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Domestic solar power in rural China - a small PV array is located on the roof. This issue takes a fresh look at renewable energy - from the potential contribution from renewables sited in cities, through a look at technologies emerging from the sea to a new source of energy for power - straw.

Photo courtesy of IT Power Ltd, a consultancy on renewable energy which has carried out projects in 90 countries for a variety of institutional and private clients

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THE INSTITUTE OF ENERGY
18 Devonshire Street, London W1N 2AU.
info@instenergy.org.uk
eworld@instenergy.org.uk
www.instenergy.org.uk

EDITORIAL
Steve Hodgson
Tel/Fax: 01298 77601

ADMINISTRATION
020 7580 7124

MEMBERSHIP, AND JOURNAL SUBSCRIPTIONS
Tel: 020 7580 0077 Fax: 020 7580 4420

ART EDITOR
Steve Stoner

DESIGN
X-Design
Tel: 020 8874 3774 Web: www.xdesign.co.uk

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Viewpoint

North Sea oil industry starts recovery as investment returns

James May, Director General of the UK Offshore Operators Association (UKOOA)

After 18 months of stifled investment and exploration activity in the UK offshore oil and gas sector, we are now seeing some signs of recovery.

It might seem absurd to be reminded that twelve months ago the UK offshore oil and gas industry was still reeling from the impact of some of the lowest crude oil prices for 30 years.

But the recent newspaper headlines featuring record profits for oil companies as crude oil prices rose to over $30 a barrel mask the toll taken on the industry when prices slid inexorably below $10 a barrel, and obscure understanding of the current economic realities that will shape the sector's future.

Investment and activity on the UK continental shelf (UKCS) plummeted in 1999, contracts dried up and nearly 100,000 people lost their jobs as the industry made its painful adjustment to what it took then to be a structural change in world oil prices.

And even with crude oil currently trading on world markets at around $25, no one in the UK offshore sector is underestimating the challenges still facing us. Oil price volatility, the increasing maturity of the North Sea and the global nature of the oil and gas industry where competition for investment capital is keen, all point to the strategic nature of the issues the UK must address.

Yet, there is evidence that confidence is once again returning to the UKCS and that 2001 will see a reverse in the recent trend of decline, with forecasts of an upturn in investment, exploration and development activity, and job prospects.

Increased capital expenditure

A recent UKOOA survey of the capital expenditure investment intentions of oil and gas operating companies suggests that development spending on UK fields could increase to over £4 billion this year, a 33 per cent increase over 2000 investment levels.

This investment is expected to have a significant impact on employment, creating around 25,000 new jobs as well as protecting jobs that might otherwise have been at risk.

It also means that, contrary to previous estimates, oil and gas production levels in the UK could potentially rise for the next three years. Provided investment plans for 2001 and beyond are realised, gas production levels could continue to increase until 2005 while oil production should not peak until 2003, extending the UK's self-sufficiency in hydrocarbons and bringing enhanced security of supply.

Announcements by Shell Expro and BP indicate the strength of the commitment that individual companies are prepared to make to the future for the UK sector. Shell intends to invest $1.2 billion in the North Sea this year with plans to bring forward six new projects to development, including Goldeneye and Penguins. BP announced a £627 million investment programme for the whole of the North Sea year – including initial development plans for the massive Clair field west of Shetland – and forecasts continuing rising capital investment over the next three years.

Smaller North Sea players have been active too, such as Talisman Energy which has widened its portfolio to become one of the largest operators of assets on the UKCS today and Kerr-McGee with its new Leadon field, the largest new development to be given government consent last year.

New companies are also buying into the UK sector, many for the first time. Companies such as Tullow Oil, Consort Resources and Highland Energy see potential in doing business here and are keen to take advantage of the considerable opportunities the UKCS still has to offer as it enters its new, mature phase.

Over 40 exploration and appraisal wells were drilled in 2000, compared to 31 in 1999, and UKOOA has just launched a web-based initiative to stimulate further exploration activity through innovative new partnership arrangements.

Modest, even fragile, recovery

While the signs are encouraging, the recovery is modest if you compare these forecasts with actual activity in 1998, when investment stood at just over £5 billion and nearly 60 exploration and appraisal wells were drilled.

It is also fragile. While remaining reserves of oil and gas are equivalent to those already extracted to date – almost 26 billion barrels of oil equivalent, they will be mostly in reservoirs that are relatively small and more difficult to develop, both technically and commercially.

Success in bringing these fields on stream - thereby preserving jobs and investment in the long term – will depend on the industry's ability to build on its existing strengths, to enhance competitiveness, develop new technologies and stimulate greater collaboration across the sector and with Government. These are the issues currently driving PILOT's agenda, the joint government and industry initiative to maintain investment in the UK.

Our industry takes pride in its resilience and ability to meet adversity head-on. Certainly, the current recovery is testament to its resolve. Given favourable economic conditions, there is no reason to believe that the UKCS cannot continue to thrive and deliver the jobs, tax revenues and security of supply this country has grown accustomed to.

World energy use and carbon emissions 'would both rise steadily without further measures'

World energy use will grow by a steady 2% cent a year from now till 2020, and carbon dioxide emissions will rise at about the same rate, with most of the increases coming in developing countries. Oil, gas and coal will continue to dominate the world fuel mix, and countries that import oil and gas will grow increasingly dependent on production from OPEC members in the Middle East.

These are some of the main projections to be found in the 'reference scenario' of *World Energy Outlook 2000*, the biennial flagship publication of the International Energy Agency. The scenario goes beyond 'business as usual' by taking into account the likely effect of policies and measures to combat climate destabilisation which have been adopted since 1997, but omits possible, or even likely future measures.

The reference scenario assumes that the world economy will grow by 3% a year; that fossil fuel prices remain flat till 2010, then rise to $28 in today's money by 2020. In that event, and without any new environment policies, overall energy demand would grow by 57% over twenty years, just slightly below the rate in recent years. Carbon dioxide emissions would swell by 60% – one-third from power generation.

Fossil fuels – coal, oil and natural gas – would continue to provide 90% of the world's primary energy, although gas would displace coal in some regions. Petroleum would remain the dominant fuel, meeting 40 % of world energy needs. Oil use would surge from 76 million barrels a day now to 115 mb/d in 2020. Nuclear power output would remain constant in absolute terms, but decline as a proportion of total energy supply as older nuclear reactors in Europe and North America are retired. New renewable energy sources would increase rapidly, but only from 2% to 3% of total demand.

Energy use would grow much faster in the world's poorer nations than in the rich. But rich and poor alike would come to depend heavily on a diminishing number of gas and oil suppliers. Middle East OPEC countries, which furnished 26 % of world oil in 1997, would be called upon to produce 32 % in 2010 and 41% in 2020.

Despite all the efforts made so far to reduce energy-related CO2 emissions, the WEO 2000 reference scenario sees them rising by 60% from 1997 to 2020, faster than energy demand and faster than in recent decades. Developing countries would account for more than two-thirds of the increase, with China's new emissions matching those of the whole OECD. Emissions from power generation would increase by more than three-quarters and those from the transport sector by nearly as much.

These projections show how much more needs to be done in the energy sector if developed and transition countries are to meet their commitments to limit greenhouse gas emissions under the terms of the Kyoto Protocol. Three other scenarios examine:

- The emissions trading case in which maximum efficient use is assumed to be made of the provision in the Kyoto Protocol which allows countries to trade carbon permits in order to fulfil their Kyoto obligations. The *Outlook* analysis concludes that a fully effective trading system would result in a 'price' of $32 for a tonne of carbon dioxide and that trading would produce major revenue flows for Eastern Europe and the former Soviet Union, the main sellers of emission credits.
- The transport case in which additional efforts are assumed to cut emissions from road vehicles and aeroplanes. A concentrated effort in the transport area could stabilise carbon dioxide emissions from transport after 2010 but not before.
- The power generation case, which assumes various programmes to reduce emissions in this key sector. It finds that fuel switching from coal to natural gas could reduce the sector's emissions by 1.7% in 2010, while extending the life of older nuclear plants could reduce them by 2.3% Increased use of renewables could achieve a 3.2% reduction and more combined heat and power generation nearly 1%.

Chernobyl's last reactor closed

In a formal ceremony attended by many overseas observers, the Government of Ukraine's closed the last remaining working reactor at the Chernobyl nuclear power plant in December. Closure signals successful implementation of an agreement reached in 1995 between Ukraine, the G7 countries and the EU under which Ukraine agreed to close the plant by the year 2000 in return for a comprehensive programme of co-operation.

The power plant consists of four Soviet designed RBMK reactors, which many experts do not believe can be upgraded to meet acceptable international safety standards. Chernobyl's Unit 1 was closed in 1996, Unit 2 in 1991 following a fire and Unit 4 was the reactor that exploded in 1986.

The co-operation programme includes help to stabilise the shelter surrounding the damaged Unit 4 reactor, assistance to ensure the safe decommissioning of the four reactors, and loan finance to complete two more modern nuclear reactors in Ukraine. Stabilising the sarcophagus surrounding the damaged reactor in Chernobyl Unit 4 is a large engineering project, costing $768million.

Servicing the market for emissions trading

Giant US-based global financial services company the Cantor Fitzgerald Group has established a subsidiary company, CO2e.com, creating what it calls the world's largest virtual marketplace for greenhouse gas emissions trading. Gas emissions trading is anticipated to become one of the fastest growing commodity markets in the world.

The company provides a globally accessible single gateway to a range of specialist climate change consultancy and advisory services which supplement the information and business tools available on the website. These include an introduction to the principles of climate change, strategy development, project implementation, risk management, reductions auditing and verification, credit registration and insurance, financial, legal advice and a 24-hour internet trading marketplace.

CO2e.com has gained support from Fred Krupp, executive director of the US-based Environmental Defence: "Actions today on greenhouse gas pollution will determine whether future climate change will be manageable or out of control, and it's encouraging to see the emergence of carbon commerce entrepreneurs like CO2e.com, who can build both the pathways and the incentives for market-based solutions to global warming".

Meanwhile, one of the world's largest international insurance brokers, Aon, and Natsource, a US-based broker of energy related products, have announced their co-operation to develop an insurance facility for the emerging greenhouse gas market.

In spite of the fact that very few countries have yet established specific compliance guidelines or trading rules, an active pre-compliance trading market in carbon reductions is starting to develop. In addition, a number of countries, especially within Europe, are making preparations to have national emissions trading platforms operational by during 2001 and several of the larger energy companies have already established internal trading platforms in anticipation of these developments.

However, the market is currently constrained by the non-standardised nature of the underlying tradable units and the diverse nature of the project activities and developers that generate the emission reductions that buyers require.

In recognition of this, the two companies have formed a partnership which seeks to enable the transfer of these risks and ultimately standardise the transacted emission reduction credit. The partnership provides a comprehensive range of capabilities covering emission trading, risk management and insurance.

Canada tests domestic fuel cell cogenerator

A Canadian utility is testing what is said to be the world's first domestic cogeneration unit based on a propane-powered fuel cell. The H Power Corporation has completed the installation of the unit for testing at the LTEE laboratory in Shawinigan, Quebec, an electricity end-use R&D division of Hydro-Quebec, Canada's largest electric utility.

Chief executive officer of H Power, H Frank Gibbard, said, "This installation is clearly a milestone for H Power's fuel cell technology, representing another giant step toward commercialisation. Hydro-Quebec will evaluate our residential cogeneration unit, which can supply all the electricity and hot water needs for an average household".

"Fuel cell cogenerators," he added, "operate without the usual infrastructure that all utilities use to distribute electricity. Being able to supply an uninterrupted flow of electricity, without power lines and free from outages caused by storms and other acts of nature is a big plus for utilities, especially when serving customers in rural and remote locations."

H Power has already sold fuel cell systems for stationary and portable applications to the US Government, state agencies, and numerous domestic and multinational corporations.

WCI publishes 'good news from coal'

The World Coal Institute has released a series of ten case studies to illustrate what it calls 'good news from coal' stories which demonstrate the efficiency and environmental benefits of 'new coal'. Among the case studies are details of:

- the successful bagasse and coal partnership at Belle Vue Power Plant in Mauritius, which generates electricity with a reduced net greenhouse gas impact;
- the Schwarze Pumpe Power Station in Germany, which showcases the new generation of advanced lignite-fired plant supplying reliable and economic electricity while minimising environmental impact;
- major greenhouse gas emission savings being made in Australia at the Appin Tower coal bed methane power project and at the Moura coal mine seamgas operation. Both projects use methane that would otherwise be vented to the atmosphere to generate electricity;
- RJB Mining's Monckton Cokeworks in the UK, where an 11 MWe CHP plant has added value to what was once a waste gas stream, securing the future of the Cokeworks as well reducing GHG emissions;
- the Great Plains Synfuels Plant in North Dakota, which is the source of carbon dioxide for an innovative enhanced oil recovery (EOR) project at the Weyburn oil field in Saskatchewan in Canada.

