THE MAGAZINE OF THE INSTITUTE OF ENERGY

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the institute of energy

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2002

Tidal stream energy

Nuclear waste disposal

Electricity industry crisis?

Institute of Energy 75th Anniversary 1927 - 2002

Louise Kingham takes up new challenge

On 5 November Louise Kingham takes up a new challenge as Director General of the Institute of Petroleum and Chief Executive designate of the proposed merged organisation that will create the 'Energy Institute', should members vote for it to proceed.

The Institute of Petroleum faces a number of exciting challenges and opportunities, not least, the implementation of a three-way merger that is currently being discussed with the Institute of Energy and the Institution of Gas Engineers and Managers. The proposed Energy Institute will collectively serve 16,000 individual energy professionals and some 500 organisations.

After ten years with the Institute of Energy, and nearly four as its Secretary and Chief Executive, Louise said, "I look forward to this new challenge to work with the IP and create opportunities for members of all the organisations discussing the merger proposal. In the summer, the trustees of the three bodies agreed to search for a candidate to fill this post and I am delighted to have this opportunity."

President of the InstE John Blackhall said, "Louise has worked with the InstE team to achieve the change we needed as an organisation to better serve members interests. We look forward to continuing to work with her in her new role."

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THE MAGAZINE OF THE
INSTITUTE OF ENERGY

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The Stingray tidal stream generator – an artist's impression. A 150 kW demonstrator model of this new renewable energy device completed on-site testing recently in Yell Sound, off Shetland – see page 14 for the full story.

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Conflict in Iraq – the oil angle

Steve Hodgson

Energy has been in the news again in a big way as the Government is forced to lend money to nuclear generator British Energy so that the company can stay in business for a few weeks.

Meanwhile, serious reports in the Sunday newspapers tell us that large parts of Britain's electricity generating industry are in financial trouble, basically due to the same reason: the rock-bottom prices for which they are being forced to sell their output. This is also the cause of British Energy's problems - the whole issue is explored more fully on page 12.

Meanwhile, the wider nuclear debate, on reprocessing and the disposal of nuclear waste, escalated recently as Greenpeace drew attention to the issue by mounting a floating demonstration in the Irish Sea as a shipment of rejected 'mixed oxide' fuel was returned – by sea – from Japan to Sellafield.

Where else has energy been in the news? There has been some movement on renewables at the World Summit on Sustainable Development back in September (see page 6), but that's about it.

Anything else? Well, there is (at the time of writing) a very real prospect of war with Iraq, with Britain seemingly bound to play a small, but significant, part. US and British planes, missiles, even troops may be firing on military installations in Iraq as you read this. But why should this be mentioned in a magazine about energy? Simple, because energy – or more precisely oil – is one of the main reasons why a new war in Iraq today looks almost inevitable.

Causes of war

The build-up of tension in the region is widely reported to be about the need for the UN – or the US – to respond to the build-up of an Iraqi capability to build and use weapons of mass destruction (WMD). The theory goes that elements of the US military who where unhappy about the 'unfinished business' way in which the last war in Iraq ended in 1992. A decade of sanctions, and a continued military presence (policing the 'no-fly' zones in the south and north of the country established at the end of the last war) has failed to shift the regime.

Now, post 9/11, and flushed with the 'success' of the campaign in Afghanistan, those elements of the US military have more credibility than ever before, and their views have been adopted by many parts of the US Government.

So, fear of an Iraqi WMD capability, and a determination to do something about it, is the current trigger for a new conflict.

However, there are two other reasons why the US is taking a strong stand in Iraq – the Israel/Palestine situation, and oil. The former we can exclude from being a suitable subject for debate in this magazine – the latter we cannot.

Security of oil supplies

The US Government knows the global oil industry well. Both President Bush (ten years in the Texas oil business) and Vice President Dick Cheney (ex Halliburton Company) are from the industry. Cheney was responsible for the 2001 US National Energy Policy Report, which called for an enormous increase in energy supplies to tackle "the most serious energy shortage since the oil embargoes of the 1970s."

Iraq currently has the capability to *produce* just 2% or so of world oil supplies; a figure which could rise to 4%, even 6% under ideal circumstances. So, today it is not a major player in the world oil game – neighbouring Saudi Arabia (which produces some 10% of world supplies), and Kuwait, are. But Iraq actually holds the second largest oil *reserves* in the world, after Saudi Arabia, and so will be important in the longer term.

The importance of Middle East oil supplies is set to grow as other sources in the world, notably the US and Europe decline.

So, the major reason why there has been a major American presence in the Middle East for some decades now; and one of two major reasons underlying the current threat of war with Iraq is the need that the US sees to protect its access to Middle Eastern oil supplies at the sort of prices it wants to pay. Indeed, there has been press speculation that Russia and France oppose unilateral military action by the US because they fear that any new, pro-US regime will tear-up existing oil exploration contracts signed between Moscow and Paris, and Baghdad.

The current Iraqi conflict (if it has come to that) has a lot to do with oil, and even more to do with one country's dependence on that oil to fuel its industry, buildings, transport systems and cars. Remember that US citizens use an average of six times the world's average per capita oil consumption to fuel their lifestyle.

This will eventually change. The balance of power will eventually shift, as the world really does start to move away from burning carbon-rich fossil fuels, with their attendant impact on both local air quality and on the world's climate, and towards sustainable, carbon-neutral sources (including nuclear power or not, depending on your prejudices). The need for the US and the west to dominate the Middle East will not last forever.

But, for the present, be clear that the US's appetite for oil is at least partly behind the Iraqi situation.

Re-inventing the nuclear generation business

The future shape of Britain's nuclear generating industry was still unclear as *Energy World* went to press, with the latest Government loan to British Energy due to be repaid by 29 November.

Environmental groups had reacted with predictable dismay to news that the Government had agreed, in September, to a short-term loan of £410 million – later extended to £650 million – to keep the ailing nuclear generator British Energy afloat. The Government "should have let British Energy go into administration" and "has ducked an opportunity to finally deal with .... the obvious fact that nuclear power simply does not work," said Friends of the Earth and Greenpeace. Environmental groups were joined in their criticism by rival, non-nuclear generators who branded the loan "blatantly anti-competitive."

British Energy, which generates around a quarter of Britain's power, had earlier shocked the Government by suggesting that it would become insolvent without immediate state aid, blaming falling wholesale power prices as a result of new electricity trading arrangements brought in last March.

Extending the loan until the end of November, the Government insisted that its "overriding priorities are to ensure the safety of nuclear power and security of electricity supplies while protecting the interests of the taxpayer." The loan is for "working capital and cash collateral for trading in the UK and North America."

Trade and Industry Secretary Patricia Hewitt said "We have decided to extend the loan for a further two months in order to give sufficient time to clarify the company's full financial position and to come to a clear view on the options for restructuring the company. No decisions have been taken and no commitments given on the company's long term future at this time. These necessarily involve detailed and lengthy discussions and it is essential that both the company and the Government have sufficient time."

See also 'Crisis, what crisis in electricity generation' on page 12.

Closer UK-Norway co-operation

A study published jointly by the oil and gas industry and governments in the UK and Norway is calling for closer co-operation between the two countries on the development of remaining oil and gas resources across the North Sea.

The report: *Unlocking Value through Closer Relationships* outlines 14 recommendations for improving co-operation between Norway and the UK on all aspects of the oil and gas industry. These could ultimately be worth as much as $2 billion through savings on capital, operating and decommissioning costs and speeding up new development, according to the UK Offshore Operators' Association.

Many of the recommendations would facilitate the export of gas for Norwegian producers to the UK. The study also recommends discussions between oil and gas producers, the DTI, OFGEM and Transco on the investment required to ensure sufficient capacity in the UK National Transmission System, particularly at St Fergus, to meet future demand for gas.

Study participant BP has already announced that it will seek to engage a number of stakeholders in a major drive aimed at securing competitive future supplies of gas to the UK by promoting new links across the UK-Norway border between the North Sea's existing pipeline infrastructure.

The UK is expected to become a net importer of gas from 2005, with Norway as one of the major potential suppliers. BP's proposal will focus on providing new cross-border linkages between existing pipelines to ensure competitive, secure and flexible transportation for significant volumes of Norwegian gas.

Remote terminal units (RTUs) from Remsdaq have been installed at two wind farms on the Kintyre Peninsula in Scotland: Deucheran Hill and Benin an Tuiric in the Jura hills, operated by Powergen Renewables and Scottish Power. The farms are in remote areas which can only be reached by forestry track.

At a basic level, the RTUs control circuit breakers at a substation, sending real-time analogue information to a control room. But they also allow Scottish & Southern Energy to benefit from sophisticated automated generation management. The RTUs are communicating with SSE's SCADA master-station using DNP3 protocol. They constrain generation such that, if total exported generation exceeds transmission overload ratings, a signal is emitted to reduce levels depending on the state of the overload.

