www.etp-scotland.ac.uk
Dr Simon Puttock
 Executive Director,
 Energy Technology Partnership
 Telephone 0141 548 2272
 e-mail contact@etp-scotland.co.uk



Triumph of the Greengobla man

A chance meeting on a plane sparked a business relationship that is set to transform the handling of food waste in London. By Tom Rowland.

Philip Moore is 71, firmly in the tradition of the heroic British boffin and he had a dream. He wanted to find a green, clean and sustainable way for cities to deal with the enormous amount of food waste they generate each day.

In London we disgorge a mountain of the stuff; 2 million tons each year and it has to be collected, dumped into landfills or incinerated.

Landfills are ecologically unsound, incineration a waste - you get little or no electricity back from conventional incineration.

Moore has spent 20 years trying to get an uncaring, spendthrift world to take his aerobic digester seriously.

Moore's dream might have remained unfulfilled except that every local authority in the land has suddenly woken up to the fact that in 2010 they are likely to start incurring huge fines for dumping food into landfill sites.

Today the Greengobla is a leading contender in a new generation of aerobic biodigesters that are being taken very seriously.

In a nutshell, you grind up food waste, feed it into the digester and 24 hours later out comes a sweet-smelling liquid that can be dried and used as fertiliser or a soil enhancer. As an added bonus the digestion process generates heat that can be harvested.

In many areas people already have three dustbins.

It is the green bins that interest Moore. At the moment it cost councils an average of £150 a ton to collect the material and food waste is difficult to convert and this must be paid for as well.

Moore had a stroke of luck; on a flight across the Atlantic he met and explained his idea to businessman Peter Temple who has been able to help him commercialise the idea.

Now a pilot Greengobla is to be built by Dagenham and Barking council and the pair have a portable version under development that will fit into a container and can be transported.

"The joy of this system is that it can operate in a very small plant with minimal environmental impacts," explains Peter Temple.



Philip Moore, great British boffin and inventor of the Greengobla which slashes processing costs by two thirds.

The Peterborough Eco Centre {PREL} is also supporting the project.

The Greengobla is a small and flexible solution that will fit into an existing industrial building without requiring modification and will happily deal with volumes between 3 and 300 tons per day, says Moore. The process conforms to the requirements of the animal by-

products legislation and all pathogens are neutralized while the end product is a benign product that will be a fertiliser or soil enhancer, depending on the mix of food and garden waste fed into the process, explains Moore.

"The process appears to offer considerable environmental management advantages over other available technolo-

gies," said Professor Stephen Nortcliff, head of the department of Soil Science at Reading University.

A committed environmentalist Philip Moore is somewhat shamefaced that he met Peter Temple on an aeroplane but for the rest of us perhaps this particular extension of his carbon footprint was just as well.

www.sustainablebio.com

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LET'S TALK

To register interest in an initial informal discussion with one of our consultants, call 020 7314 5898 or email energy@wspgroup.com.



True sustainability

Sustainability is a broader concept than just building a wind turbine, bolting on a solar panel or building an energy efficient or passive house. By Tom Rowland.

Although many fund managers see ethical and sustainable investment as ways of building portfolios of equities, other classes of asset are also affected by the new ways of thinking.

Renewable energy and real estate are also subject to a shift in emphasis and here it is much easier to see the benefits from environmentally friendly management.

But while many companies in the sector now wish to be associated with sustainability, eco values and renewable technologies for many the commitment is only skin deep and in many cases just a public relations gimmick.

Others have a much deeper commitment.

"I believe true sustainability is certainly the way forwards in the next few years", says Reimo Hammerberg, partner in the law firm Sorainen which specializes in advising large and medium-sized international firms investing in the Baltic States and Belarus.

The Oxford Sustainable Group is involved in renewable energy, renewable agriculture and sustainable development in central and eastern Europe and near Asia. The group currently owns and manages around 2.5bn Euro GDV (final project value). www.OxfordSustainable.com

By improving the social infrastructure, ensuring the creation of local jobs and services and being sure the supply chain is also sustainable,

Hadley Barrett, chief executive of the Oxford Sustainable Group, has developed sustainable projects which are also highly profitable.

The company uses an index it has developed to measure and manage the true sustainability of projects – The Oxford 360 degree Sustainability Index.

"Using our sustainability knowledge, we have been able to develop projects more rapidly, for a lower price and at a higher quality level than conventional projects. On average we have returned above 50 per cent per annum cash-on-cash and all our projects to date have been either ahead of schedule or above expectations. The returns speak for themselves," said Mr. Barrett.

Examples include a 30MW biomass electricity generation project in the Baltic States, which has returned over 100 per cent per annum up to construction.

During a two year period, a standard environmental impact analysis together with a 360 degree Strategic Impact Analysis were performed, leading to fast-tracked planning approvals to produce a project that pleased both the local authority and central government.

The electricity developed in this installation will provide power for the equivalent of around 10,000 homes. In addition, enough heat will be generated to supply all the surrounding local businesses and residential areas with sufficient additional capacity for the next five years.

The approach has been endorsed at the governmental level.

Vygaudas Usackas, Lithuania's ambassador in London, said that a truly sustainable approach of the type employed by Oxford is a valuable foundation for the environment.

The group and its approach is, "welcome across all of the Baltic countries," he said.

A second project is an early-stage large energy development in the central Balkans.

The plan is to generate 3000MW of energy by 2020.

This concept is to mix electricity generation from wind, solar and biomass to achieve a constant electricity stream.