Copies of each case study are available from the World Coal Institute website at: www.wci-coal.com/goodnews.htm

West of Shetland fields lead new oil and gas activity

Almost £1 billion is to be invested in four new oil and gas projects, bringing more than 2,500 jobs to the West of Shetland oilfields, Edinburgh and Tyneside, according to Trade and Industry Secretary Stephen Byers.

One thousand jobs will be created by the £320 million Magnus gas pipeline from the West Shetland field, including 220 jobs at the pipe finishing company near Edinburgh. Some 900 jobs should follow approval of development at the £340 million Leadon oilfield in the North Sea off the Shetland Islands, 800 of these at the Swan Hunter yard on Tyneside which will build a floating production and storage system for the development. Meanwhile, BP's investment of £210 million in developing the Foinaven oilfield should create 550 jobs and investment by Ranger Oil of £75 million will bring 80 jobs to develop the Kyle oilfield.

Byers called the new investment: "the biggest the North Sea has seen in years" adding that: "These projects show that globalisation and new technologies can be a bringer of opportunities and not a threat".

Government consent has been given for the Magnus pipeline, the first from the deep Foinaven and Schiehallion fields West of Shetland. It is a unique project to take surplus gas via the Sullom Voe oil terminal on Shetland to the North Sea's most northerly oil platform on the Magnus oilfield some 340 miles north east of Aberdeen. There the gas will be injected into the oil reservoir 8900 feet under the seabed to flush out an extra 50 million barrels of oil. The gas - equal to another 50 million barrels of oil - will be recovered and landed via another pipe network for use onshore, providing first access to West of Shetland gas which currently has to be re-injected locally.

The Leadon oilfield was the largest project to be given the go ahead during 2000. Discovered in 1979 but not developed by its previous operators, it will be brought onstream using a floating production and storage system to be built at the Swan Hunter yard on Tyneside.

Supply cable replacement at the Needles

Offshore geotechnical contractor Seacore has completed replacing the mains electricity supply cable to the Needles Lighthouse on the Isle of Wight. The company used a combination of abseiling from the cliffs at Alum Bay and working from an offshore jack-up platform to install the cable.

Trinity House, the principal lighthouse authority for England, Wales, the Channel Islands and Gibraltar, was forced into replacing the six-year old cable after it had twice developed faults, the most recent of which could not be detected by electrical test equipment or during a visual inspection by divers.

The old cable formed part of the automation scheme to change over from powering the lighthouse by constantly running diesel generators, installed just after the last war, to fully automatic unmanned operation. Originally expected to last at least 20 years, it has been replaced with a heavier duty cable.

The underwater section of the cable drops from a shaft into the sea at the base of high chalk cliffs at Alum Bay across a narrow ledge in shallow water and runs along the seabed in deep water for nearly a kilometre, before snaking back up onto the ledge and into the base of the cliff adjacent to the lighthouse. Seacore proposed placing the cable in protective ducting anchored to the seabed in narrow trenches cut into the shallow water ledges at Alum Bay and the lighthouse. The long run of cable in the deeper water would be laid directly on the seabed but additionally secured by two concrete blocks at both ends as it approached the ledges.

Installing the supply cable involved a jack-up platform as well as abseiling from nearby cliffs

How to test housing for energy efficiency

Post Construction testing *– a professional's guide to testing housing for energy efficiency* is a new General Information Report (GIR 64) from the Government's Energy Efficiency Best Practice programme.

It is essential that thermal insulation and other energy efficiency measures are detailed and installed correctly if a completed house is intended to achieve its intended performance. As work proceeds, defects are rapidly covered up and become hidden within the depth of the structure. This can lead to increased running costs, poor levels of comfort to the occupants from draughts, and deterioration of the building fabric due to the presence of moisture.

This report describes some of the available tests, their advantages and, where appropriate, gives guidance on specification for designers, contractors and developers trying to improve the performance of new and upgraded housing.

Contact the Environment and Energy Helpline on FREEPHONE 0800 585794 for a free copy.

CHP to power and chill 'Internet hotel'

The Guardian iT Group has come up with a solution to sidestep the power supply shortages threatening to hold back the market for European 'Internet hotels'. Its new £50 million site will be the first in Europe to be powered – and cooled - by its own CHP energy centre.

To be supplied by PowerGen under a £23 million design and build contract, the energy centre will result in savings in running costs of approximately £3 million per annum.

Several Internet hotels, huge computer centres that host thousands of web sites for clients, have failed to open on time because power suppliers cannot meet their massive energy demands. They can require over twice the power of a typical hospital and speculation earlier this year suggested that the planned rush of new site openings in London in the next four years would increase the City's demand for power by a fifth. This level of demand can only be accommodated after lengthy modification to the local electricity supply infrastructure.

To override these problems, Guardian's web hosting subsidiary, iXguardian Limited, will rely on its own gas-fired CHP unit as the primary power source at its new London Heathrow Internet hotel site. Electricity from the national grid will only used as part of a backup supply, which will also include several uninterrupted power supplies and diesel generators.

Heat from the CHP unit will be used to cool the site - heated air will be pumped into a heat exchanger where it will be condensed to create chilled air. This will maintain the temperature required to ensure computer equipment can operate efficiently.

Forests and soils 'may increase global warming'

Global warming may occur faster, and simply planting forests may be less effective in slowing the warming than previously expected. These are the conclusions of two new papers by Met Office experts studying the effects of vegetation, soils and oceans on climate change.

In one paper, a research team from the Met Office's Hadley Centre for Climate Prediction and Research, in collaboration with Southampton Oceanography Centre, describe the world's first computer model of climate which includes the effect of climate-induced changes in vegetation and the carbon cycle. Using this model, the team led by Dr Peter Cox predict that global warming is likely to cause the world's soils to emit more carbon dioxide to the atmosphere, leading to further warming of the climate.

The model predicts a rise in average global land temperatures of 6°C from 2000 to 2100, which is 2°C higher than predictions made before these effects were included.

Dr Cox said: "Our initial results suggest that vegetation and soils, which currently absorb about a quarter of human-made carbon dioxide emissions, could accelerate future climate change by releasing carbon to the atmosphere as the planet warms. This potentially large climate feedback needs to be investigated further."

The second paper shows that planting new forests will not slow global warming as much as expected. The Kyoto Protocol allows countries to plant forests in order to offset some of their carbon dioxide emissions from burning fossil fuels. However, forests are generally darker than the underlying terrain, and hence absorb more of the sun's heat, particularly in snowy conditions. In some areas of Canada and Siberia, the paper suggests this warming effect is actually greater than the relative cooling afforded by carbon dioxide uptake. Planting forests in these areas would therefore increase warming rather than decrease it as intended.

The author Dr Richard Betts said: "Natural forests are key for maintaining biodiversity and rainfall patterns, but in colder regions, growing new forests may not be as useful as expected for reducing climate warming. In some areas it could even be counterproductive".

BNFL restarts reprocessing shipments

Nuclear reprocessing company BNFL has completed the first shipment used nuclear fuel from mainland Europe to Sellafield since May 1998.

Fuel from the GKN-operated nuclear power station at Dodewaard in the Netherlands has now arrived at the company's thermal reprocessing Plant (Thorp). The fuel had earlier been carried from the Dutch port of Vlissingen to Barrow by BNFL's ship, the European Shearwater.

Ninety three shipments of used fuel have now arrived from Dodewaard at Sellafield. Once all the fuel is removed from the reactor, the way will be clear for decommissioning work at the Dutch power station to progress.

Meanwhile, BNFL has welcomed a Health and Safety Executive announcement that the company has completed all the recommendations in the HSE's highly critical report into it's MOX demonstration facility (MDF) - see *Energy World* April 2000.

BNFL's Chief Executive Norman Askew said: "This opens the way to the re-commissioning of MDF as a support facility which is the next step to the eventual commissioning of the Sellafield MOX Plant".

The company is now working towards meeting the recommendations in the HSE's wider, and no less critical, Team Inspection Report which addresses issues across the whole of the Sellafield site.

Energy use and building services at the new Essex Records Office in Chelmsford are controlled by a network of York ISN (integrated systems network) building controllers. Methods of environmental control include absorption chillers, chilled beams, ultrasonic humidification and variable head pump sets, in conjunction with pressure dependent modulating valves for the heating system. Fifteen re-circulating air handling plants serve the building, with eight of the air handling units servicing the storage and archive area. These are kept within very close temperature and humidity parameters; typically within 0.5°C and 5% humidity. The versatility of the York system is based on the fact that each intelligent controller is, in effect, a full building management system which can control its local environment totally independently. Conversely, they can be easily interconnected via a single communications cable to form part of a complex, completely integrated building management system. Local interface network controllers provide a gateway into ISN so that printers, computers or modems can be connected for local and remote reporting and control. The Essex Records Office system has a total of eight controllers with approximately 400 input/outputs. Central control is achieved via a PC using the York Facility Manager software package.

CHP consents continue but plants 'may not be built'

Energy Minister Helen Liddell has resumed granting 'Section 36' consent for new CHP stations, giving the go ahead for the construction of more than 200 MW of new capacity in the last two months. New CHP plants include a 110 MW scheme which Scottish & Southern Energy plans to build at the Kimberly-Clark paper mill at Northfleet in Kent; a 60 MW scheme proposed for the Montell Polyolefins works at Carrington, Greater Manchester; and another 60 MW scheme, to be built by PowerGen CHP Ltd at North Mersey Goods Yard, Port of Liverpool.

This follows Government consent, granted last November, to Conoco to build a huge, 475 MW CHP plant at its Humber refinery at South Killingholme.

Last November the Government ended its stricter consents policy, under which consent had been withheld from new electricity-only gas fired power stations for two years in favour of higher efficiency CHP. At the same time it consented six new CCGT stations which had been held-up by the 'moratorium'. The move was seen as a retrograde step by environmentalists keen to see only CHP stations developed.

Not all the consented CHP capacity will be built, though, according to the CHP Association, as currently high gas prices and the prospect of further falls in electricity prices as new electricity trading arrangements are brought in the spring, have both damaged the economic case for CHP. CHPA research suggests that a third of the new capacity will remain on the drawing board.

Changing power supplier via the internet

Britons are currently throwing away over £1.5 billion between them by not switching to their cheapest electricity and gas suppliers, according to research by Datamonitor.

Aggressive advertising campaigns on the part of energy suppliers seem to have fallen on deaf ears, says the company, with many UK customers still unaccustomed to the fact that they can save money on their energy bills by switching supplier. Others are unsure of where to look for information on which supplier would be cheapest for them. The vast majority, suspects Datamonitor, simply cannot be bothered to switch supplier, despite the fact that they could save an average of £125 per year.

The company has now launched its new power2switch.com service, and hopes to make the process of finding the cheapest supplier, straightforward and hassle free for the UK consumer. The service is an independent price comparison website which allows consumers to find their cheapest supplier and switch online

It joins several other similar services, the latest to be launched being uswitch.com, which returns details of cheaper electricity supply details in less than eight minutes.

Living for the city

- the potential for renewable energy

by Dr D Elliott, Energy and Environment Research Unit, The Open University

Currently around 70% of the UK population lives in urban areas and, in effect, rely on rural resources for many of their basic necessities - most obviously food, but also water and energy. In effect, cities are dependants - even parasitic. To put it in contemporary terms, their ecological footprint, that is the area of land that would be needed to support them and deal with their wastes, is many times the land areas they actually cover. For example the footprint for London is about 125 times the area of the city, and equivalent to nearly all the UK's productive land area.

This article sketches out the lines of the emerging 'sustainable city' vision, focusing on energy. The emphasis is on energy use in buildings, which is responsible for around half the UK's current carbon dioxide emissions. The particular focus is on energy supply – on the assumption that the crucial energy conservation and energy efficiency aspects will have already been dealt with.

It is now sometimes argued that, far from being a major energy drain, cities could meet a substantial part of their energy needs from their own energy resources, without adding to the problem of climate change, by using renewable energy sources. In the past, energy has usually been brought in to cities, from remote and usually polluting power stations, by wire or pipe. However, technologies are now available that can use clean renewable energy sources which are directly available in cities; solar photovoltaic (PV) technology being the most obvious.