Ford plans wind park for Dagenham

Renewables specialist Ecotricity and the Ford Motor Company are to submit a planning application to build London's first wind park, three 1.8 MW wind turbines to be located at Ford's Dagenham Estate.

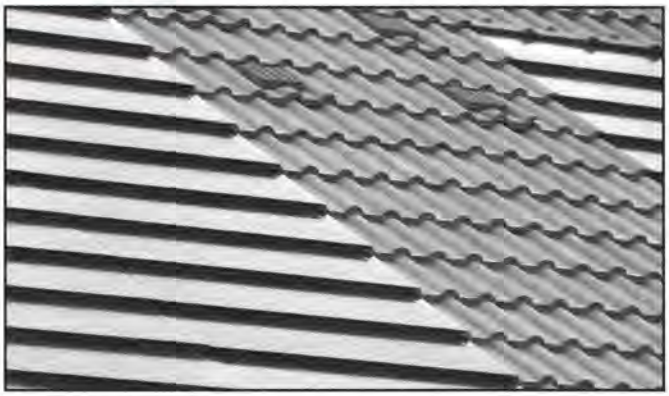
Just 16 km from the City of London, the development will, says Ecotricity, create a major new Thames-side landmark for the capital and will make a key contribution to the renewable energy targets outlined in the Mayor of London's draft energy strategy.

If given the go ahead, the park will provide 100% of the electricity requirements of Ford's new 'clean room' assembly hall that is being built to expand production of high-tech diesel engines at Dagenham. The park will be Ecotricity's second 'merchant' wind power initiative, where companies receive their own turbines and the power generated is used on-site, rather than fed into the national electricity grid.

One of the turbines will feature a 65 m high public viewing platform, accessible via a stairwell located inside the turbine tower. Providing a unique opportunity to experience wind power from the heart of the machine, visitors will enjoy views that rival those available from the London Eye, says the company. The platform is to form part of the new visitors' centre.

BP supplies TXU-Europe with 'largest UK solar installation'

BP Solar is to supply 87,000 state-of-the-art photovoltaic (PV) cells to be used in the construction of the new headquarters building for energy supplier TXU-Europe in Ipswich. Scheduled for completion in December this year, the 200 kW project represents the largest solar installation in the UK, says BP.



The high performance, mono-crystalline silicon PV cells, which are housed in glass panels and serve the dual purpose of replacing conventional materials and harnessing energy from natural light, will provide an output of over 200 kW at peak performance. This is over 10% of the maximum power requirement of the building. The system will also cut carbon dioxide emissions by an estimated 140 tonnes per year.

The £35 million building project, which is beginning to take shape in the heart of the Ipswich Village redevelopment area, is effectively creating a new 'clean energy' headquarters for TXU-Europe, the UK's largest domestic electricity supplier. All 1,000 of TXU-Europe's staff based in five existing offices in the Ipswich area will be relocated to the new building.

Four types of glass-to-glass PV module are being incorporated into the fabric of the six-storey building structure and will be fixed using a standard curtain wall system. There are also over 600 standard BPS laminates being installed as screening around the roof-top plant areas and to utilise otherwise 'spare' roof space for additional PV generation. The solar modules will be integrated on the south facing facades, spandrel panels, modesty panels, and on the atrium roof.

Meanwhile, residents of nine new family houses built for CDS Housing Association on the Pinehurst Estate in Merseyside are enjoying the results of the installation of Redland PV700 solar panels built directly into the traditionally tiled roof of the two and four-bedroom houses. The scheme is part of CDS's £20 million regeneration programme involving over 600 refurbishments and 27 new-build homes on the Anfield-based estate.

The 1.68 kW (peak) systems now in use by the Pinehurst Estate residents are expected both to export power to the grid at times, and to cut electricity bills by over 40%. Redland's PV partner, SunDog Energy of Penrith managed the system installation, and was able to use conventional roofing contractors.

Trust helps to cut bus particulates

TransportEnergy, the renamed transport campaign operated by the Energy Saving Trust, has helped fund the fitting of emission reduction equipment to over 2,500 buses and coaches in the past two years, saving over 200 tonnes of soot from polluting the environment.

TransportEnergy's CleanUp programme has been instrumental in improving air quality in the UK by fitting equipment to the most polluting diesel vehicles.

Particulate traps for buses and coaches typically cost around £3,000 each, but the cost to operators of both commercial and public sector vehicles can be cut by up to 75% by going through the CleanUp programme. Some £450 worth of funding is also available to maintain the equipment.

Speaking at the ExpoCoach 2002 event, David Lemon, Head of Technical Services for TransportEnergy said "Research

Government to study CO_2 capture and storage

The Government is to investigate the scope for carbon dioxide capture and storage (C&S) as a way of reducing greenhouse gas emissions from fossil fuel powered stations. The technique would prevent the emission of CO2 from power stations into the atmosphere by storing the gas underground in depleted North Sea oil and gas wells.

The recent Government energy review concluded that C&S could reduce carbon dioxide emissions from coal-fired power stations by 80-90%.

The study will look at:

- the environmental impact of storing CO2 underground and any risks of gases leaking back into the atmosphere;
- the potential for CO2 being used for enhanced oil recovery;
- the need for further research and development to fully develop the technology;
- the potential for collaboration with other countries such as Norway and Denmark which are interested in the technology;
- the legal implications for permanently storing carbon dioxide under the seabed at the North Sea's depleted oil and gas wells; and
- the economic cost of power generation as a result capturing the CO2 at the power station site.

Energy Minister Brian Wilson said "By developing this technology it could be possible for fossil fuels, such as coal, to have a cleaner greener future. This is essential if they are to continue to play a role in the UK's electricity generation and contribute to the need for secure and diverse energy supplies.

The UK has often taken the technological lead in new sustainable technologies but failed to capitalise on it. I am determined to convert that know-how into real projects which help reduce the effects of climate change." The results of the study will be published next spring.

One of a fleet of natural gas-fuelled vehicles (NGVs) present at a seminar held in Warwickshire by the Natural Gas Vehicle Association and the Society of British Gas Industries.

Interest in NGVs is said to be beginning to take off in the UK thanks to the imminent introduction of congestion charging in London – NGVs will be exempt from the charge. Benefits of NGVs are said to include up to 99% lower reduced levels of particulates; 10% lower carbon dioxide emissions than diesel; reduced noise levels and 80% lower duty than for diesel.

has shown that vehicle emissions are directly linked with respiratory diseases. While emissions of carbon dioxide cause global warming, local pollution in the form of fine particulates can result in over 10,500 hospital admissions each year due to respiratory problems. The fitting of a particulate trap to a bus or a coach reduces fine particulate matter by over 90%, and emissions of carbon monoxide and hydrocarbons by about 80%."

Buyers of distinction

The Major Energy Users' Council (MEUC) has announced the winners of its 'Customers of Distinction' awards for 2002. Institute of Energy Secretary and Chief Executive Louise Kingham was among the judges.

Keith Agnew, energy manager at chemical manufacturer Solutia UK, Newport in Gwent, was named the 'Action Energy Champion' for a campaign which achieved significant energy savings and environmental benefits at very little cost to the company. The company's energy use fell from 19 to 9 GJ per tonne of product between 1998 and 2002 resulting in cost savings of £350,000.

Tesco won the 'Best Use of Electricity' award for achieving savings worth £18 million in 2000-01 through the use of an energy help desk, training for relevant staff and the adoption of new technologies.

Paul Dunk of the Energy Centre at the Boots Company, Nottingham, won the 'Best Use of Gas' award for an "innovative and robust" solution to challenges, caused by new electricity trading arrangements, faced by the major CHP plant at Boots.

Retail and leisure group Scottish & Newcastle won the 'Most Effective Implementtion of a Strategy' award for its comprehensive and systematic approach to energy and environmental issues over a large number of widely dispersed sites.

The Corporation of London won the 'Best Energy Strategy' award for its continuing mixture of investment in energy efficiency and energy saving activities throughout the organisation – with a clear record of achievement.

Rod Sinden, responsible for energy procurement for one of the UK's largest purchasing consortia, LASER, won the 'Energy Buyer of the Year' award for a number of initiatives, including the introduction of electronic data exchange for his customers.

World summit rejects renewables target; Kyoto inches forward

Renewable energy eventually took a starring part in the World Summit on Sustainable Development in Johannesburg in September, but efforts to agree a specific target for its growth failed. Indeed, the debate over whether to proscribe a target or not delayed final agreement on the overall 'Plan of Implementation' by a whole day.

The plan calls for countries to act "with a sense of urgency" to substantially increase the global use of renewable energy, and also commits participants to the phasing out of subsidies for non-sustainable energy sources, where appropriate. Both parts are seen by the sustainable energy NGOs as weak; no target for renewables and phasing out of subsidies "where appropriate", rather than to a schedule which was to have included a review of progress in 2007.