One of the drawbacks of many single energy source schemes is a supply prone to interruption. The site also exploits a synergy in combining wind and biomass.

The scale of this project means that it will also be a useful step in aiding the European Energy Security Policy, which aims to create a strategic inter-EU energy supply through the use of renewable sources.

A third project is a 150m Euro poly-functional, front-line development on the Romanian black sea coast returning 58 per cent per annum, which includes retail, hotel, commercial, residential and energy components.

"One benefit of this polyfunctional 'rest-work-play' site is that residents will be able to enjoy local amenities at a level and ease-of-use not yet seen in Romania. The final result will be a CO2 negative project – reducing the amount of CO2 produced globally – and will contribute to a reduction in the surrounding traffic density and



BedZed Eco-community development Beddington Surrey.

lead to a rise in local land values," says Mr. Barrett.

Oxford has also agreed to give something back, by supporting the local government in cliff face restructuring and infrastructure development for the surrounding area.

The last project neatly illustrates how a 360-degree approach can work.

The first 90 degrees examines the site itself, which includes materials choice, access, living standards and energy.

The second 90 degrees considers the connection to the site, such as electricity, water and sewage.

The third 90 degrees then analyses the local environment and local stakeholders. It is a wider measure than the UN's view of sustainability with is limited to natural, economic and social aspects. This analysis focuses on all stakeholders, including local residents, political requirements, infrastructure, technological needs and, of course, the investors.

The final 90 degrees considers the effect on the global environment, for example from carbon emissions and the supply chain.

The result is the inclusion of the full range of institutions and stakeholders,

leading to faster approvals and a stronger ethical approach to each project.

"In combination with a structured project management process implemented by each member of our team we have a very solid and repeatable process that generates above average returns across all of our markets and areas. This is unique in the CEE region," says Barrett

However, this approach requires a highly expert team and more management time for the creation of the appropriate solution. Because this is a new market, few if any companies have the full range of investment, management, sustainable and political expertise needed to generate such complete solutions.

"Most companies imagine that sustainability reduces returns, this is a misconception due to lack of experience in the field. The opposite is true," he says.

While initiatives that are merely public relations gimmicks do appear to lead to higher costs and lower returns, it seems that true sustainability, when undertaken correctly, is able to significantly improve performance.

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PROMOTIONAL FEATURE

The world is your Oyster with Aquamarine Power

By 2030, it is projected that global demand for electricity will increase by 55 per cent. This has generated impressive growth across the renewable sector and Aquamarine Power is providing the technology to meet this demand.

Based in Scotland, Aquamarine is developing wave and tidal marine energy technologies. Oyster, a hydro-electric nearshore wave power converter is the company's leading technology with a full scale prototype being installed at EMEC this summer. Neptune, the 2.4MW tidal stream device is at pre-fabrication stage with the full scale prototype expected to be completed at the end of this year. Aquamarine is actively pursuing the application of its technologies into the desalination industry.

Lead by an experienced and successful engineering and management team with considerable knowledge from the

offshore wind, marine energy, and oil and gas industries, Aquamarine also boast an in-house site development team, delivering a complete concept to consent site development service.

Aquamarine has been placed at the forefront of marine energy project development by investing heavily in technology as well as engaging innovative and enthusiastic staff. Supported by key investors and continuing its growth by seeking motivated team players, Aquamarine are tackling the challenge of making marine renewable energy mainstream.

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AN 'EMERGING MEMBER' OF THE WORLD GREEN BUILDING COUNCIL

Despite global economic challenges, the growth potential of Romania and the Central Eastern European region is substantial. Mandated European Union commitments, fiscal incentives, and an increase in professional investors and real estate developers in pursuing greater energy efficiency and environmental responsibility in their developments have contributed to a significant increase in the market for green construction products and services.

The Romania Green Building Council is a non-profit, non-political association encouraging the market, educational, and legislative conditions necessary to promote high performance construction that is both sustainable and profitable. The RoGBC is supported by 52 member companies including our founding members list below:

AIG LINCOLN	CUNDALL
ALUKOENIGSTAHL	EPSTEIN
Anghel, Lizac & Associates	Holcim
ARCHIBUS	JW Marriott Grand
Aquarius GROUP	LAFARGE
AtisReal / BNP PARIBAS	NEMETSCHKE Allplan
BauMax	OXFORD Management
Bovis Lend Lease	ProLogis
CAELUM Development	PSV
Cascade Group	Schoenherr
CEMS Technologies	Somfy
Chapman Taylor	SOPOLEC
Clifford Chance	URSA
Concelex Development	Vitalis Consulting
Corporate Office Solutions / Steelcase	Willbrook Management
	WSP Romania

Our members are taking a leading role in bringing green building principles and ensuring Romania and the region develop in a sustainable manner. The RoGBC is very active in building awareness, providing training, promoting green building legislation, supporting green building certification, and promoting domestic, regional and international collaboration.



Upcoming Events:

"Roof Gardens, Green Roofs and Urban Landscape"

10 March – Bucharest

"Sustainable Construction Materials"

19 March – Bucharest

"Creating Greener Workspaces"

22 April – Bucharest

"Architecture Days 2009"

13-16 May – Cluj

Prior Activities:

"How to Get an 'A' for Energy Performance Certificates"

"Green Building"

"Green Architectural Principles and the Enabling Technologies"

"Greening Our Hotels"

Please visit our website and contact our team for more details about these events and how we can collaborate on promoting green building projects.

www.RoGBC.org



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