Cities actually offer an ideal location for the installation of solar PV modules. For example it has been estimated that, if PV arrays were mounted on suitable south facing roof tops and facades in a city like London, they would have a total generating capacity similar to that of around two conventional power stations.

Of course, there are drawbacks with solar PV. Solar energy is not available continuously, especially not at night! Nevertheless, some types of urban energy use are well matched to solar energy availability, most obviously day time office electrical loads and, in particular, summer time air conditioning loads. In addition, if power from PV arrays is fed into national power grid, low levels of solar energy availability in one location can to some extent be compensated by excess solar energy available in other areas, with the grid acting as a buffer, balancing out local variations

However, if power from PV arrays can be stored in some way, then of course, the solar options widen. The most obvious storage route is to use electricity from PV arrays to electrolyse water to generate hydrogen gas. Although safety controls have to be stringent, hydrogen can be stored and transmitted down pipes and used where and when needed, either for direct heating, as a combustible fuel, or in a fuel cell, to generate electricity. It can also be used as a fuel for vehicles, either directly or via a fuel cell.

Cutting the cost of PV

PV is of course still expensive. Currently PV arrays on a typical domestic roof costs something like £20,000 and will only offer a few kW of generating capacity. Enough, on average over the year, for lights and most other domestic electrical systems, but not enough for major loads like heating. However, such systems are usually linked to the grid and extra power can be imported when needed, with any excess power being exported, thus potentially reducing overall electricity bills. Sadly, at present the electricity companies typically only pay as little as 2 p/kWh for power sold to them and charge up to 7 p/kWh for power bought from them. So PV is not very attractive to many people.

However, matters should improve. Firstly, PV cells are getting cheaper. As and when demand for them rises, their price should drop dramatically. One study suggests that, given the creation of a reasonable market, PV would become competitive with conventional sources. Secondly, there is pressure on electricity companies to accept the idea of 'net metering'. Consumers who are able to export some power themselves would then only be charged, at reasonable rates, for the net amount of power transferred.

One company (Eastern, now part of TXU Europe) is now offering this option. In addition, the full VAT charge has now been removed on professionally installed solar systems, including PV, so there should be more of an incentive to invest in this technology.

The economics of PV also need to be set in a wider context. A modern integrated PV roof, made up of solar PV tiles, can substitute for an ordinary roof, so some of the cost of the PV system is offset, and this cost will in any case be offset by the value of the power generated. What other building item will actually earn it's keep? This same argument concerning costs has also been used on a wider scale. Prestige corporate headquarters office buildings often have vastly expensive facades of marble. A PV array could add the same glamour at around the same cost, but also generate power.

So far I've focused on PV solar for electricity generation, but there are other urban solar options, most obviously direct solar heat collection, for space and/or water heating. London has around 200 solar house projects, many of them the legacy of the old GLC/ South London Consortium days, and there are some 40,000 water heating systems installed around the UK. Passive solar design has subsequently become common in many new buildings, as a cost effective design option. Typically this can cut fuel bills by up to 30% over an average year. In addition there are of course a whole host of other ways to

in urban areas

improve the energy efficiency of buildings, by good design of the body shell, proper insulation levels and the use of low energy appliances and domestic systems. The potential for energy saving is considerable, and as buildings become more energy efficient, then it becomes easier to supply their reduced energy needs from renewable sources.

Recycling city wastes

Direct solar energy is of course only one of the renewable energy options available in cities. Cities also generate huge amounts of domestic and commercial wastes, which have a high calorific value, most of which is derived ultimately from solar energy. The first step should be to try to reduce the amount of waste produced, at source and then by composting, and recycling, but even so, cities are still likely to produce large amounts of waste, and it seems sensible to try to recover the energy from the non-recyclable waste that is left.

Recovering energy via waste combustion is not always popular, given fears about toxic emissions, and there are limits to the number of landfill sites we can accommodate near to cities, even if the methane gas they produce is tapped and used to generate power. Rightly or wrongly (and I'm from the former camp) fears about dioxin emissions from poorly run incineration plants continue to plague waste combustion projects. One possibility is to move to pyrolysis, which seems to have fewer problems. Even less problematic is the well established technology of sewage gas combustion, and sewage is one resource cites have in plenty.

Of course all combustion processes inevitably generate carbon dioxide, a greenhouse gas which contributes to climate change. However, recovering energy by waste combustion is at least partly greenhouse neutral, in that most of the original material is biological, and carbon dioxide was absorbed in its production. As for landfill gas, while there can be problems with toxic leachates, since we do have landfill sites, it is surely better to capture methane from them, rather than letting it escape into the atmosphere. Methane is a very powerful greenhouse gas.

Whether or not you view it as strictly renewable, the use of domestic and commercial wastes as a fuel is currently very commercially attractive. It becomes even more interesting if it is linked with cogeneration - that is using the heat produced as well as the electricity, in combined heat and power (CHP) plants. They can more than double the overall efficiency of energy use, and small local CHP plants can feed heat to local district heating networks. CHP and district heating really comes in to their own if use can be made of natural biomass as a fuel rather than wastes. Cities may not seem like an obvious source of biomass, but most cites do generate surprising amount of wood wastes from parks and the like, and some energy crops might be grown on brownfield sites. Some modern low density cities, like Milton Keynes, should have sufficient woodland and parkland wastes to run sizeable power plants. We are working on a wood waste fired system for the OU.

CHP plants do not have to be large. Whereas in the past there have been plans for city wide CHP/district heating systems, these days the emphasis is on smaller units meeting local heat loads. Indeed some people even think we could move to domestic scale units, with these eventually being run off renewably-produced hydrogen gas, piped down a gas main, but with natural gas being used in the interim.

The bottom line, in my quick sketch of the main urban energy options, is that, given sensible attention to building design and the efficient use of energy in low energy devices and appliances, energy demand could be cut significantly and renewables could make a significant contribution. For example, studies of Leicester carried out by the OU Energy and Environment Research Unit, suggested that demand could be cut by at least 60%, and much of this reduced energy requirement could then be met by CHP plants and from locally available renewable sources, with renewables supplying perhaps around 25% of the cities power. As a result, by 2020, Leicester's carbon dioxide emissions could be cut by 80% on 1990 levels.

However, this analysis does not exhaust the possibilities for urban renewables. In

Awarded an Audi Foundation grant worth £1,250 a year ago, Norwich inventor John Adam has since been busy testing his domestic wind energy generator at his home in St Augustines. The 47-year old former University of East Anglia student is midway through a 12-month full-scale test of an energy provider he believes could save homeowners money in relation to their electricity bills.
Data loggers are now measuring the energy that his roof-mounted design is generating. Adam has fitted a centrifugal fan with vertical axis above the roof's ridge that is coupled directly to an alternator and rectifier inside his loft. Output is fed to one or more re-chargeable batteries positioned in the roof space.

Vauxhall dealer installs PV power

Vauxhall unveiled Britain's first partially solar-powered car dealership last autumn: at Vauxhall dealer New Crown Sharpes at Daybrook, Nottingham. The installation includes a large solar array on the roof, solar elements in an east window aimed at capturing the imagination of passers-by, and a display constantly demonstrating the amount of energy the system is generating.

Vauxhall is collaborating with BP Solar on the Nottingham solar power showcase with some funding coming from the Regional Government Office, GOEast.

The sun's energy provides enough power to light an impressive canopy over a Network Q display vehicle, and to supplement a substantial proportion of the dealership's other electricity needs – from showroom lights to power for vehicle lifting platforms, the equivalent of the consumption of four average houses.

Vauxhall chairman Nick Reilly said today: "We lead the UK motor industry in the production of alternative energy vehicles, with the largest range of environmentally-friendly dual fuel LPG/petrol vehicles. We will also have ready for market in 2004 a fuel-cell car whose only emissions will be pure water. In addition, our manufacturing plants constantly monitor energy usage to ensure maximum efficiency. So this is a logical extension of our commitment."

some cities, there are other opportunities for using renewable sources, for example, micro-hydro projects on small rivers and even streams. One such project is underway on the River Wandle in south London. Another option available in some locations is geothermal energy. Although not strictly renewable, heat can be extracted from aquifers and fed to district heating networks, as has been done in central Southampton. More generally, and without geographic constraints, use can be made of ground source heat pumps for heating buildings.

By contrast, the prospects for the use of locally generated wave and tidal power directly in cites are limited, since the main wave resource is in remote areas offshore and few cites are on rivers with significant tidal ranges. However, in some locations it might be possible to use power from small onshore wave energy units or tidal stream generators in estuaries.

Urban wind power

Finally, to complete my review of novel renewable sources, what about wind power? So far, wind power has been seen as pretty much irrelevant in urban contexts. Wind speeds are usually too low and finding acceptable sites almost impossible. However, a colleague at the OU, Dr Derek Taylor, is developing a novel building integrated wind turbine system which fits into the roof space of a house, the Aeolian roof. This takes advantage of the fact that wind speeds can be increased by appropriately shaped roof designs. Assuming that noise and vibration problems can be avoided, we may yet see wind power make an urban contribution.

Including wind power with the other novel renewable energy sources I have outlined above, it may very well be possible that, in some situations, the contribution from urban renewable energy sources could rise well beyond the 25% suggested above.

Moreover, assuming continued improvements in the efficiency of energy use in buildings and elsewhere, and the integration of energy efficiency and energy conservation systems with advanced renewable technologies, such as renewably powered hydrogen fuel cell systems, then the urban renewables contribution could rise much higher.

However, total urban self-sufficiency seems unlikely. So, the rest of the power required would have to be imported from rural areas - from remote windfarms, hydroelectric projects, offshore wave energy devices, tidal stream devices and so on. Some of the energy from these non-urban sources would of course be best used locally, and that is especially true of locally grown energy crops. But there should be sufficient extra, in time, to supply the cities.

Targets for sustainability

The Government's current overall target is to obtain 10% of the UK's electricity from renewables by 2010, and possibly 20% by 2025, but that could well be exceeded. Certainly, several countries elsewhere in Europe are already doing better than that. For example, Austria and Sweden both obtain around 25% of their total energy (not just electricity) from renewable sources.

The longer term prospects for renewables certainly look good. The Shell global scenario suggests that renewables could be supplying around 50% of world energy by 2060 or so, while the World Energy Council's ecological scenario suggests that, if need be, we could move to a contribution of over 80% from renewables by 2100. Ultimately, then, it is conceivable that we could, if we wanted to, move to a world economy based mainly on the use of renewables - including the energy used in cities. That was certainly the conclusion of the fossil-free global energy scenario produced for Greenpeace. The message was that renewables could in principle help us to reach a sustainable future. All that was needed was practical application and the political will.

Renewable energy technology has been relatively slow to develop in the UK compared with most of the rest of Europe, despite the fact that the UK has a very large

renewable resource base. The UK Government's Non Fossil Fuel Obligation (NFFO) cross-subsidy scheme, introduced in 1990, has certainly provided a stimulus, but the emphasis has been on price convergence with conventional sources, rather than on capacity building. Thus, for example the UK has only managed to install around 380 MW of wind capacity so far, compared with the 4000 MW plus installed recently in Germany.

However, the fact that price convergence has begun to be achieved in the UK for some of the more developed renewables ought to imply that a commercial market could lift of for renewables. If so, then, as demand grows, capacity build-up should follow.

Clearly the UK is adopting a market led approach, but one in which new markets are enabled by a range of mechanisms designed to stimulate the commercial adoption and use of renewables. The NFFO was the first, but it is now being replaced by a Renewable Obligation on energy supply companies, which will require them to work towards sourcing 5% of their output from renewable sources by 2003 and 10% by 2010. That should stimulate the development of increased renewable supply.

In parallel, on the demand side, the government is introducing an 8% climate change levy on business use of energy from April 2001, but has exempted power obtained from renewable energy sources from this tax. Consequently, businesses are likely to want to contract with suppliers of renewable energy. Currently most of the regional electricity companies, along with some independents, are offering green power retail schemes of various sorts, for both business and domestic consumers.

What the new green power market offers is a way for consumers, large and small, to get access to green power without having to install generation systems themselves- enabling them, in effect , to 'go green' at a flick of a switch (or, rather, a change of supplier). Around 13,500 domestic consumers had done just that by March last year, and 100 or so companies and organisations have also switched over, perhaps most notably the Millennium Dome company. Several local authorities have done likewise.

Of course, as I've suggested, some domestic consumers and some businesses can install renewables systems in or on their premises to meet some of their power needs, although, as I have described, it is unlikely that the majority of them will be able to meet all their needs in this way, at least not for some while. So that's where the green power retail market comes in - providing a way to top up with externally generated renewable energy.