In addition to the main agreement, a group of nine major electric companies signed agreements to undertake sustainable energy projects in developing countries.

Not everyone saw the overall outcome on energy as negative "The issue of a target for renewable energy was a worthwhile goal," said Summit Secretary-General Nitin Desai, "but the reality is that with sustained action, we can build up the renewable energy industries to the point where they have the critical mass to compete with fossil fuel-generated energy".

The Plan of Implementation does contain targets and timetables on a series of other issues, including halving the proportion of people who lack access to clean water or proper sanitation by 2015.

Better news for environmentalists came as the Russian Prime Minister, Mikhail Kasyanov, used his speech to the World Summit to announce that Russia intends to ratify the Kyoto Protocol in the near future. Combined with a previous announcement that Canada also intends to ratify the treaty, the Russian news indicates an increasing probability that the treaty will enter into force. At the same time, Australian Prime Minister John Howard suggested that his country might change its mind regarding the Kyoto Protocol and sign it "if we become convinced in the months ahead that it's in Australia's interest."

Reduced oil imports 'would aid US war effort'

Measures to reduce US dependence on oil imported from the Middle East would also help it win the ' war on terrorism', according to the former director of the CIA James Woolsey. The Bush Administration should, says Woolsey, reduce dependence by:

- encouraging the use of more fuel-efficient hybrid cars;
- generating ethanol from biomass or waste;
- beefing up the Strategic Petroleum Reserve to 1 billion barrels; and
- increasing Russian oil production by 50%.

Drawing on his experience in counter-terrorism and international affairs, Woolsey outlined the four-point plan as what he called 'the oil component of the US war strategy'.

Woolsey said the US must take urgent steps to increase its Strategic Petroleum Reserve to at least one billion barrels, and encourage its allies to stockpile oil. He also called the Administration to take steps to double Russian oil producing capacity. This, he said, would involve convincing Russia to privatise its pipelines and ports.

Woolsey said the move to highly fuel-efficient hybrid cars must be strongly encouraged. "We have five-passenger hybrid cars in the dealerships now. They get 50 miles per the gallon compared to the average SUV's 10 to 15 mpg. There should be as many incentives as possible to scrap older cars and move to hybrids." He added that rather than concentrate on fuel cells and other new technologies that would not be available for some time into the future, the urgency of the war on terror required solutions with existing technologies that can be adopted now.

California targets 20% from renewables by 2017

California has signed a new 'Renewable Portfolio Standard' (RPS) into law, which commits the state to double its use of non-hydro renewable energy for electricity production within the next 15 years. The state will require all retail sellers of electricity to increase their use of wind, geothermal, biomass, and solar power by 1% per year until they reach the required 20%, and all electricity providers must achieve the 20% goal by 2017.

Although roughly one third of the US states have RPS legislation in place, California's RPS law is arguably the strongest.

Four new photovoltaic power systems being built in California have raised the average size of new PV systems well into the hundreds of kW mark. Sun Power and Geothermal Energy is installing a 520 kW solar power system at a wastewater treatment plant in Oroville. Toyota Motor Sales, is following suit with a 501 kW system at its headquarters facilities in Torrance.

Meanwhile, the City of San Francisco is planning to install two large solar power systems: a 688 kW system at the Moscone Center and a 600 kW system at the city's Southeast wastewater treatment plant.

IEA sees abundant energy, but challenges on security, investment, environment and poverty

"The world has abundant energy resources for the coming thirty years, but these resources have to be converted into accessible, reliable supplies, which demonstrate that the renewed concern for security of supply is well-founded," said Robert Priddle, Executive Director of the Paris-based International Energy Agency, launching the 2002 edition of World Energy Outlook, the IEA's flagship publication.

His remarks continued to stress the negative "Despite our plentiful energy resources, there are formidable challenges. Consuming countries will increasingly depend, especially for oil, on a small number of producers, some of them located in unstable political areas. To get the energy out of the ground and to the market will require investments of trillions of dollars."

The Outlook, which appears every two years, projects trends in energy supply and demand, prices, trade and carbon emissions from now until the year 2030. This year, the Outlook presents an 'Alternative Policy Scenario', which assumes that OECD countries adopt all those energy efficiency and climate-friendly policies and measures now under discussion, as well as the basic 'Reference Scenario'.

The Reference Scenario projects continuing rapid growth in energy demand from now till 2030, at a rate of 1.7% annually – slightly down on the 2.1% average over the last 30 years. By 2030, the world will be consuming two-thirds more energy than today. And developing countries will replace the industrialised world as the largest group of energy consumers.

Fossil fuels will remain the dominant sources of energy, filling more than 90% of the coming increase in demand. Oil demand will increase even faster than in the past thirty years, says the IEA. Natural gas will be the fastest-growing fuel, doubling in volume in the 30-year projection period. Coal will grow more slowly, and its share in world energy supply will decline. Under present policies, nuclear power will decline as old plants are retired and few new ones are built. Renewable energy will increasingly contribute to power generation – use of wind power and biomass will expand very quickly, but from an extremely small base.

The two energy sectors that will grow most over the next thirty years are electricity and transport, especially in the developing world, where rising incomes will swell the demand for both.

Energy trade is set to expand very rapidly, as the major oil and gas consuming nations increase their imports. Production of oil and gas will be increasingly concentrated in a few states – OPEC members, especially in the Middle East, and Russia.

Enormous investments will be required to increase production to meet rising world demand – and to move that production to market. The WEO 2002 estimates that developing countries will need investment of $2.1 trillion to meet growing demand for electricity generation alone. This is more than double the investment in power generation in these countries over the past thirty years.

Steady growth in energy use will also drive up emissions of carbon dioxide. In the Reference Scenario, energy-related carbon emissions will grow by 16 billion tonnes, or 70% above today's level. The lion's share of new emissions will come from developing countries, with China alone adding 3.6 billion tonnes. Under this Scenario, OECD countries with Kyoto commitments will need to rely heavily on the purchase of emissions credits in order to fulfil them.

In the Alternative Policy Scenario, OECD countries will achieve cuts in carbon emissions, particularly through the use of renewable energy sources in electricity generation. Meeting the Kyoto targets will still not be easy.

In the meantime, energy poverty will persist. Some 1.6 billion people now lack electricity. If no radical new measures are taken to change the situation, 1.4 billion will still have no access in thirty years time, because population growth will nearly keep pace with the growth in new electricity connections.

Copies of the World Energy Outlook are available from IEA Books in Paris, fax: +33 1 40 57 65 59, email: books@iea.org

Norway opens wind farm

Norway's Statkraft has opened the first phase of a new wind park, at Smøla in the county of Møre og Romsdal. The 20 turbines will generate 120 GWh per year, equivalent to the consumption of some 6,000 households, says the company.

The plan is to build Smøla Windmill Park in two stages. The second stage will involve a further 55 turbines, with a total installed capacity of about 150 MW, corresponding to about 450 GWh per year. This is sufficient to cover the electricity needs of some 20,000 households and would be a firm step towards achieving the authorities' ambition of installing 3 TWh wind power in Norway by the year 2010.

But, says Statkraft, the development of wind power is hardly profitable at today's market prices, unless the authorities agree to providing predictable subsidies, and it is unclear whether the second stage can be built.

Statkraft says it is working on plans for the development of wind farms to generate a total of about 2.5 TWh per year, but that prospects for some of these schemes are uncertain due to financing issues and objections raised by the Norway's military.

We have seen a good deal of coverage of economic problems within Britain's nuclear power industry in the press recently, with some commentators suggesting that a reliance on state aid has always been the Achilles heel of the industry. Others suggest that the industry will never solve the problem of how to deal with long-lived nuclear wastes.

In the UK, the debate of waste disposal seems never-ending. Consultation on the Government's latest paper: 'Managing Radioactive Waste Safely' closed in March. However, we are a very long way from any resolution as the main aim of that paper, says the Government, is to "start a nationwide debate on how to manage solid radioactive waste."

Does anyone know how to proceed? In this feature we reproduce edited versions of two papers delivered in to the World Nuclear Association's annual symposium held in London in September. Dr Ian Duncan addresses the issue of public acceptability while Veijo Ryhänen describes how Finland is taking a lead in long-term disposal.

What to do with nuclear waste

The resolution *of the problem of finding an acceptable method of disposing of long-lived nuclear waste lies in the better identification of public attitudes, writes Dr Ian Duncan. The crucial point is to identify ways to allow recovery, and further treatment if necessary, of deposited wastes by future generations.*

by Dr Ian J Duncan

In the heady days of the 1970s, the accelerating growth of commercial nuclear power was acknowledged in publications projecting exponential growth, shortages of uranium and enrichment services, the need for spent fuel reprocessing and a breeder reactor programme. As society tried to adjust to this rush to nuclear, it was assumed that the closure of the fuel cycle and the disposal of its wastes was a foregone conclusion. Many options for disposal were proposed, such as geological burial, indefinite storage on or near the surface, placement on or in the ocean bed, continental subduction zones, ejection into space or placement on the ice sheet of Antarctica. Failing these, there was a belief that a society that was technically able to develop safe nuclear power would surely be inventive enough to devise an acceptable disposal regime. It would be but a short time before the safe disposal of all nuclear waste was demonstrated – a prompt technical fix.

After all, the volume of waste was small when compared to other industrial waste and the radiotoxicity would decay with time. The waste was specific and better managed than other hazardous wastes and therefore things would turn out all right in the end. There was also a sense that government was standing firmly behind industry to prevent any default and a belief, or hope, that a compliant public would accept such a nationally important issue as they had done with similar essential industrial developments until that time.

However, the period of rapid expansion in nuclear power coincided with deep social change as communities gained sufficient understanding and resources to be able to mount organised resistance to the siting of critical facilities, such as power reactors and waste repositories. Nuclear power was not alone in this, as there is now similar resistance to the siting of gaols, motorways, drug rehabilitation centres and airport extensions. The process of 'decide, announce and defend' (DAD) no longer satisfied society and DAD became DADA, 'decide, announce, defend and abandon'.

Classification of waste

Under this heading, the nuclear industry usually enters into a discussion about definitions for, and boundaries between, the various levels of radioactive waste. The recent re-categorisation of radioactive waste to include:

- exempt;
- VLLW, very low level waste;
- LLW, low level waste;
- LILW-SL, low and intermediate level waste – short-lived;
- LILW-LL, low and intermediate level waste – long-lived; and
- HLW, high level waste;

has many advantages, one of which is to provide an opportunity to compare nuclear waste to society's other hazardous waste.

It becomes clear that not all radioactive waste needs to be regarded as highly hazardous. There is a range of degree of radioactivity from that similar to background radiation (as, for say, VLLW) to the very high levels of HLW. There is, however, a public perception that all nuclear waste is a singular material, discrete from other waste because of its radioactivity. The nuclear industry has promoted this concept in the knowledge that radiotoxicity decays with time whereas chemical toxicity does not necessarily. The isolation of radioactive waste should therefore be less of a problem than, say, the isolation of insecticide residues or heavy metals.

In perpetuating the concept that radioactive waste is different from other hazardous wastes, the nuclear industry has been 'hoist on its own petard'. It has wrongly engendered and perpetuated in the minds of the public the idea that *all* radioactive waste is *equally* the most hazardous of all materials. I believe that it would be more logical to discard this adopted distinction. After all, most hazardous wastes are discrete in some physical, chemical or biological aspect, one from another. There are hundreds, if not thousands of hazardous wastes, and we may well ask how each of these is being disposed of.

While the nuclear industry has always shied away from criticising competing energy sources or wastes produced from other industries, it is now time to review this. It has become clear that a comparison of all wastes and their disposal is the only way for the public to comprehend the degree of potential hazard. Scientific statements as to the nature and degree of a

potential hazard are generally unintelligible.

A comparison between, say, LLW and waste from insecticide production or hospitals would show that the former is more manageable. It is solid, does not require further processing other than compaction, does not require sealed containment and is adequately disposed of in shallow earth burial. Short-lived intermediate level wastes would appear as just one of the moderately hazardous wastes of society, if compared to, say, ex-military chemical wastes. Long-lived intermediate and high level waste would, of course, rank much higher on a list of all of society's hazardous wastes, but these too can be shown to be manageable and safely disposed of.

The dynamics of waste disposal

Wastes do differ from one another, but there is a common theme running through all waste disposals. I believe that this theme is captured in the phrase 'all waste will become part of the earth'. The earth I refer to is all of the atmosphere, hydrosphere and lithosphere. Axiomatically, this includes the entire biosphere – that part of the air, water and rock that supports life.

Figure 1. Potential hazard-time relationship for typical geological disposal of ILW.

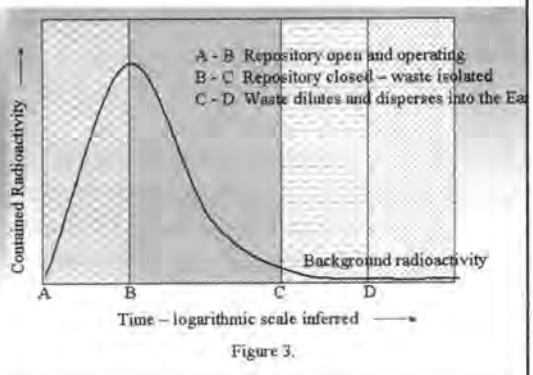


Figure 3.

It seems that the public perception of each waste disposal is that it involves a single step, putting it somewhere so that it will no longer be a potential hazard to the environment. Once placed, it is regarded as being static, securely locked away, and usually forgotten. In reality, however, all waste disposal is a dynamic process that accommodates chemical, physical and biological change, and then dilution and dispersion over time. The products of combustion are discharged into the atmosphere and within minutes are diluted and dispersed into that medium – a brief but dynamic process (setting aside the question of whether all gaseous emissions are truly harmless to the environment). Waste legitimately placed into landfill instantly becomes part of the biosphere, but with time it will be neutralised, diluted and possibly dispersed into the soil so as not to be hazardous to the environment.

Waste requiring isolation for a short period, such as surplus radio-pharmaceuticals (for example thallium and technetium), are retained for a few days to allow for partial decay before being safely discharged into the environment. The disposal of radioactive LILW-SL waste from the nuclear industry is a further demonstration of dynamic waste disposal. It accommodates physical change over time (radioactive decay) before there is any opportunity for it to connect with the biosphere. Beyond its designed isolation period, and with dilution and dispersal into the surrounding rock, the legacies of that waste should not present a hazard to the biosphere.

The disposal of HLW is a long, dynamic process that uses time to allow for radioactive decay, and eventually for its dilution and absorption into its over-pack and surrounding rock. It is the combination of containment and a selected space and time that will ensure that this waste will not be hazardous, should its remnants ever connect with the biosphere.

The modus operandi of all waste disposal is therefore to provide not only the space and medium of disposal, but to provide the time necessary for the change from being potentially hazardous to passive – a truly dynamic process.

The fourth dimension of disposal

The disposal of any waste requires the development of a three dimensional repository. Having also established the common thread of dynamism (change with time) that runs through all waste disposal, we are left with a further problem. In summary, when considering the subjects of family and environment, about 60% of the populations tested selected an outer time horizon of 50 years or less and about 85% selected 100 years or less. In a subjective way this can be expressed as 'a majority of the people have an outer time horizon not greater than the life of their grandchildren'. This is a significantly shorter time period than that necessary for the isolation of longer-lived hazardous wastes and is perhaps the root of the public's lack of confidence.

My research in Japan, Switzerland and the UK measured the public's confidence in deep geological disposal and found that more than half the population believe that the isolation could break down and allow a connection of waste to the biosphere in 1000 years or less. This compares unfavourably with the need to provide isolation periods of up to 100,000 years.

There is a possible solution to the puzzle of the disposal of all long-lived wastes. The wastes should be contained, buffered with suitable materials, put in place with a high probability of being safe, and allowed to change from potentially hazardous to passive with time. The public would probably have a greater confidence in such a disposal regime if that process could be reversed and the waste be recovered, should any future generation decide that it is necessary to do so. The general concept for a dynamic but retrievable scheme is shown in Figure 1 where A represents the opening of the repository; B the closure of the repository; C the design life of the containment system; and D the time by which all waste, if absorbed into the earth, would no longer be a potential hazard to the biosphere.

The repository would remain open while receiving waste. At any time during that period the process can be reversed if required, and the containers of waste

recovered. After the repository is closed, the containers of wastes can be retrieved by mining methods, if society requires it. The technology for such retrieval exists today but the container and repository design may need to be reviewed. The minimum design life for the containment system should be not less than the period necessary for the isolation of the waste, beyond which there could be a gradual dilution and dispersal into the over-pack and surrounding rock, without presenting a hazard to the biosphere. Should future generations find that a repository is imperfect, then it could be repaired, using current geotechnical processes. The next step is to thoroughly test people's inherent values and beliefs about reversible deep geological disposal.

Conclusion

An acceptable regime for the disposal of higher level, and longer-lived nuclear and other hazardous wastes remains to be implemented in most countries. This has once again been brought into focus with the possible resurgence of nuclear power due to a growing power demand and a need to reduce greenhouse gas emissions. More recently, the prospect of the clandestine use of nuclear waste as a weapon has once again focused attention on the security of interim surface storage of these wastes.