And as I've indicated, with the advent of two -way 'net metering' arrangements, it may be that so called 'micropower' generation by users will interface increasingly with the more conventional power supply system. Users could thus become part of the generation system, as well as being consumers.

Demonstrating success

The UK may be dragging its feet in some areas- for example our 100 solar PV roof programme looks pathetic compared to Germany's 100,000 PV roof programme and the USA's 1 million solar roof target. But there seems to be at least the beginnings of a way ahead - with direct relevance to urban energy users.

What we now need as some practical examples on the ground. And they are happening. Over the years Milton Keynes has been one of the pioneers, with more than 400 solar/low energy houses of various types. Initially most of these were public sector projects, like the 177 passive solar houses on the Pennyland estate built in 1980-81, but subsequently there have been three major commercial exhibition sites for demonstration housing projects, with a strong emphasis on energy efficient design and the use of environmentally sound energy sources.

Certainly there is now a lot going on. The Peabody Trust, the RENUE group, and many others, including the national network of d-i-y solar clubs, have developed some very innovative city-based renewable projects.

What is particularly interesting about these recent projects is the often very high level of local community involvement. If we are to move ahead to sustainable cities based on novel energy technologies, then we must expect to have to deal with design and implementation problems. To try to improve our rate of learning, it seems important to involve users and consumers in the design and decision making loop more effectively.

The same of course goes for rural populations: they will not relish having wind farms and energy crops plantations imposed on them just to service the energy needs of urban areas. That's one reason why it is important for cities to try to resolve their energy needs themselves. It is true that PV solar is still in its infancy, at least in the UK, but this option, along with the other renewable energy options I have mentioned, offers a chance to deal with the urban energy problem at source.

The bottom line is that, if properly designed, with proper attention to energy losses and efficient energy use, many urban buildings could use renewables to meet a significant part of their remaining energy needs. What we have to do now is make it happen both in the UK and, of course, around the world. Half of the world's population live in cities and the environmental problem are growing. Perhaps, historically, it falls to the great cities created in the west to pioneer the sustainable solution?

David Elliott worked initially in the nuclear power industry (UKAEA Harwell) and with the UK Central Electricity Generating Board, before joining the Open University Faculty of Technology, where he has developed courses and research programmes on sustainable energy technology. His most recent book is Energy, Society and Environment: Technology for a Sustainable Future (Routledge 1997). He is a senior lecturer in the OU Department of Design and Innovation, and director of the OU Energy and Environment Research Unit. He is also the editor of the renewable energy journal RENEW: see the on-line version at http://technology.open.ac.uk/eeru/natta/rol.html

Power of the sea

- taking renewables offshore

Oceans cover two-thirds of the planet and offer huge open spaces where new energy technologies could be deployed on a grand scale – with far fewer constraints than those which land-based renewables are already facing. Indeed, developing the marine renewable energy resource might be the only way of reconciling the needs to both increase supplies into the developing world and reduce emissions of greenhouse gases and other pollutants.

On these two pages we have rounded-up three technologies in various states of development. The LIMPET wave device is actually land-based but derives its power from the ocean – the first installation has already delivered electricity into Britain's national grid. Marine current devices will be sited close to shore in areas of fast moving tidal waters – the first should be installed off the Devon coast later this year. Tidal Electric's generator is perhaps some way off, but the US-based developer is also targeting Britain's waters.

First marine current turbine due in 2001

Marine current turbines such as the one pictured could be a commercial reality within five to ten years, according to Peter Fraenkel of Marine Current Turbines Ltd (MCT), a subsidiary of IT Power Ltd. There are no doubts on either technical feasibility or that the technology can be used at a scale large enough to make a significant contribution to energy needs, says Fraenkel. The question is how soon costs can be driven down to competitive levels.

MCT has made some progress and is currently working towards installing its – and the world's - first 300 kW machine off the coast of Lynmouth in Devon later this year. This will be followed by a small 'farm' of three or four machines located close together not unlike a wind farm. This activity is being supported by European funding.

Artist's impression of a marine current turbine – the first of these could be installed in fast-moving tidal streams within a decade

The company has settled on a design using a rotor (or two rotors) mounted on a mono-pile foundation in such a way that the turbines can be raised to the surface for maintenance. Reliability and long equipment lifetimes are key ingredients to a successful installation – Fraenkel's company is aiming at service intervals of up to five years and useful lifetimes of the main equipment of several decades, albeit with turbines and drive trains being replaced a number of times during this period.

Marine current devices have several advantages over other renewable technologies, according to Fraenkel.

- A suitable energetic marine current location can offer four times the energy intensity of a good wind site and some 30 times the energy intensity of sunshine in the Sahara; hence marine current turbines need only be a quarter the swept area of a wind turbine of the same power (or 1/30 the size of an equivalent solar photovoltaic array) and size equates with cost.
- A marine current turbine can deliver energy to a timetable since the tides are accurately predictable; therefore the end product is inherently more valuable to a utility than randomly generated electricity
- Not only are the turbines relatively small (compared with other renewable energy devices), but because of the bi-directional flow they can be packed much more closely together aligned across the current at less than 50 m intervals; this leads to a compact installation which in turn yields considerable savings in cabling and installation costs.
- Since weight is not a critical factor for a submerged turbine, the construction can be a steel fabrication so the manufacturing costs per tonne promise to be relatively low.
- physical conditions under water tend to be relatively predictable and calm – so extreme conditions require much less 'over engineering' than will apply for wind or wave powered technologies, and this also helps to keep costs down.

Nor should marine current turbines offend environmentalists, says Fraenkel. The technology should pose a minimal threat to marine life and the low visual profile (in some cases zero visual profile) should make it acceptable to planners to grant permission for large installations relatively close onshore. Most of the more promising locations have such high velocity currents as to make them unattractive for other marine activities, so serious conflicts with marine traffic or fishing are unlikely.

As well as its Devon project, MCT is also studying the feasibility of a similar project in the Philippines.

Contact Marine Current Turbines Ltd at tel: 0118 9730073, or visit the website at www.itpower.co.uk

World's first wave power device feeds power to Scotland

The world's first commercial wave power station, on the Scottish island of Islay already famous for its malt whiskies, has successfully fed electricity into the UK's national grid. The station has a 15-year power purchase agreement with the major public electricity suppliers in Scotland.

This first 0.5 MW LIMPET (land installed marine powered energy transformer) wave energy converter operates right on the shoreline, as the picture shows. However, the developers say that further units could be incorporated within rubble mounds or caisson breakwaters to provide self-financing coastal protection schemes, providing power to local communities.

The device comprises an oscillating water column (OWC) with Wells turbine power take-off. The OWC consists of an inclined concrete tube with its opening below the water level. External wave action causes the water level in the collector to oscillate. This variation in water level alternately compresses and decompresses the trapped air above causing air to flow backwards and forwards through a pair of contra-rotating Wells turbines. The turbines are self-rectifying: they are driven in the same direction irrespective of the direction of the airflow. Each of the two turbines on Islay is mounted on a shaft of a 250 kW induction machine.

Scottish-based Wavegen and Queen's University Belfast jointly developed LIMPET with European Union support, after gaining experience from a small research wave energy station installed on Islay in 1990. LIMPET's 500 kW rating makes it able to provide enough electricity for about 400 local homes.

Managing Director of Wavegen Allan Thomson sees the commissioning of the first LIMPET as proof that wave power devices have finally joined other proven and commercially successful renewables technologies. With modular construction and simple operation it could fulfil a growing need for coastal communities all over the world, especially islands seeking to replace diesel generation with clean indigenous power whilst revitalising maritime industries.

Wavegen points to several advantages of its shoreline technology, such as its use of a highly reliable and simple air turbine, its easy construction and installation with no marine operations, and its projected 60 year life.

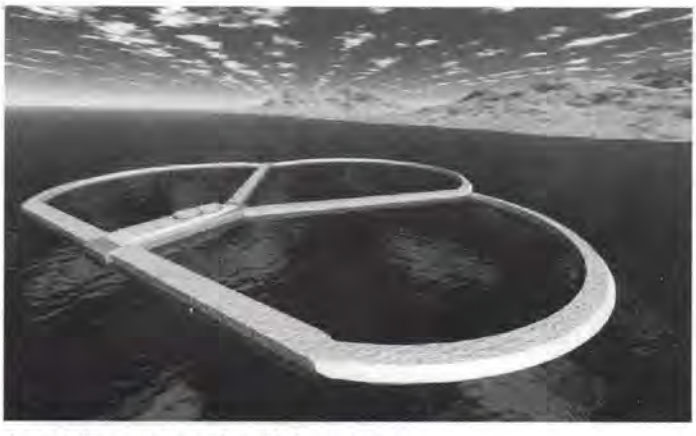
Contact Wavegen at tel: 01463 238094 or visit the website at www.wavegen.co.uk

The LIMPET onshore wave power device at Islay

Offshore 'circular dams' for South and North Wales

An American developer, Tidal Electric Inc, plans to construct three large tidal generator 'islands' off the shores of Wales; 30 MW installations off Port Talbot and Fifoots Bay in south Wales and an 80 MW installation off the beaches of Rhyll in the north.

The generators are not tidal barrages, but artificial hollow islands (or circular dams) located offshore in areas where the tidal range is particularly high (the power output is proportional to the square of the tidal range, making siting crucial). They would work by impounding water at high tide and, as the tide goes down, generating electricity as seawater is released from the island. A second generation cycle takes place as water flows back into the island from the next high tide. Power will be transmitted to shore by underwater cables.



Artist's impression of a tidal generator - Wales could be site of the world's first scheme

Neither the technology used to build the structures, nor that used to generate electricity (conventional low-head hydroelectric equipment) is new or unproven, and the power output will be utterly predictable, says Tidal Electric's Peter Ullman. Yet the potential for power generation is enormous.

The company is at a relatively early stage in developing what was a brand new concept, and is about to start detailed feasibility studies for the UK schemes. But Ullman has done plenty of groundwork - a couple of US universities have reviewed the basic concept and pronounced it viable. In the UK, Ullman has concentrated on gathering local support; talking to local people and possible development partners, and has met with a nearly unanimously positive response.

A scheme should take two years to build, says Ullman. Less certain is how long it may take to convince the financiers and obtain Government approval for such a novel idea.

Visit the Tidal Electric website at www.tidalelectric.com

Turning straw into power at Ely

by Geoff Loram

Energy Power Resources Ltd has recently completed commissioning two new large biomass power generation projects: the 36 MW Elean Power Station at Ely which is fuelled with straw and the 10 MW poultry litter plant at Westfield in Fife. Here, in the first of two articles, Geoff Loram reports on the engineering and the economics of the Elean straw-fired plant.

EPRL was formed in 1996 with the object of obtaining funding for and managing renewable energy projects. David Williams, who as manager of generation projects at SWALEC had already brought on stream renewable energy projects costing £100 million, joined as managing director in that year. In 1997 he was joined by Malcolm Chilton, another electrical engineer, who brought with him the project team from Associated Energy Projects when that company disappeared in the reorganisation of the group that became Vivendi .

The company took over two NFFO projects that had failed to get off the ground and brought them forward with the results that are reported in this article and the succeeding one. The company has a further 20 projects in various states of development, the largest of which is the Riverside Resource Recovery project which also had a previous life as Cory Environmental's Belvedere project.

To fund, build and operate the Elean plant, the world's largest straw burning plant, EPRL set up EPR Ely Ltd, a joint venture with Cinergy Global Power of the US. The power station was built by FLS Miljø, of Denmark, under a design, build and operate turnkey contract. FLS Miljø is part of the BWE group which had its origins over a century ago in Burmeister and Wain, the shipbuilders renowned for building some of the world's largest marine diesels.

Straw as fuel

Straw is an agricultural by-product that has a number of uses but of which there is a considerable surplus in the cereal growing areas of eastern England. When the burning of straw was made illegal in 1992, means of dealing with this surplus, which was estimated to be some 5 million tonnes per year, had to be found. Of the existing uses: animal bedding and feed, plant protection and on-farm use as a fuel for heating, only the latter showed any promise of significant increase and even that could only absorb a small part of the surplus.

The only other option available to the farmers was one which was already quite extensively used, and that is to plough in the chopped straw left behind by the combine harvesters with the stubble. This disposal method has some disadvantages, so farmers are very willing to sell their surplus straw if they can recover the cost of baling it and transporting it to a collection point.