I hold that the resolution of this critical issue lies in a better identification and quantification of public attitudes and beliefs. I believe that the public's preferred option is *for*, not *against*, an acceptable final disposal for *all* existing and future hazardous waste. Of all of the sciences employed so far in the research for an acceptable regime for nuclear waste disposal, sociology seems to have been practically omitted, but this can be put right. We should start by identifying the disposal regimes acceptable to the public, and then develop the technologies and processes to achieve this.

Dr Ian Duncan had a long career in copper and uranium mining in Australia, before starting to study the relationship between society and the disposal of radioactive waste.

The Finnish final d

Plans for the final disposal of nuclear waste are further advanced in Finland than almost any other country in the world. Veijo Ryhänen describes how work has progressed, from a repository for the disposal of low level wastes to current plans for the disposal of long-lived spent fuel.

In Finland, four nuclear power plant units have been operated for over 20 years. The plants are located at two sites, Olkiluoto and Loviisa. The units supplied 27% of electricity demand in 2001. In May 2002, the Finnish Parliament approved the Government's 'Decision in Principle' to construct a new nuclear power plant unit in Finland.

Responsibility for nuclear waste management lies with the utilities, which have established a joint company, POSIVA, to take care of spent fuel disposal and other specialised aspects of nuclear waste management.

The construction of the first Finnish underground repository for low and medium-level waste was started in 1988 at Olkiluoto. The repository, which was commissioned in 1992, is located less than one kilometre from the power plant units. It is situated at a depth of 70-100 m in crystalline bedrock. The total capacity of the silos is about 8000 m^3 of waste.

The excavation work on the Loviisa repository began in 1993, and the facility was commissioned in 1998. The repository comprises a transport tunnel of about 1100 m in length, with tunnel and hall spaces built at a depth of about 110 m. The repository, when built to its full capacity, will accommodate about 4000 m^3 of waste.

For spent fuel, facilities have been constructed for interim storage. Spent fuel bundles are stored in water pools at both power plant areas until disposal, which, it is intended, will begin from 2020. Thus, the available storage capacity gives enough time for all the preparatory measures necessary for the implementation of final disposal.

Another important element in the Finnish nuclear waste management system is the nuclear waste management fund, which was established in 1987. The utilities have to collect a fee within the price of nuclear electricity and set it aside in the state-controlled fund. The fund and the securities must cover all the future costs of waste management, including spent fuel and operating waste, as well as other necessary activities (decommissioning of power plants, etc). By 2002, about 1200 million euros had been accumulated in the fund.

Development of deep disposal for spent fuel

Until 1996, spent fuel from the Loviisa power plant was returned to Russia (originally to the Soviet Union). However, already in the early 1980s, a national programme for spent fuel disposal was considered necessary, since only a part of the spent fuel from the Finnish power plants was exported. Hence, the development of a technical concept suitable for Finnish geological conditions was started. Currently, the Nuclear Energy Act does not allow the export or import of nuclear waste. The Finnish programme aims at the construction of a national deep repository for spent fuel in the 2010s, and the facility should start operation in 2020.

The planned permanent way to take care of spent fuel is emplacement of the packaged spent fuel in the repository to be excavated in crystalline bedrock at a depth of several hundred metres. The packaging is based on use of copper canisters, which will be surrounded by compacted bentonite in the repository.

Systematic work aimed at the siting of the repository was also started some 20 years ago. The essential aim of the site characterisation programme was site selection by the end of the year 2000. The programme advanced into deep drillings and other field work in 1987. In the final phase of site selection studies since 1997, site characterisation was focused at four site candidates; the two nuclear power plant sites (Olkiluoto at Eurajoki, and Loviisa) and at two other sites (Kuhmo and Äänekoski).

The latest updated safety analysis was reported in 1999. It proves that the final

lisposal programme

by Veijo Ryhänen

disposal of spent fuel can be implemented in compliance with safety regulations issued by the Government at any of the four sites studied. The results do not provide grounds for ranking any one of the sites above the others with regard to safety.

POSIVA started the assessment of environmental impacts (EIA) of spent fuel disposal in 1997. In the first phase, the procedure consisted of drafting the EIA programme. Inhabitants of the candidate municipalities were encouraged to participate in the process. The EIA process was continued by studies of the impacts on nature and on the utilisation of natural resources, on land use and on human health, as well as by an assessment of the social impacts. Alternatives for spent fuel management were also compared. The final EIA report was completed in 1999.

Decision in Principle

The Finnish Nuclear Energy Act requires that a policy decision, a 'Decision in Principle' (DiP) has to be applied for nuclear facilities prior to implementation. This also applies to a final repository for spent fuel. The DiP is made by the Government. A positive DiP does not, however, in itself enable POSIVA to construct the planned repository. In the DiP process a judgement is made on whether the planned facility is '...in line with the overall good of the society'. Later, separate licenses have to be applied for to enable the construction and the operation of the facility.

According to Finnish legislation, the siting issue is closely connected with the DiP. The approval of the host municipality is a precondition for a positive decision, in addition to a supporting statement from the Safety Authority. POSIVA submitted the DiP application to the Government in 1999. The site of the facility for which the decision was applied was Olkiluoto in the municipality of Eurajoki. Several factors supported the selection of Olkiluoto as the final disposal site.

Site investigations proved that the bedrock at Olkiluoto is suitable for safe disposal. According to the EIA results, environmental impacts would be minimal in a municipality where a nuclear power plant already exists. At present, the Olkiluoto nuclear plant units produce most of the spent fuel in Finland; thus the need for transportation will be minimised. Olkiluoto also offers the possibility of utilising sea transport in addition to road and railway alternatives. The power plant activities at Olkiluoto and the existing infrastructure of the area are also clear advantages for final disposal. Furthermore, there is a good local support for the repository in the municipality.

Statements concerning the application were requested from the Safety Authority, STUK, several ministries, the municipal council of Eurajoki, neighbouring municipalities and regional authorities. The public had also the opportunity to express its opinions on the application. The hearings and review of the application for DiP were completed in early 2000. Almost all of the statements requested, in total about 20, were in favour of the DiP.

According to the Safety Authority, STUK, the policy decision can be made on the basis of safety and Olkiluoto is suitable for the safe disposal of spent nuclear fuel. The municipality of Eurajoki took a decision supporting the selection of Olkiluoto as a repository site in January 2000. In December 2000, the Government approved the POSIVA application.

The Nuclear Energy Act requires that the final phase in the DiP process is a decision by Parliament, which may decide that the DiP remains in force, or may reverse it. The first debate took place in Parliament in February 2001. After the preparatory work of two Parliamentary committees, the decision was again debated in a plenary session. The final vote in May 2001 was in favour of the approval. In May 2002, the Parliament also accepted the disposal of spent fuel from a new Finnish nuclear power plant unit in the same repository.

The Future

The new stage of the final disposal programme after a positive DiP will entail the construction of an underground research facility (ONKALO) at Olkiluoto. The facility will be used to obtain detailed site data for the application for a construction licence and for fitting the deep repository into the local geological structures of the Olkiluoto island. The technical design and demonstration work and the complementary site characterisation results will provide the basis on which the safety case will be prepared to support the construction licence application around the year 2010.

The underground characterisation facility will consist of an access tunnel and an associated ventilation tunnel, as well as research levels at depths of 300, 400 and 500 m. The total length of the access tunnel will be some five kilometres. The aim is that ONKALO will eventually be used as a part of the final disposal facility.

The construction of the access tunnel is scheduled to start in 2004, and the total length of the construction period is estimated to be 5–6 years. Research activities at the main research level, at a depth of 400 meters, will probably be started 3–4 years after the excavation work has commenced. Once ONKALO has been constructed and the underground characterisation studies completed, the project will move on to the construction of the actual final disposal facility in the 2010s.

Veijo Ryhänen is the Managing Director of POSIVA, the waste management company formed in 1995 by owners of the Olkiluoto and Loviisa nuclear power plants, TVO and Fortum.

The World Nuclear Association

The World Nuclear Association (previously the Uranium Institute) is based in London. Contact the Association at tel: 0207 225 0303, email: wna@world-nuclear.org or visit the website: www.world-nuclear.org

Crisis, what crisis in electricity generation?

Electricity generators are hurting, post NETA, and suggesting that, at these prices, they may not be able to guarantee to 'keep the lights on'. Steve Hodgson reports.

Rock-bottom wholesale power prices – some 40% lower than those in 1999 – mean that nearly all British electricity generators are currently operating at or below marginal costs – a fundamentally unsustainable state of affairs. A state of affairs that has seen casualties in several generation sectors.

Nuclear operator British Energy is in well-publicised trouble, requiring the injection of £650 million of emergency funds from the Government to keep it afloat in October. The US-based AES Corporation has put its 360 MW coal-fired Fifoots Point power station in Wales into receivership and is reported to be unable fully to meet interest charges on debts held by its giant Drax coal/gas plant in Yorkshire. Meanwhile, Powergen is mothballing two plants: the Grain oil-fired station near London and the gas-fired Killingholme station - 1800 MW of capacity in all.

Away from the very big players, trade associations report the wide-spread closure of combined heat and power (CHP) plants and an almost drying-up of new orders for CHP – a fall to just 38 MW of new capacity commissioned in 2001 compared with more than 800 MW in 2000. The CHP Association is demanding reform of NETA to allow CHP and other forms of distributed generation to compete fairly. The renewables sector has perhaps suffered least, now that the Government's Renewables Obligation is propping up prices, but wind generators in particular reported severe difficulties in the first few months of the 'new electricity trading arrangements (NETA), which came into force in March 2001.

The Electricity Association has said that all generators, whether nuclear, fossil or renewable, were reporting steep and unsustainable drops in wholesale electricity prices over the last three years, adding that "the industry simply cannot afford to continue to run plant indefinitely at these sorts of prices."

Time to reform NETA?

NETA is seen as the root of the problem. Introduced to replace the discredited Electricity Pool and to make the generation industry more competitive, NETA has worked. It has successfully created a commodity market for electricity and has helped to lower wholesale prices across the board – by a huge 40% according to the most quoted estimate. However, not all of the fall in prices is due to NETA, say the generators, as increased competition and plant divestments have played a part too.

It's no wonder that the generators are hurting. What is curious is that the large electricity companies are not calling for a wide-ranging reform of NETA. This is partly explained by a reluctance to change expensive, NETA-compliant trading systems installed just a year and a half ago.

The other reason why many of the electricity industry's biggest players have kept quiet is that having an electricity supply – as well as a generation – business provides something of a cushion against high wholesale prices. Recent moves back towards a 'vertically integrated' industry, where companies have interests in generation, transmission, distribution and supply of electricity, have helped some companies to stay buoyant. Supply businesses positively benefit from low wholesale prices – particularly where the benefits of lower wholesale prices are not passed-on in lower retail prices for consumers.

However, that leaves the generation specialists in big trouble. Hence the woes of British Energy; a large generator with a tiny supply business; other 'merchant' operators of modern, gas-fired CCGT stations; and CHP operators.

Close plants to raise prices?

So what's the solution? Classic market theory suggests that the closure of plant will help to raise prices. But with electricity it's not that simple. The scale of closures seen so far has had very little effect on prices and the system needs some 'over-capacity' to cope with cold winter days anyway. Just how much excess or over-capacity is harder to quantify.

Market forces could cause the weakest plants to progressively close, to the point where the electricity system could no longer meet peak loads. This, in a somewhat simplified analysis, is what happened recently in California. Generators had no incentive – the prices were too low – to build any new plant in the state and demand growth eventually exposed a lack of capacity.

Energy regulator Ofgem insists that NETA is working to the extent that it has started to reduce the 25% level of overcapacity inherent in the electricity system. Some of this fat has to be cut, says Ofgem, before prices will settle down to a more acceptable level.

However, British electricity generators point out that, left alone, the market is by no means certain to preserve a sufficient margin of generating capacity over demand. They want NETA altered to ensure that operators are rewarded for keeping some plant idle, but ready to leap into action to help meet demand peaks. They also say that whatever the solution is put in place to solve the British Energy problem must not disadvantage the rest of the players.

There is no doubting the seriousness of the problem. One merchant banker is quoted as saying that "virtually all independent power producers in the UK are severely underwater and making debt payments out of cash reserves. These reserves only last a year and we are already about six months in."

Predicting the solution is rather more difficult. Perhaps market forces will prevail, with prices rising again as plants are closed – *and* a sufficient margin of capacity over demand will be maintained. Or perhaps the Government will recognise that electricity is too important to be left entirely to market forces and will step-in to reform NETA to ensure that the lights stay on.

Providing power to remote sites

The US based Northern Power Systems has been designing, building, and installing 'power solutions' for a range of customers for more than 25 years. Solutions include both the conventional and the non-conventional, on and off-grid: wind, photovoltaic, natural gas and hybrid fossil/renewable power systems. Here, two recent schemes illustrate the way that newer, sustainable energy technologies are being integrated into mainstream power systems.

TelePower unit at Canada's Corridor pipeline project. The container houses the diesel generator, battery bank and control system. The PV arrays can be seen above.

Northern Power Systems has completed construction of 22 turnkey power systems for the Corridor pipeline in Canada, part of the Athabasca Oil Sands Project. The pipeline system transports diluted bitumen from the Muskeg River mine, north of Fort McMurray, 493 km south to the Scotford Upgrader, north of Edmonton, Alberta; and returns diluent, a substance used in the process to condition bitumen north back to the mine. Upgraded product is then transported to a refinery in the Edmonton area.

The power systems are of two types: 14 'GridTie' grid-connected systems, and eight 'TelePower' diesel-photovoltaic hybrid power systems. Both types will provide power for telecommunications, SCADA, cathodic protection and block valve actuation at strategic points along the dual pipeline.

The GridTie systems are connected to existing power lines, providing an uninterrupted power supply in case of a power outage. Power for valve actuation is supplied from the grid.

The TelePower systems have been installed at remote sites where no grid power is available. These systems use PV modules as the primary power source, with diesel gensets providing back-up power during times of low solar energy. In addition, lead-acid batteries are used as the energy storage medium. A controller, also supplied by Northern Power, is used to control system operations.

When valve actuation is required at the remote sites, a signal is received via SCADA and transmitted to Northern's system controller, which activates the genset to provide power to open or close the valve.

The 22 systems for the Corridor project were built at a production facility located in Morrinville, Alberta, just north of Edmonton. Due to the extremely cold winters in Alberta, Northern designed the systems for optimal performance in this challenging environment.

The company was awarded the contract by SNC Lavalin, which is responsible for engineering, procurement and construction management of the pump stations and related facilities. Northern drew on its experience with the Caspian Pipeline Consortium and the ARCO Villano oil pipeline project in Ecuador.

Northern Power builds a range of TelePower systems which incorporate a wind or PV generator alongside a diesel or propane or natural gas-fuelled generator, together with a battery bank and controller. Northern has also supplied solar/diesel hybrid TelePower systems for seismic monitoring sites in Antarctica, which the US Government uses to monitor worldwide compliance with the Comprehensive Test Ban Treaty.

Meanwhile, Northern Power Systems has been commissioned to design and install a photovoltaic power system at the world's leading environmental research and policy institution, The Woods Hole Research Center (WHRC) in Falmouth, Massachusetts, US.

The new 26 kW photovoltaic array and monitoring system will provide green power to the organisation's Ordway campus, a new sustainable research facility currently under development. The campus, designed by architectural firm McDonough + Partners – which specializes in environmentally sensitive buildings – is expected to generate its own electrical requirements, as well as the energy needed for heating and cooling the facility. Northern's photovoltaic system will enable the research center to generate almost 37,000 kWh of electricity annually, making it the one of New England's few totally green-powered facilities.

The Ordway Campus will be converted from a summer home to an energy-independent scientific headquarters. The Center has already conducted extensive studies of methods of energy conservation, and has investigated existing and developing technologies suitable for creating an energy-producing facility.

Northern Power will design and install rooftop PV panels which convert solar energy into electricity. Electricity is then inverted from DC to AC and used in the building. Excess power is sent to the local utility, effectively running the meter backwards.

The building will produce all of its energy from renewable sources, including a thermal ground source heat pump. It is intended that the building will produce more energy than it uses, but will remain connected to the electrical grid, which will serve as a battery to be used when renewable sources are inadequate for satisfying short term energy needs. WHRC has established an aggressive annual energy consumption target of 75,000 kWh/year, some 84% less than the average amount needed for a building of this size.

The project was funded by a grant from the Massachusetts Technology Collaborative's Green Buildings Program, the state's development agency for renewable energy.

Contact Northern Power Systems at www.northernpower.com

The Stingray tidal stre – 150 kW demon

by Dr Tony Trapp, The Engineering Business Limited

Much recent renewables development effort has been for offshore devices – wind, tidal and wave power. A particularly exciting new technology is the Stingray tidal steam generator, which has just completed on-site trials. Here, in an edited version of his paper presented in September this year to MAREC 2002, a conference on marine renewable energy, Tony Trapp describes the development of the device up to August. Also included are extracts from bulletins sent back to shore during on-site testing.