EPR Ely set up a subsidiary, Anglian Straw which owns and operates a fleet of 10 HGVs to purchase and collect 200,000 tonnes a year of straw from contracted farms within 50 miles and deliver it to the station. The straw is baled by the farmers in 'Hesston' bales, 2.5 m long and 1.2 m square and weighing in excess of half a tonne. The HGV train comprises a lorry and trailer, each of which carries three layers of six bales, making a total load of 36 bales and an economical payload. EPR have calculated that the number of bales that they will handle in year would stretch the 670 miles between Lands End and John O'Groats, adding that that is still only 2% of the nation's surplus straw.

The combustion characteristics of straw are that it has a modest net a.r. CV of around 14-15 MJ/kg depending mainly on the moisture content, which normally ranges between 10 and 25%. The volatile/fixed carbon ratio is high at around 4:1 and the thermogravimetric analysis shows that it burns rapidly at a comparatively low temperature. This last property is valuable as combustion can be achieved with low percentages of excess air, thus increasing the boiler efficiency and minimising the volume of gas and the size of the boiler. Another positive feature is the very low levels of both chlorine and sulphur; the former allows the boiler to be operated at a higher temperature and pressure than would be the case with, say, a mass-burn incinerator; and the flue gas cleaning is simplified. There is a fairly heavy parasitic load but the net energy efficiency is still well in excess of 30%.

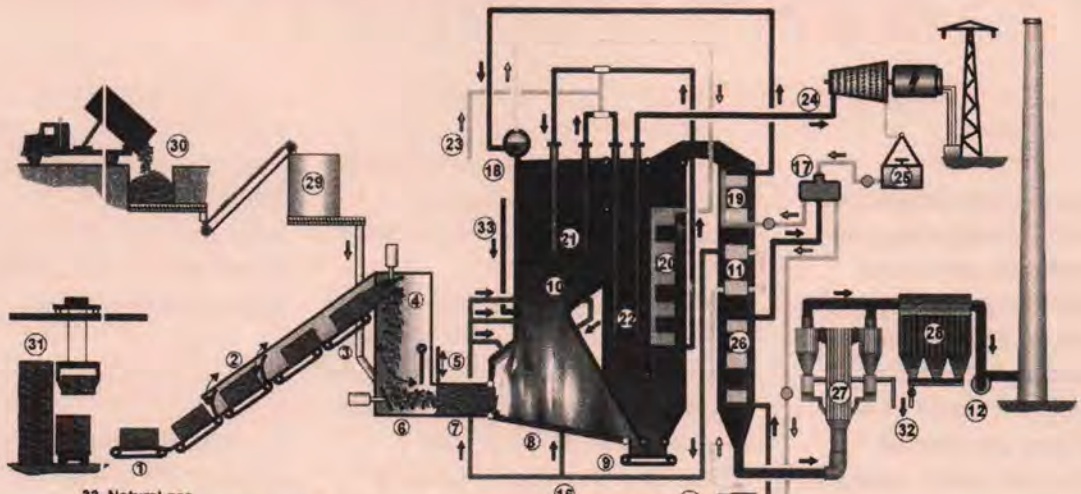
The waste-burning plant

The plant consists of a boiler and turbine house flanked by two straw reception and storage barns. The latter are arranged so that there is a one-way traffic flow through them and they are fitted with fast acting roller shutter doors to reduce to a minimum the incidence of the inevitable loose straw straying out of the building. A powerful vacuum collection system is provided to pick up the loose straw and send it to the boiler feed system; combustion air is also drawn from the barns so that they are at a slight negative pressure.

Bales are unloaded by a gantry crane fitted with six individual, hydraulically operated lifting clamps and a complete layer of bales is lifted off the lorry at one time. The bales are either placed on an automatic conveying system or stacked for night-time or weekend use; there is storage capacity for 2,100 tonnes – enough for four days operation. The clamps are fitted with a microwave moisture measuring device which sends a pulse of energy through the bale and measures the energy absorbed by the moisture. The weight of the bale as measured by an integral load cell is corrected to 16% moisture, the contracted amount, so that the company is not paying for excess water and the farmers are encouraged to keep their bales dry. Bales that have a moisture content of over 25% are rejected.

The conveying system is ingenious; it consists of a run of flat plate on which the bales slide, broadside on, being propelled by four lines of Renold chains that are just proud of the surface and engage with the bottom of the bale. To keep the stresses low, the chains are in a series of sections lengthwise with only a short gap between them, thus providing continuous propulsion to each bale. As they approach the centreline of the boiler from either side, the bales are thrust end-on up four inclined ramps (see diagram) at the top of which is a scarifier which cuts the twine and breaks up the bales. This allows the loose straw to drop down four chutes

Schematic of the straw fired boiler at Elean



33 Natural gas
32 By product and ash handling
31 Straw barns
30 Wood chip
29 Wood chip silo
28 Fabric filter
27 Gas Suspension Absorber
26 Flue gas cooler
25 Aircooled condenser
24 High pressure steam to turbine
23 Water for atemperators
22 Superheater 3
21 Superheater 2
20 Superheater 1
19 Economiser
18 Steam drum
17 Feedwater tank
16 Preheated combustion air
15 Air preheater
14 Combustion air intake
13 Forced draught fan
12 Induced draught fan
11 Air preheater
10 Combustion chamber
9 Slag conveyor
8 Vibrating grate
7 Water cooled duct
6 Stoker
5 Fire dampers
4 Scarifier
3 Dosing unit
2 Seal gates
1 Chain conveyor

from which it is augured into the furnace and drops onto a vibrating grate. The feed to the grates is controlled automatically by the boiler conditions via the control room computers. There is provision for feeding woodchips to the grate as a supplementary fuel.

As can be seen from the diagram the boiler is quite straightforward with ample provision for the large proportion of overfire air needed for this volatile fuel. The pronounced 'throat' in the radiant section creates the necessary turbulence and there is 2 seconds residence time at 850°C. The chemical make up of the fuel includes elements which can form alkali salts and give rise to tube fouling. However, the relatively high temperature at which the superheaters operate means that, although the salts condense on them they do not solidify but drip harmlessly into the ash quench where they shatter and add their valuable potassium and phosphate salts to the ash, increasing its value as a fertiliser.

After passing through the economiser and air preheater, the flue gases are cooled by the returning boiler water feed before passing through a dry gas suspension absorber of FLS Miljø's own design where any remaining acids are removed, and on to a Lodge Sturtevent bag filter before final discharge to the stack

The superheated steam passes through a high efficiency ABB turbo-generator; this has separate high and low pressure turbines, the former rotates at 11,000 RPM and the latter at 3,600 RPM driving the generator at 1,500 RPM through separate gearboxes. The pass out steam is ducted to a Balcke-dürr air-cooled condenser unit; this consists of ten large, slow speed fans which keep the noise levels to the low level imposed because of an adjacent footpath. Provision has been made to serve future heat sinks, such as a proposed green house development, as and when they become a reality.

The plant generates 36 MWe at 11 kV which is stepped up to 33 kV in a transformer at whose outgoing terminals the net output is metered. At 36 MW the fault levels are such that this output must be directed to a major grid connection, in this case an Eastern Electricity sub-station 11 km away. In addition to the expense of having to take the power that far, for the first few kilometres the line runs close to local villages and is buried to minimise the impact; the remainder is on poles. The poles are the longest available, but to maintain the ground clearance limits when the wires heat up and sag in hot weather, the plant output is restricted by some 10% in summer. The grid connection cost £1.5 million.

Project economics

The economics of the project are based on its having obtained a contract under NFFO 3 for an electricity price of 6 p/kWh until the year 2013. The question therefore arises as to what the economics of straw as a fuel might be under the future renewables regime. At the moment of going to press we have only the Government's proposals, which are subject to consultation, as a guide to what the contract prices might be. As it stands, it might seem that the technology might struggle to agree contracts that would include a viable price; but there are some factors that could improve the outlook. First, the consultation process might result in a higher level of prices; second, successor plants may be able to build on the experience at Elean and make cost savings. Third, this plant inherited some very onerous planning conditions, the most notable of which was the requirement to sink it some 8 m into the landscape – entailing the excavation of 300,000 m^3 of clay – and provide extensive landscaping. The high cost of the grid connection was another factor.

At about £1.67 million/MW, the capital cost is pretty high for a plant that pays for its fuel and receives no disposal 'gate fee' but EPRL are quietly confident that they will be building more biomass fired generating stations, possibly utilising a mix of fuels including straw, poultry litter, Miscanthus (a woody grass), wood chips and recycled paper. EPRL have applied for/just received planning permission for a similar plant in Corby.

Energy, the environment

by Paul Kennedy, Energy Manager, Corporation of London

Being a large organisation as well as a local authority, balancing, energy, the environment and economics is not always straightforward. The Corporation of London, with it's headquarters at Guildhall, is responsible for the public administration of the City of London, the world's leading international financial centre, and directly manages a diverse number of energy 'guzzling' functions and facilities. These include familiar public buildings such as schools, libraries, museums, police stations, crematoria and some not so familiar such as the three wholesale fresh food markets, Smithfield (meat), Spitalfields (fruit and vegetables), Billingsgate (fish), and the Barbican Arts and Conference Centre, Tower Bridge and the 15th Century Guildhall itself.

Here, the Corporation's energy manager Paul Kennedy reports on the Corporation's considerable commitment to energy management, its use of one of just four large-scale district energy schemes installed in UK cities, and on its experience of the Energy Efficiency Accreditation scheme.

The Corporation's energy spend is around £8.7 million per annum - a figure that has remained relatively stable over the last five to six years. The energy costs are dominated by electricity which account for 75% of the total. Water and gas are a close second, water tending to fluctuate depending on the vagaries of the supplier's billing system.

Energy management is carried out through:

- promoting energy efficiency to all departments and users of the services,
- providing advice both in-house and outside, including for example Home Energy Conservation Act advice to tenants and residents of the City, of which we have some 8,000,
- energy/water contract procurement to minimise costs wherever possible,
- provision of design advice, directly or indirectly through the Corporation's Energy Code of Practice, to clients and those responsible for design, and
- reporting progress to the Corporation's Energy Committee.

The Corporation has had an active Energy Committee for nearly 30 years and is almost unique amongst local authorities in having this committee of elected members dedicated to the issues arising from energy usage.

The Committee's terms of reference include:

- ensuring policies and strategies are set that minimise energy and CO2 emissions,
- ensuring legislation is monitored which may affect the various departments (in the past these have included, the Electricity Act, Home Energy Conservation Act and more recently the Local Government Act 2000 and for the future proposed changes to the Building Regulations),
- facilitating and supporting dissemination of information to City businesses, and
- informing and advising other Corporation committees.

Energy management at the Corporation has a three pronged approach. Reporting direct to the Energy Committee the Corporation has a dedicated energy management team whose success is measured against three criteria: reducing costs (£), reducing energy (kWh), and reducing associated emissions of carbon dioxide.

At a time when local authorities are under increasing scrutiny to improve efficiency, getting the balance right between these three measurement criteria is not easy. The effectiveness of Corporation policies and strategies in the 10 years is significant:

- in terms of cost - £2.7 million saved,
- in terms of energy - 6% below the 1990 consumption,
- in terms of carbon dioxide - 27% below the 1990 level.

The cost reductions are not cumulative; these are new identified savings each year. Therefore, once a saving has been claimed it will not be claimed again. The slate is effectively wiped clean.

Energy reduction targets are weather adjusted and this is in a decade where we experienced numerous mild winters. Carbon dioxide savings are as a result of both purchasing of renewable energy supplies and the switch from conventional gas and electric heating to the Citigen CHP scheme.

The Citigen local energy supply

The Corporation has been aware of the rising interest in CHP since the mid 1980s and saw an opportunity to develop a large scale CHP system within its area. It felt that the City could offer particular advantages which would make it very attractive to a CHP developer on a commercial basis. These included the large number of heating and cooling loads within a concentrated area, both Corporation and private, the availability of existing services subways for pipes and cables and the backing of the Corporation itself.

The Corporation chose not to carry the risk of developing the system itself, partly because in the long term it saw most of the customers coming from the private sector, but also because of the capital investment required. Consequently it opted to develop a partnership approach with the chosen operator in the form of a co-operation agreement.

The chosen operator was Citigen (London) Limited now a part of TXU Europe Ltd and the system base is located in Charterhouse Street, EC1. The system provides heating and cooling to customers within the EC1 and EC2 districts of the City.

The Citigen scheme is one of only four large scale urban CHP systems in the UK, and one of only two to produce and distribute chilled water for use in building air conditioning systems (the others are in Sheffield, Nottingham and, with a chilled water capability, Southampton).

So committed is the Corporation to the CHP scheme that nearly all the principal City properties receive a heat supply, and three receive a cooling supply in addition. These include the Guildhall, the Barbican Arts Centre, the recently refurbished London Central Markets (Smithfield), the Museum of

and economics
- getting the balance right in the City

London and Wood Street Police Station. Several of these buildings are totally dependant on Citigen for heating and cooling.

Although the Corporation is currently Citigen's major customer, a number of private customers are also supplied and the proportion will increase over the next few years. It is the Corporation's stated policy to support the development of the CHP system and others by encouraging building owners to take supplies and become customers, and to continue to make new connections for its own buildings where this is viable.

Heat, power and cooling

Technically the scheme is unique. Each engine produces 12 MW of heat and is coupled to an 11 kV alternator with an electrical output of 15.6 MW. Gas is fed to the engines at a pressure of 350 bar from twin compressors housed within purpose-designed explosion-proof enclosures.

Sophisticated emission control equipment is capable of removing up to 95% of the NOx content of the exhaust gases. The station also boasts two of the largest absorption chillers in use in Europe. These units, manufactured by Trane, are each rated at 5.6 MW.

Heat is recovered from engine exhausts, turbochargers, jacket cooling, and lubricating oil and transferred via heat exchangers to the district heating network. The absorption chillers are also supplied with heat.

The station lies within a thriving conservation area and most passers-by have no idea that a power station exists here as the building facade gives no clue as to the nature of the business within and the plant has been sound-proofed extremely effectively.

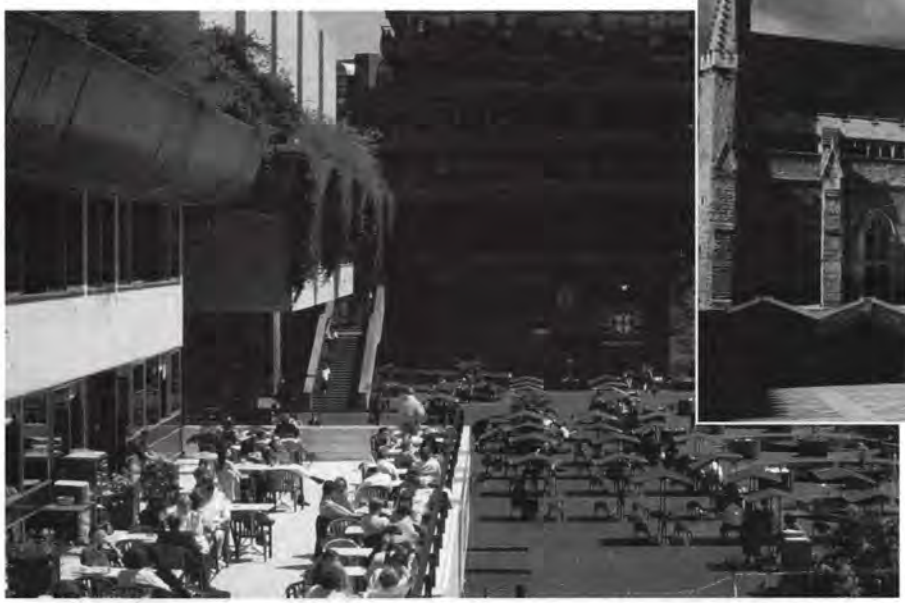
Besides demonstrating support for the Corporation's environmental policy, the CHP scheme brings a number of practical benefits for the Corporation's own properties.

- There is no need for boilers, chillers, roof-top condensers, flues, etc with space saved being put to other uses. (The Grade II* Listed London Central Markets (Smithfield), recently refurbished by the Corporation to meet the latest EC hygiene standards is totally dependent on Citigen for heating, air conditioning and refrigeration system cooling).
- The CHP scheme supplies for the London Central Market overcame all the usual difficulties associated with providing conventional heating and cooling plant.
- At the Guildhall, capital expenditure on replacement boiler plant has been avoided.
- Dependence on CFC and HCFC refrigerants is being gradually phased out at its air conditioned properties.
- Initially perceived as an energy reduction initiative, it is estimated that from the date the Corporation first took Citigen supplies in 1993 financial savings in excess of £400,000 have been achieved on energy costs. There has inevitably been a significant input in staff time spent in the day-to-day management and protection of the Corporation's interests.
- Reliable performance has been achieved since 1997.

Accrediting performance

The Corporation, therefore, through its Energy Committee and others clearly demonstrates it is totally committed to the responsible management of the environment. The responsible management of energy and water is one way of showing this.

Although the Corporation has had a dedicated energy management team for 15 years, what has been most effective is the professional way in which officers and members work together to achieve the same goals.



The Barbican Arts Centre and the Guildhall – both rely heavily on energy produced by the Citigen district energy scheme

In 1992 members were approached to consider whether the Corporation could meet the demanding criteria that is required to become accredited under the Energy Efficiency Accreditation Scheme. The scheme is awarded by the Institute of Energy and managed by the National Energy Foundation.

The Energy Committee was keen to know just how effective policies adopted by members had been. Accreditation, with its thorough and independent investigations into policies, investment and progress, offered this professional audit of functions.

The Corporation was awarded accredited status in December 1993 for the overall management of its sites. In 1996 and 1999, they again successfully retained accredited status and the most recent certificate sits proudly in the members' wing of Guildhall.

Apart from general pride, what additional benefits has accreditation brought the Corporation?

- It has given the Corporation tremendous belief that it is on the right track.
- Accreditation is independently assessed and backed by the Institute of Energy which gives it an independent seal of approval.
- It acts as a health check for our energy management procedures and confirms that these procedures are working.
- As a selling point, the double e logo provides an important marketable image.
- Re-accreditation every three years is an effective tool, ensuring the Corporation maintains its high standards.
- The Corporation is proud to be associated with high calibre accredited organisations to share and exchange, experience and information.
- Accreditation would highlight any major defects in strategy, policy or performance.

Training Energy Wardens

So where do we go from here? There is no doubt that accreditation is a clear public demonstration of commitment to high standards of energy efficiency and the logo can be effectively used in literature and corporate publications to demonstrate this, as the Corporation have shown.

At the end of the day energy management is simply good management. However, for an individual department to have a clearly defined energy policy, takes local commitment, commitment from the top of that department, no matter how large or small. It requires a fervent belief in the principles of energy conservation and sustainable development, protection of the environment and the prudent use of natural resources in parallel with economic stability.

For Corporation sites to buy into those principles, each would be halfway to accreditation. Commitment and foresight coupled with further investment in maintenance and repair, regular monitoring and targeting and then re-targeting energy usage will bring its rewards – direct to the site.

Energy management is all about networking, working together, sharing the responsibility. People want to listen, to learn from each other to find out what's in and what's not.

The Corporation uses networking effectively with their Energy Wardens: energy stewards, energy monitors, milk monitors, call them what you like; handled correctly they are an extremely effective means of gathering and disseminating information, allowing the energy team to work from within departments rather than from without.

In 1996, in our re-accreditation submission, our assessor highlighted that the Corporation could do more in the way of training, especially of Energy Wardens and also of raising staff awareness.

We took that advice and set about a programme of basic one day training in energy efficiency. This led to more detailed training the following year aimed at, in particular, technical staff including a not insignificant number from the Barbican Centre.

One particular Energy Warden from the Barbican Centre came to both training courses followed, in 1997, by a senior manager's training course. These training sessions were the start for a transformation in the way the Barbican Centre viewed its energy usage, and has led to a huge improvement in efficiency.

New cooling for the Barbican

For instance, the Centre recently successfully completed a £470,000 project to replace six obsolete refrigeration chillers with supplies of chilled water from Citigen. These units produced chilled water for the air conditioning systems serving the main public areas of the Centre: the concert hall, cinemas, theatres, main foyer, and several smaller areas. They also supply chilled water to the adjacent Guildhall School of Music and Drama. Both the Barbican Centre and the School are owned, funded and managed by the Corporation of London.

The work has enabled the removal of the chillers installed in 1976-78 and use of R11, R12 and R22 refrigerants to cease. In addition, it has allowed two wet cooling towers to be removed and lake cooling to be discontinued. Within the next two years it is planned to extend the chilled water supply to the Barbican's exhibition halls, replacing a further two 1 MW chillers.

Since 1999 over 90% of the Centre's electrical load has been supplied from a renewable source (Future Energy Accredited) making this one of the greenest buildings in London.

Since 1990 the success at the Barbican has been staggering: a 40% reduction in energy consumption and an 81% reduction in carbon dioxide emissions.

In December 2000 the Barbican Arts and Conference Centre was quite rightly awarded accredited status and is now committed to an on-going drive to further improve energy efficiency.

The Corporation recognises that, as the level of Government closest to the City, it has a duty to continue to act responsibly with regard to the environment in all its policies and actions - including its use of energy.

The Corporation also recognises that to move the City closer to the ideal of sustainable development it must continue to work in partnership with the wider community to encourage a sense of responsibility towards the environment by individuals, groups and business.

Contact Paul Kennedy at e-mail: paul.kennedy@corpoflondon.government.uk

Engineering profession 'in need of a skills overhaul'

The UK engineering profession is in need of an overhaul, according to a new report on the future role of the Engineering Council – the lead registration and regulatory body for the profession.

Presented to Minister for Science Lord Sainsbury just before Christmas, the report: *Making the Best of Valuable Talent* recommends a sea change, with engineers broadening their skills horizon. Even the term 'engineer' does not adequately embrace the wider technology and engineering community, says the report, and the Engineering Council itself may need to be renamed.

Independent review team the Hawley Group canvassed opinion widely and found that neither engineers nor their employees are satisfied with the current skills mix. They want to learn other disciplines and in particular to acquire business skills so that they can contribute better to wealth creation. The profession is keen to reposition itself and become part of the "science, engineering and technology community." The main findings of the report are unequivocal.

- There is a real opportunity for a new style Engineering Council to make a considerable contribution to wealth creation.
- Requirements for engineering and technological skills are changing fast.
- It is vital the Council and the profession keep pace so as to serve economic needs adequately.
- This requires major changes to be implemented. Such changes will have the support of business and industry.

The report responds to a request from Lord Sainsbury for a strategic paper whose recommendations should be implemented quickly. Established 15 months ago, the Hawley Group conducted research and survey work across a wide spectrum of companies, and from company chairmen to young graduates.

The Report's objective is to set the course that the Engineering Council, the profession and the Government should now follow in order to maximise the value of engineering and technology skills to the economy. It offers a snapshot into current thinking about engineering skills across the business community and society at large.

The document recognises that UK engineers are among the best in the world, but it warns that this is a profession in need of an overhaul.

Dr Robert Hawley, who is also the current Chairman of the Engineering Council said: "The Hawley Group has heard that many engineers and business leaders want the Council to become more relevant and credible. It should offer the expertise and know-how which make it a natural place for industry to turn for help and guidance on pan-professional matters. These issues are not found in British engineering alone. They are world-wide and we believe the UK's efforts to tackle it lead the field."

A key aspect of the "Hawley Group" research is that it explored the needs of innovative high-tech companies as well as more traditional forms of engineering. The Group has found that the wider engineering community wants an organisation which will:

- help give engineers entrepreneurial and business skills,
- exploit the web for keeping knowledge up to date, and
- support business in matching skills to jobs.

"The development of the future careers of scientists and technologists, of which we employ many, will be seriously enhanced if many of these proposals are taken up", commented Crispin Simon, chief executive of Biocompatibles plc, who was one of the senior industrialists consulted.

The report has identified several key areas where the Engineering Council, working with the engineering Institutions, can add greater value to the UK economy. One is in the promotion of engineering. The Group recognises that although each of the 34 professional engineering Institutions in the UK has something important to say, "too many voices are currently giving confused messages."

Institute of Energy Chief Executive Louise Kingham said: "There is no doubt in my mind that the engineering profession needs to change. Those able to bring about change should look towards the smaller bodies such as InstE who have had to innovate to move forward."

Trilateral agreement recognises British, French and Italian qualifications

A trilateral agreement was signed in Paris in December will pave the way for greater recognition abroad of the qualifications of British professional engineers.

The new arrangements will give British registered Chartered and Incorporated Engineers the knowledge and assurance that their professional qualifications will be recognised in both France and Italy.

It will also give engineers of equivalent status from these countries the same recognition when working in Britain. British companies will have the assurance that French and Italian qualifications match those of Chartered and Incorporated Engineers in this country.

The Engineering Council signed the agreement following two years of negotiations with France and Italy which was finalised during the FEANI, (European Federation of National Engineering Associations) annual Assembly in Hamburg during October.