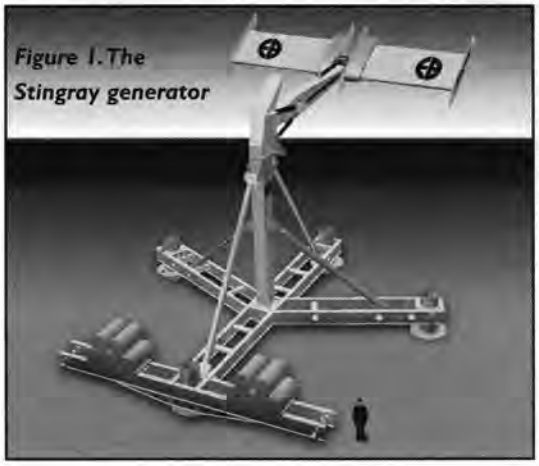


Figure 1. The Stingray generator

The patented Stingray tidal stream generator was proposed as a concept in 1999 by The Engineering Business (EB) in 1997. Serious development of the technology started in late summer 2001, following an award of £160,000 from the DTI under its New and Renewable Energy Programme. This funding was a 75% contribution towards a fast-track feasibility study into designing and building a 150 kW Stingray demonstrator, with the remaining project costs being met by EB.

The overall objective was to determine whether the proposed technology has long-term commercial prospects and whether a demonstration machine was the next logical step in evaluating these prospects. After 12 weeks of activity a team from the DTI conducted a thorough review of the project and in January 2002 Energy Minister Brian Wilson announced the award of a £1.1 million grant to EB to proceed with the design, construction and installation of the Stingray demonstrator.

The Stingray generator

Figure 1 illustrates the principle of the Stingray tidal stream generator - a large hydroplane has its angle of attack varied to produce lift and drag, which forces a support arm to oscillate up and down. The arm is restrained by hydraulic cylinders and the resulting high pressure oil is used to drive an hydraulic motor, close-coupled to an electrical generator. The generator output feeds an industrial drive system giving a dc output.

In a Stingray farm the output from a number of devices would feed a dc bus which typically connects through a submarine cable to land, where an invertor produces ac power for the user.

The feasibility study for Stingray involved five major activities, investigation, mathematical and physical modelling, site location and investigation, parametric cost study, and a design review.

Investigation

The investigation stage identified mathematical and physical modelling parameters and produced an outline base-line design, in terms of mechanical, hydraulic and control systems. A small-scale model was also designed for tank testing and installation and maintenance methodologies for a full size generator were considered. EB identified a workable, cost-effective, solution to the problems of safe and low cost installation, based around a moored barge with a cable system that lowers Stingray to the seabed.

Mathematical and physical modelling

A mathematical model was developed to assess and optimise the design and control of Stingray. The base-line design was then modified parametrically to determine the key design variables and the effect, in terms of efficiency and unit energy cost, of any changes.

Physical modelling has subsequently validated the mathematical model through confirmation of the applicability of lift coefficients. Glasgow University provided assistance with the evaluation of hydroplane characteristics and the selection of the optimum hydroplane geometry. Physical hydroplane model tests were carried out at Newcastle University, mainly to validate that the calculations used to predict foil performance were correct. They were also used to examine the effects of rapidly changing the foil attack angle.

The mathematical and physical modelling provided data that was used in an economic model. This indicated that the Stingray concept has the potential to be commercially successful and should yield performance comparable to other forms of renewable energy. Further work is required to refine the techniques and further investigate the effects of added mass. Stingray economics should be compared to other emerging technologies, such as wave power, rather than fully developed renewables such as wind energy that have benefited from many years of development. It is reasonable to suppose that wave and tidal energy systems will similarly demonstrate reduced cost and improving performance as these technologies mature.

Parametric cost study

The parametric cost model illustrated that Stingray is cost comparable with other tidal stream systems. However, it also indicated that further attention must be paid to certain key areas. For example, investigation as to whether the predicted benefits of shortening the drive arm can be achieved in practice, or whether these benefits are offset by developments in control strategies; investigation as to the practical

am generator
strator completes on-site testing

limits on using wide hydroplanes with a relatively short chord length; more detailed analysis of the effects of increasing hydroplane width on the weight of the support structure; and investigations into making the machine a single hydroplane.

Design review

The findings of the above stages were used to review the Stingray concept and presented to the DTI as a summary of progress.

In summary the Feasibility Study demonstrated that the Stingray concept is technically robust and commercially viable with the Stingray system being cost-comparable with other tidal stream systems. The study also concluded that the next stage in Stingray development was to design, build, install and operate a large-scale machine in a real offshore environment.

The 150 kW demonstrator

In January 2002, EB established a team of engineers tasked with completing a range of activities to enable the demonstration machine to be installed in Summer 2002. The main tasks included:

- development of the Stingray concept with further mathematical modelling;
- design of the Stingray deployment system to allow safe deployment and recovery of the 185 tonne machine;
- detailed design of Stingray taking account of the fatigue loading of the structure (and the seabed);
- design and procurement of the power and control system including software development;
- site survey, seabed survey and monitoring of current for 30 days;
- completion of an environmental appraisal;
- acquisition of all necessary permits and consents including a temporary lease;
- consultation with all interested parties – about thirty in total; and
- assembly of the system on Tyneside, shipment to Shetland, commissioning and installation.

The demonstrator Stingray in Yell Sound has been designed to produce time-averaged power of 150 kW from a 4 knot current.

The majority of the above tasks have been completed in about seven months and at the time of writing the system is on site in Yell Sound ready to launch to the seabed, as shown in Figure 2.

Site Selection

The site selection process comprised a combination of desk top study, environmental appraisal, consultation, current modelling and survey. Site location was determined by a number of factors:

- hydrographic/metocean – water depth, current velocity, current direction, current profile and wave regime;
- physical – foundation and cable route conditions;
- environmental – designated sensitive areas and other users (fishing, aquaculture, military, etc); and
- other factors – accessibility, in terms of travel time and costs; local port facilities for use in connection with installation/decommissioning; local stakeholder interests in terms of support of local official bodies and other stakeholders; applicable consents and leases.

Desk top study

The desk top study was undertaken by EB with some external help. As part of this study, a shortlist of ten potential Stingray demonstrator sites were assessed against defined selection criteria (based on the parameters identified above). The preferred site identified by this review was Yell Sound on Shetland.

Yell Sound has a strong, predictable tidal regime in water depths that are suitable for the demonstrator. Preliminary assessment of foundation conditions suggested the probability of bedrock at the seabed. Although a number of environmentally sensitive sites border Yell Sound, they are not assessed to be prohibitive to the project. Other seabed use is minimal in the immediate area of interest. There is strong support for, and interest in, the project at local (Shetland and north east England) and national (Scotland and UK) level.

Current modelling

A 3D current model of Yell Sound was commissioned from the Robert Gordon University in Aberdeen. The objective of this study was to predict the most suitable sites in which to install the Stingray generator. This prediction was based primarily on tidal energy considerations, but it also took account of other practicalities.

Figure 2. Stingray in its launch position, mounted on a support barge

A computational grid was developed, which used a low density grid (150 m) in the far field and a high density grid (90 m) in the narrow channels around the area of interest. This is the region where the fastest and most complicated currents occur and where the best sites for locating a tidal current energy generator were predicted. The hydrodynamic model was

validated against data from Hydrographic Office tidal diamonds and a BP survey of tidal currents. A good correlation was achieved between these data sets. Within the targeted area, the fastest predicted spring current is approximately 2.7 m/s (5.4 knots).

Site survey

A survey was undertaken to determine whether the tidal resource in the proposed location was adequate for power generation and to enable the safe and economic design of foundations, installation methods and operational integrity of the structure. To achieve this, site specific information was required on:

- site suitability (water depth, current regime, environmental impact);
- soil type and variability;
- seabed topography (level seabed, free from obstructions preferred); and
- scour potential.

Geophysical and hydrographic surveys were carried out simultaneously in February 2002. An environmental appraisal report was commissioned from, and produced by Entec UK Ltd. Together with the survey data these were analysed, and confirmed that the Yell Sound site was appropriate for the Stingray demonstrator.

The proposed site at Yell Sound was selected to allow safe passage of vessels overhead. The selected site is at approximately 29 m below Chart Datum, resulting in 5.4–7.3 m clearance. The site has been chosen in consultation with Shetland Islands Council Marine Operations Department.

Site operations

At an early stage in the design and build project, EB decided that the demonstrator should be capable of easy deployment and recovery on many occasions during the trials. This is the start of developing new technology and it is sensible to allow for modifications and adjustments to be made as the programme develops. EB developed and built the launch and recovery system but has also arranged for the deployment barge and support vessels to be on site, fully manned around the clock. This has resulted in an increased project cost but was considered to be essential for this kind of operation. This has no impact on long term commercial viability but should enable more rapid system development.

Further Stingray development

The development of new 'wet' renewables technology is difficult, time-consuming and expensive and expectations of early commercial success should be tempered by the long and painful attempts to develop successful wave energy technologies that has happened over the past 25 years. However EB remains confident that, with persistence and sufficient funding, the Stingray system can be developed into a commercially attractive technology. There is a considerable challenge in trying to develop a business based on Stingray and much progress has been made in the past year.