Engineers who want to take advantage of this new opportunity should contact Dr Jim Birch, Deputy Manager Membership, at the Engineering Council on 020 7557 6478 or email: jbirch@engc.org.uk

Events

February 2001

Oil & gas North Africa
Conference and exhibition,
5-8 February, Tunis, Tunisia
Details from Spearhead Ltd,
tel: 020 8949 9777,
website: *oilgasnafrica@co.uk*

Building energy analysis and simulation
Course, 6-7 February,
London, £355
Details from the Institute of Environmental Engineering, tel: 020 7815 7675,
e-mail: *fuadp@vax.sbu.ac.uk*

International coal supply contracts and transport logistics
Course, 12-16 February,
Surrey, £2630 + VAT
Details from Coaltrans,
tel: 0207 779 8945, e-mail:
coaltrans@euromoneyplc.com

Better buildings for industry – improving energy efficiency
Workshop, 14 February,
Birmingham, free
Details from BRECSU Events,
fax: 01923 664602,
e-mail: *brecsueve@bre.co.uk*

Energy efficient heating systems
CIBSE CPD course,
14 February, London
Details from Maggie Procopi,
tel: 01442 866378,
e-mail: *maggie@cibsecpd.com*

Advance your presentations
Approved by the Institute of Energy
CPD course, 15 February,
London, £395 + VAT
Details from Speakfirst Training, tel: 0870 841 4111

Fuels, emissions and air quality
Co-sponsored by the Institute of Energy
Seminar, 20 February,
Birmingham, £235
Details from The Society of Operations Engineers,
tel: 020 7630 1111, e-mail:
soe@soe.org.uk

Low energy air conditioning systems
Course, 20 February,
London, £245
Details from Mid Career College, tel: 01223 880016,
e-mail: *courses@mid-career-college.ac.uk*

The German energy sector
Conference,
20-21 February, Berlin, £995
Details from CCI Ltd,
fax: 0207 505 0079, website:
www.asi-conferences.com

UK bioenergy
Conference, 21 February,
Cambridge, £200 + VAT
Details from British Biogen,
tel: 020 7831 7222,
e-mail: *nikki@britishbiogen.co.uk*

World oil - what's next?
Conference, 21-22 February,
Calgary, Canada
Details from the Canadian Energy Research Institute,
e-mail: *conference@ceri.ca*

Domestic energy rating
CIBSE CPD course,
22 February, London
Details from Maggie Procopi,
tel: 01442 866378, e-mail:
maggie@cibsecpd.com

Building Regulations Part L – Conservation of fuel and energy
Course, 23 February,
London, £185
Details from the Institute of Environmental Engineering,
tel: 020 7815 7675,
e-mail: *fuadp@vax.sbu.ac.uk*

Electric utility finance
Conference,
25-28 February, London
Details from the Edison Electric Institute, website: *www.eei.org*

Chilled ceilings and beams for low energy air conditioning
Course, 27 February,
London, £245
Details from Mid Career College, tel: 01223 880016,
e-mail: *courses@mid-career-college.ac.uk*

Creating an all energy future
Conference and exhibition,
27-28 February, Aberdeen
Details from JPPR,
tel: 0208 241 1912,
e-mail: *info@all-energy.co.uk*

Refrigeration and air conditioning
Exhibition, 27 February
– 1 March, Birmingham
Details from Emap Trenton,
tel: 020 8277 5208, e-mail:
shonat@trenton.emap.co.uk

Better buildings for industry – improving energy efficiency
Workshop, 28 February,
Edinburgh, free
Details from BRECSU Events,
fax: 01923 664602,
e-mail: *brecsueve@bre.co.uk*

March 2001

Embedded generation and the network
DTI conference,
1 March, Birmingham
Details from Sheena Newell,
tel: 01235 433602, e-mail:
sheena.newell@aeat.co.uk

Energy efficient housing design for the 21st century
CIBSE CPD course,
8 March, London
Details from Maggie Procopi,
tel: 01442 866378,
e-mail: *maggie@cibsecpd.com*

Americas coal
Conference, 12-14 March,
Cartagena, Colombia
Details from Coaltrans,
tel: 0207 779 8945, e-mail:
coaltrans@euromoneyplc.com

The future of utilities
Co-sponsored by the Institute of Energy
Conference, 14-15 March,
London, £995 + VAT
Details from the Adam Smith Institute, tel: 020 7608 0541,
e-mail: *admin@confs.co.uk*

Keeping the lights on: electric tradition or innovation?
Co-sponsored by the Institute of Energy
Conference,
14-15 March , London
Details from the Royal Institute of International Affairs conference unit,
fax: 020 7321 2045

Energy efficiency: advising the advisers

The Government Office for the West Midlands recently played host to the first of a series of ground breaking workshops organised by the Institute of Energy. The events are the result of the recent success by the Institute in securing a commission from the Energy Efficiency Best Practice Programme to deliver a series of five Energy Efficiency Best Practice Workshops for business advisers. To date, workshops have taken place in Birmingham, London and County Durham, with a total of over 50 delegates., Further events are scheduled to take place in London and Manchester this month. Indeed, the workshops have proved so popular that a sixth additional event, to take place at the Institute's offices in London, was added to the original programme of five events in order to help meet the demand.

The workshops were commissioned as a result of research which showed that SMEs could reduce their energy and water costs by 20% or more by implementing energy efficiency and waste reduction.

The programme and learning materials are designed to equip business advisers who work with small and medium-sized enterprises (SMEs) with the knowledge and expertise on energy efficiency to advise their clients. Workshop attendees will find that this knowledge of energy efficiency generates immediate benefits for their clients and the businesses themselves by helping to keep down costs and hence reinforce the value of the professional advice that the business advisers offer.

The highly practical course content, delivered by Cliff Bassett CEng MInstE of Briar Associates, began with an introduction to energy management followed by sessions on tools for benchmarking current performance, fuel purchasing, quick and easy ways to save money and buying energy efficient plant and equipment.

The programme and content is designed to not only promote best practice but to also offer continuing professional development to course attendees. The workshops are approved by the Institute of Business Advisers to qualify its members for CPD points towards their professional portfolio.

The workshops will have a lasting impact on the activities of the business advisers who attended as they were amply supplied with materials and resources to help them devolve the energy efficiency best practice knowledge gained. Resources supplied to them included not only delegate packs but also videos, books, leaflets and specialist guides to help them meet the learning needs of their clients.

The workshops proved not only popular but extremely pertinent to the work of business advisers as each workshop was extremely well evaluated and many delegates recommended that colleagues attend future events.

For further information on the workshops, contact Suzanne Cooper, Events Officer on 020 7580 0077.

The President of the Institute of Energy, Brian Chamberlain presents the Group Member certificate to Stordy's David Smith.

Energy will undoubtedly be one of the most important issues if not the most important issue of the 21st century, for both the industrialised world and the developing economies. As energy production, its availability, its use and the impact of its use move up the political, economic and environmental agenda of governments, non-governmental organisations and business, the role of the Institute of Energy has become increasingly more important. The Institute's activities and its sphere of influence as the authoritative voice of the energy field have raised the Institute's profile within UK government departments, industry and academia. The Institute's Secretary & Chief Executive, Louise Kingham says,

"As a learned society, the Institute of Energy's principal purpose is to promote the cost effective and environmentally responsible provision and management of energy in all its forms, and foster the professional development of its members to the benefit of the wider society. In addition to our professional membership, we are now encouraging the involvement of companies and organisations with energy related interests, and educational institutions whose curricula cover appropriate subjects."

To cater for this market, the Institute has two grades of membership, the 'Group Member' grade, which has three levels depending upon the size of the company; and the 'Academic Affiliate' for education and research establishments.

Brian Chamberlain, the President of the Institute of Energy recently presented a certificate of group membership to Stordy Combustion Engineering Ltd., the Wolverhampton based manufacturer of industrial combustion systems. Stordy's managing director - David Smith accepted the certificate on behalf of the company during the Institute's Midland Branch Annual Dinner at the Belfry late last year.

Institute helps industry gear up for the Levy

The Institute of Energy has been sub-contracted by Carl Daniels CEng MInstE, of Clifford Talbot Partnerships and Trevor Floyd IEng, AMInstE, of Tenby Consultancy Group, to provide support for their work on behalf of ETSU's Energy Efficiency Best Practice Programme to assist industry in preparing for the Climate Change Levy.

Now that 2001 is upon us, the Levy will soon be a very real concern for many UK industrial sectors. In spite of its imminence, however, concrete plans to mitigate its effects have yet to be laid in many cases. With this in mind, ETSU has secured funding from the DETR to run training in energy efficiency and awareness for the workforces of those sectors in the first wave of negotiated agreements.

Recent years have seen a growing realisation that it is those who are in daily contact with processes and plant who are best placed to make efficiency improvements. At the same time though, they may lack some knowledge of exactly why such improvements are necessary. The current Workforce Gearing project aims to fill some of these knowledge gaps: stressing the importance of participation at all levels of an organisation's structure, and impressing upon the workforce that savings are often there to be made relatively easily and cheaply.

With the organisation and support of Rob Wall at Institute headquarters, Carl and Trevor will be attending events run by sector trade associations and large energy users from those sectors. They will use materials from the now well established Learning Toolkit, developed by the Institute in conjunction with a number of partners including government bodies and trade unions, to educate and motivate members of the workforce to contribute to the minimisation of the Levy's effect on their organisations. The Toolkit contains everything from brief twenty-minute presentations outlining the need for and benefits of efficiency improvements in general, to much more detailed site-specific programmes looking at particular plant and operations. It also encourages employees to look for opportunities to save energy and minimise waste and provides support and guidance on projects with these aims. It is hoped that this 'bottom-up' approach to energy efficiency will bring real financial benefits for participants and environmental benefits for society at large.

Sectors involved in the project thus far include: Food and Drink, through the British Soft Drinks Association and the National Association of Master Bakers; Ceramics, through the British Ceramics Confederation; and Engineering, through the Surface Engineering Association. At the time of writing, Rob was also talking to a number of other bodies from industries as diverse as chemicals, brewing, and paper. With such a varied and wide-ranging potential audience for training, it is hoped that Carl and Trevor's expertise can have a real effect right across British Industry.

Regions pupils sustain their school

The Schools Sustainable Development Award 2000 was held on 8th December, at the Coventry Motor Musueum. The event was organized by Coventry and Warwickshire Savers Group (formally Local Agenda 21 and Energy and Water conservation Working Group) and sponsored by Jaguar Cars. Cardinal Wiseman School picked up the winning trophy along with a cheque for £1,000.

They demonstrated how their energy conservation campaign resulted in annual savings of around £10-11k on their electricity bill.

The other part of the event included the result of a poetry competition. Over 40 pupils stepped up to each collect a certificate and a copy of their book of poetry on the theme of water and energy conservation. The book, containing all the winning entries is named 'Raindrop, teardrop', after the title of this poem written by Gemma Smith aged 14 of the Rugby High School:

Water here - None there
Wet and windy - Dry and hot
Turn on the tap - Hike to the well
Pure and fresh - Muddy and polluted
Soapy washing-up water - Ashes in a pot
Sludgy mud - Cracked earth
Eight cups a day we are told to have
- They'll be lucky to get eight sips
Raindrops - Teardrops

Another poem published was titled 'Nuclear the future' by Anthony O'Kane, age 14 from Bishop Ullathorne School:

Why do we waste all the world's energy.
Why must we waste and burn all oil and coal
Why must we rely on plutonium to run our cars and warm our houses.
Soon we will be left with no fossil fuel and only a fossil of what used to be our world.

Commenting on the book of poetry, Chairman of the Savers Group, Nersi Salehi said: "This book gives us an exceptional insight into our children's beliefs and views about protecting our planet and sustaining life in the future."

Councillor John McNicholas, Cabinet Member (Environmental Services), said: "I am impressed by the pupils' talents in both these projects. Their dedication and enthusiasm to help sustain our future living environment is something we should all applaud."

The Schools Sustainable Development Award will be held every two years.

InstE provides the right tools for the job

The InstE and the DETR's Energy Efficiency Best Practice programme are working together to provide the most concise and practical package of measures to date to support and guide energy professionals in their work. As the implementation of the Levy approaches and confusion grows about the assistance that may or may not become available, the InstE and EEBPp have turned their attention to the energy practitioner. The various products and services previously promoted have been reworked, updated and new products made available to help energy practitioners excel in their field and be acknowledged for their achievements.

Within this 'one stop shop' energy practitioners will find a number of services including:

- Access to useful concise information
- Introductory short courses in energy management
- Specific short courses in energy auditing, IT for energy management and energy purchasing & tariff analysis
- A variety of longer-term learning options including part time, full time and distance learning courses
- Independent career development advice
- Independent coaching to include the design of personal development plans
- One to one visits to energy intensive, negotiated agreement or voluntary agreement sector organisations or intermediaries to develop training plans, technical solutions and awareness activities for all employees
- Audits to determine improvement plans for individuals and organisations wanting to achieve best practice
- Bespoke industry based training packages designed to suit your needs
- Access to a broader network of colleagues to help and support you in your job
- Briefings for senior management to explain the significance of energy management in your organisation to achieve top level commitment and investment for your work.

The aim is to provide a seamless solution to your energy management needs, whether they be personally related to your development or wider organisation needs, the InstE and EEBPp can help you. A team of professional staff and energy experts are available to support these solutions individually or as a package designed to meet your needs. Even if you are unsure about what is needed, or whether you are already achieving your best, a health check won't hurt so contact education@instenergy.org.uk to book your consultation. All you need to do is be ready to tell us about the symptoms and we will map out the cure so that you can get the best from your job and your organisation can achieve best practice. Initial consultations are free and the solutions you choose will be affordable.

A series of one-day events for energy managers and those with this responsibility have been scheduled for you to find out more. To register to attend one of these free events please email events@instenergy.org.uk Places are limited so book early to avoid missing out.

Attention all Members!

Please send your email address to

membership@instenergy.org.uk

so that we can regularly contact you about InstE activities. Even if you believe we have your email address recorded, don't worry about sending it through again so that we can check your details are correct. Thank you.

BRANCH EVENTS

FEBRUARY 2001

NEWCASTLE
6 February 17.30 for 18.00
'Recent developments in incineration'
John Thistlewood, Teeside Energy from Waste Plant.
Venue to be confirmed
Contact: Brian Pacey
tel 01670 737479, Email:
brian@bpacey.freeserve.co.uk

LEEDS
14 February 14.30
'Regenesys Energy Cell for Electricity Storage'
Presentation by NPower
Leeds University Dept. of Fuel and Energy
Contact Andrew Mallallieu
tel 0113 276 8888 ext 2324

LONDON
20 February (evening)
Low Carbon Energy Supply Options
Imperial College, South Kensington
Contact Joanne Wade,
tel: 020 7359 8000 email
joanne@ukace.org

WARRINGTON
22 February 17.45 for 18.00
'Gas Turbine Engineering and its role in Technology Development'
Dr Joanne Smedley, Head of Combustion, Aero and Industrial Technology Ltd
Contact Eric Curd
tel 0151 625 6744, Email:
eric.f.curd@btinternet..com

CARDIFF
23 February 10.00
28th Annual Idris Jones Memorial Lecture and Luncheon
'Achieving the UK's Commitment to Greenhouse Gas Emissions Reduction by 2010'. Dr Eoin Lees, Chief Executive, Energy Savings Trust
Contact: David Suthers,
2 Dan-y-bryn Close, Radyr, Cardiff CF15 8DG

FARNBOROUGH
28 Feb 2001 (evening)
'Combustion Research at DERA' by Chris Wilson at DERA Pyestock. Followed by site visit to test area. Contact: Chris Wilson. tel: 01252 374663 (day) 01252 673570 (eve) email:
cwwilson@ntlworld.com

MARCH 2001

WESTFIELD
Date to be confirmed
Visit to FPR Chicken Litter Renewable CHP plant, Fife
Contact: John Currie,
tel: 0131 455 2253
email: *j.currie@napier.ac.uk*

BIRMINGHAM
1 March 19.00
Austin Court.
'Enigma: Bletchley Park and the Battle of the Atlantic'
Dr. Mark Baldwin. Meeting hosted by Instutite of Electronic Engineers. Contact Harry Freeman. tel: 0121 353 2397
Email: *hfreeman@talk21.com*

NEWCASTLE
6 March 17.30
'Clean Energy and the Climate-the dilemma'
Repeat of the Melchett Lecture by Professor Ian Fells. Curtis Auditorium, University of Newcastle. Contact: Brian Pacey. tel 01670 737479, Email:
brian@bpacey.freeserve.co.uk

BELFAST
7 March (evening)
NI Branch Annual Dinner
Contact: David McIlveen-Wright
Email: *dmcilveenw@aol.com*

NEWCASTLE
7 March 17.30 for 18.00
'The Development of Lights for Lighthouses and Buoys'
Cdr Malcolm Wannell, Director of Engineering, Trinity House Lighthouse Services.
Venue: Dept of Marine Biology, University of Newcastle
Contact: Brian Pacey
tel 01670 737479, Email:
brian@bpacey.freeserve.co.uk

NEW MEMBERS

NORTH WESTERN
Mr P Smitham Graduate
Greater Manchester Fire Service
Mr D M Yorke MInstE
Corus Rail

LONDON & HOME COUNTIES
Mr M T Aplin Graduate
Imperial College
Mr I J Bradshaw MInstE
Shell Gas Direct Ltd
Mr S R Butler Graduate
Imperial College
Dr A W Cox MInstE
Capable Technology Ltd
Mr R A Croysdale Associate
Lifespan Healthcare NHS Trust
Mr R Eghan Student
South Bank University
Mr B Gill Graduate
Imperial College
Mr N J Grice Associate
Graham Powell Consultants
Mr M Keeley Student
South Bank University
Mr C McCarthy Companion
Office of Gas and Electricity Markets
Mr D Porter Companion
Association of Electricity Producers
Mr S Preece Graduate
Ministry of Defence
Miss H Rattay Graduate
Cambridge
Mr J Tennet Graduate
Cranfield University

SCOTTISH
Mr J I Currie FInstE
Napier University
Mr H Kelly MInstE
Argyle Energy

YORKSHIRE
Mr F R A C Baracho
Graduate
University of Sheffield

MIDLANDS
Mr G M Ahmed AMInstE
Energy Services (UK) Ltd

SOUTH WALES & WEST OF ENGLAND
Mr P Johnston Student
University of Wales, Cardiff
Mr M G Moultrie MInstE
Torpy Energy
Dr Robert Wilton Weaver MInstE
Corus Colours

OVERSEAS
Mr E G O'Donnell
Graduate
Limerick County Fire and Rescue Ireland
Caldera Paradies Ltd
Group Member Chile

HONG KONG
Mr C M Lin FInstE
Hong Kong Productivity Council

SITUATIONS VACANT / WANTED

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Email : line6@energy121.com

Energy / Environment / Chemical Engineers

Seek alternative PAYE positions £16k to £60k+.
Sales / Design / Project / Managing / Consulting. National Diploma to PhD level technical skills. Project to MD level management experience. Enquiries in confidence to Steve Howe.
Email : line4@energy121.com

Ltd. / Freelance Energy Engineers offer their services in 2001 :

Computational Fluid Dynamics; ++ IT; Gas Eng. / Transporters Network Code; up to post MBA level commercial skills; up to post PhD level technical skills; numerous lingual capabilities; will travel. Enquiries in confidence to Steve Howe.
Email : line5@energy121.com

Senior Mechanical Power Engineers Ref 548 - perm/contract

Experience in boilers, steam turbines and gas turbines required. Chartered engineers with overseas experience in the study, development, design specification and construction of utility and industrial plants.
Email : info@instenergy.org.uk

Site Manager Ref 530 - contract

Knowledge of power plant design standards, health and safety legislation and engineering contracts required. Background of boilers, steam turbines, material handling, electrical aspects of power generation and plc control systems.
Email : info@instenergy.org.uk

Lead Engineers - Mechanical/Electrical or C&I - Ref 529- Saudi

To administer and supervise the execution of the work of the relevant discipline, during construction and commissioning. 20 years experience expected.
Email : info@instenergy.org.uk

Construction Manager Ref 528 - Saudi

25 years experience with a background in Mechanical Engineering covering design, construction, erection and commissioning of major power plant.
Email : info@instenergy.org.uk

C&I, Mechanical and Electrical Engineers Ref 520/1/2 - Overseas - Single Status

BSc or equivalent engineers with 10 years related experience to work on plants with 4x600MW Gas/Oil fired boilers, Turbine Generators, Desalination Plant, Auxiliary Boiler and Emergency Diesel Generation equipment. c£40-45,000pa
Email : info@instenergy.org.uk

MCR MENTORS AND ASSESSORS

Dear Members,

Due to continued growth in the number of candidates pursuing membership and Engineering Council registration through the Mature Candidate Route, the Institute wishes to expand its pool of Mature Candidate Route Mentors and Assessors.

The Mature Candidate Route is a path to obtaining professional recognition for candidates, who are at least 35 years of age and who do not possess the appropriate academic qualifications for membership at either the grade of Member or Associate Member. This route also provides candidates with an opportunity to obtain recognition with the Engineering Council at Chartered Engineer or Incorporated Engineer levels. Candidates are required to produce a submission of approximately 5-10,000 words on an approved energy/engineering-related subject and attend an oral examination based upon the submission.

Candidates elected onto the Mature Candidate Route are allocated a Mentor who has specialist experience and knowledge of the candidate's chosen submission discipline. The role of the Mentor is to provide both technical and academic guidance and advice to the candidate during the preparation of the submission. On formal presentation of the submission for assessment, two Assessors are then appointed by the Institute. The role of the Assessor is to judge the academic content and presentation of the submission and the supporting oral evidence provided by the candidate, to determine whether the necessary academic standards for membership and registration have been attained.

If you are interested in becoming either a Mentor or Assessor for the MCR please contact Sanjeev Kumar by email at skumar@instenergy.org.uk or by telephone on 020 7580 0077, for further information.

the institute of energy

Rooms to Hire 2001

The Institute of Energy, set in the heart of the West End of London, is here to help you if you are looking for rooms to hold meetings, seminars or workshops.

Room	Rate for Members	Rate for Professional Institute/Body	Rate for Business Users
Council Room (up to 35 people)	Up to 4 hours: £120 Full day: £190	Up to 4 hours: £130 Full day: £220	Up to 4 hours: £220 Full day: £400
Members' Room (up to 12 people)	Up to 4 hours: £60 Full day: £115	Up to 4 hours: £70 Full day: £120	Up to 4 hours: £120 Full day: £220

ALSO AVAILABLE:
Catering (hot/cold buffet, cold drinks, etc), audio/visual equipment for hire, other smaller rooms for hire

For further information please contact Derek Smith at:
The Institute of Energy, 18 Devonshire Street, London W1N 2AU
Tel: 0207 580 7124 Fax: 0207 580 4420 e-mail:djsmith@instenergy.org.uk

BEST PRACTICE PROGRAMME
ENERGY EFFICIENCY

Energy Services Contracts for the public sector
Free Workshops - March 2001

BEST PRACTICE PROGRAMME
ENERGY EFFICIENCY

A series of FREE workshops tailored to the needs of the public sector, describing a cost-effective package which delivers:

- plant investment
- energy efficiency

and helps you to achieve goals for climate change and CO_2 reduction.

Dates and venues 2001

Tues 6 March	Institute of Public Finance, London
Weds 7 March	Moat House, Peterborough
Thurs 8 March	Edinburgh Posthouse
Tues 13 March	Chester Moat House Hotel
Thurs 15 March	Gatwick Moat House Hotel
Mon 19 March	Redwood Lodge Hotel, Bristol

Why attend?
The workshop will, through presentations and group-working, provide an understanding of the concepts and issues to be addressed in forming robust agreements.

Who should attend?
Senior managers within government establishments, local authorities, schools, sport centres and higher education establishments who have responsibility for managing and financing energy services. Those attending may include chief executives, prison governors, vice chancellors, head teachers, estate directors, finance directors and energy managers.

Energy services contracts (ESCs) for the public sector

Energy services contracts are a well established means of delivering cost-effective building services and improved energy and environmental performance. The concept, which is sometimes referred to as contract energy management, offers a range of services including:

Plant design
Financing
Installation
Energy supply
Ongoing maintenance and operation

The scope of schemes may vary from small-scale boiler installation to large-scale CHP provision.

The pressures of cost control, the Climate Change Levy and the need for CO_2 abatement has led to an increased use of ESCs to deliver results to the public sector. The opportunities presented will be of increasing importance to all those with responsibility for energy estates management.

For further information and booking details please contact BRECSU Events on -
Tel: 01923 664723 Fax: 01923 664602 e-mail brecsueve@bre.co.uk

These workshops are run on behalf of the Energy Efficiency Best Practice programme by BRECSU.
There is no charge for attendance, but as places are strictly limited and demand is expected to be high, early booking is recommended.