The next stage in the development of Stingray is to design, build, install and operate a 5 MW 'pre-commercial' Stingray power station with a projected 15 year life. EB believe that if encouraging results are obtained from the 150 kW demonstrator, then this power station should be installed in 2004. This is an ambitious target and will require a significant investment. Together with DTI assistance, Stingray has been entirely funded by The Engineering Business from profits generated in its submarine telecom and oil and gas businesses. It is now time for an outside investor to share in the development and EB is now carrying out a fund raising exercise so that this development programme can continue.

Contact the Engineering Business Limited at www.engb.com
Papers from MAREC 2002 will be available soon, on CD-ROM, from the Institute of Marine Engineering, Science and Technology; tel: 0207 382 2620, email: info@imarest.org

On-site trials in Shetland

Stingray's first on-site trials were conducted in September, after the above article was completed. Below are extracts from the bulletins sent back from Yell Sound during the trials.

September 2002 – after 12 months of intensive development, EB has successfully installed Stingray in Yell Sound off the Shetland Isles. In a landmark achievement, believed to be the world's first offshore installation of a full scale tidal stream generator, Stingray was gently lowered 36 m to the seabed on 13 September. The launch was aided by near perfect weather and tide conditions and the operation went without a hitch.

Following installation, the EB team has been working around the clock to assess the performance of the device. Initial testing involved measuring instantaneous power output at different points of the power cycle. The results were extremely encouraging, with significant power outputs being recorded.

Engineers are now using the full control system to operate the generator. This automatically adjusts the position of the hydroplane throughout its stroke in order to maximise power output. EB is in the process of testing a number of different control strategies to develop the optimum in terms of power generation.

Stingray was safely recovered on 25 September and has now been returned to Sullom Voe. In the very early hours of the morning the EB launch and recovery system was used to carefully bring the generator back to the surface. Once safely secured, the 'Forth Drummer' towed the barge and Stingray back to the mainland.

During its offshore trials, EB operated Stingray in up to 4 knot tidal currents and gathered a huge amount of data. Initial results look promising but before the sales and marketing department begins to make any outrageous power generation claims, the engineering team will complete a thorough analysis of the numbers. In the meantime, it is already clear that the test programme has allowed EB to learn a great deal about the economic and practical realities of operating an offshore generator.

Evaluating the performance of wind 'catchers'

Monodraught's WindCatcher ventilation and daylighting system at Reading University

The University of Reading School of Construction and Engineering has undertaken a study to evaluate the performance of the SunCatcher combined natural light and ventilation system, and WindCatcher natural ventilation system, both from Monodraught.

Dr Hazim Awbi and researcher Abbas Elmualim are in the process of carrying out a long-term evaluation of the 1 m^2, SunCatcher which is installed in one of the lecture rooms in the School of Construction Management and Engineering. An initial survey of the occupants of the room suggested a substantial improvement of the indoor environment after the installation of the system, which provides excellent daylight performance as well as natural ventilation to the classroom.

WindCatchers operate on the principle of encapsulating the prevailing wind from any direction by way of internal segments, turning the wind through 90° to bring in fresh air and at the same time expelling the stale air from the room.

Wind-catching systems originated in the Middle East, where they have been in use for more than 3,000 years. Traditionally constructed from wood-reinforced masonry, wind towers were a common sight in towns and villages throughout the Middle East and, indeed, many are still seen today, with some of the older systems being faithfully restored to demonstrate their heritage of the past. In the modern design of WindCatchers manufactured in GRP, Monodraught has brought together two ventilation principles of encapsulating the prevailing wind but also incorporating the passive stack element into one design that is divided into four quadrants. Modulating dampers manufactured from recycled plastic and digital controls provide exact control of the ventilation rate.

One important application for the WindCatcher ventilation system is for night time cooling, which is of great benefit in educational and business premises which are vacant during the night. Night time cooling can be achieved by volume control dampers being programmed to open fully for a period of time during the night, and closed again in the early morning. This allows the cool night air to be carried down into the building leaving the interior feeling fresh and clean when the occupants arrive, without compromising security measures.

SunCatchers combine the benefits of WindCatcher natural ventilation with SunPipe natural lighting technology in one unit providing both energy-free ventilation and daylighting. A silverised mirror-finished aluminium tube takes natural daylight into the heart of the building.

WindCatchers and SunCatchers are increasingly being installed in buildings throughout the UK. A programme to refurbish HM Treasury building in Great George Street, London, includes the installation of WindCatcher natural ventilation systems for the first time on Government buildings. Fourteen 1 m^2 devices and two 2 m^2 units have been installed at roof level to provide natural ventilation.

The involvement of Reading University is enabling their performance to be evaluated in a more scientific way, which in turn will enable a more accurate prediction to be concluded on their performance in temperature climates such as the UK.

Contact Monodraught on tel: 01494 897700, website: www.monodraught.com

Cut boiler cycling to save energy

Performance tests by the Building Research Establishment (BRE), are said to prove that the GasForce Burner Management Unit (BMU) can reduce energy consumption by up to 16%. These energy savings were achieved under strict laboratory conditions in BRE's environmental test chamber, says the company. The BMU works by controlling the duration of the heating boiler 'burn' to optimise efficiency whilst maintaining comfort levels. It allows the boiler to respond to a call for heat from the building at any time but, under normal loads, does not allow the boiler to cycle inefficiently.

Front plate of the boiler management unit

The BMU saves fuel by extending the cooling periods and reducing the amount of dry cycling, or unnecessary firings, carried out by the boiler. How much it saves depends on the loads applied to the heating circuit and the outside temperature. On a typical British winter's day with a minimum outside temperature of 5°C, the BRE tests recorded savings of 13.2%. On a similar day with minimum temperatures of 10°C, the BMU achieved a 16.1% reduction in energy consumption.

"We are particularly pleased that BRE's tests confirmed performance results GasForce had already achieved in live applications," said John Ord, Marketing Director for GasForce. "News of the BMU's official certification is already having a positive effect for us. Telford & Wrekin Council, which has already carried out its own tests spread over a heating season, has confirmed its intention to proceed with the installation of BMU's in 120 schools throughout its authority."

Contact GasForce Ltd at tel: 0208 553 2676, website: www.gasforce.com

Information

Climate Change and Power – Economic Instruments for European Electricity *Christiaan Vrolijk – editor*

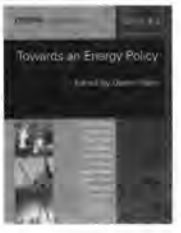
Published by Earthscan Publications Ltd for The Royal Institute of International Affairs (www.earthscan.co.uk) at £19.95

How are we, really, to control – or reduce – carbon emissions from Europe. Well, as electricity generation is the single most important source of carbon, we could start here. But electricity industries vary widely across the continent

In this book, edited by Christiaan Vrolijk, who until recently was with the highly respected RIIA in London, is some 300 pages of analysis of the mechanisms by which carbon emissions from the European electricity industry may be curbed. The book describes the characteristics of the main European electricity regimes and defines the range of instruments available – the main options being economic instruments, including emissions trading, taxes and voluntary agreements. But, as electricity systems vary widely across Europe, so the book also assesses the potential of each instrument to make a difference, both within its own regime, and for Europe as a whole.

Towards an Energy Policy *Dieter Helm – editor*

Published by Oxera Publications (www.oxera.co.uk) at £35



The UK Government is about to publish a new White Paper which will show the direction of future energy policy for some time to come, following consultation on the PIU's report published earlier this year.

Here, in a book edited by Oxera's Dieter Helm, an experienced commentator in the field, is a set of analyses of the problem; of the environmental challenges, of the need for investment in energy networks, of Britain's 'dependency' on natural gas, of the prospects for nuclear power, and of opportunities for energy efficiency. Energy policy has traditionally been good at solving yesterday's problems, says Helm. It remains to be seen whether the energy review produces a new policy capable of addressing today's – and tomorrow's – issues.

On-line Combustion Handbook

Published by the International Flame Research Foundation (IFRF) (www.handbook.ifrf.net)

Only part of this on-line resource is available to the public; in the UK, the rest comes with membership of the British Flame Research Committee (contact Jeff Rhine at email: rhinenergy@aol.com). But the sample available to all should give readers a taste of the information on offer.

The full website contains over 100 'files' of information, organised within subject areas as answers to questions: 'How do I calculate …', 'What data is available for ….?' etc. Files cover information on fuels, combustion-generated pollutants, combustion processes, flame lengths, combustion chambers, burners and mathematical modelling. Produced by engineers drawn from the membership of the IFRF, the content is added to and updated regularly, as befits a website rather than a text book.

Sustainable Housing Schemes in the UK *Nick White – editor*

Published by the Hockerton Housing Project (www.hockerton.demon.co.uk) for £10

Panning a low energy or sustainable housing development and want to see what others have done before you? This book, produced by residents of the Hockerton Housing Project, will help.

The Hockerton Project describes itself as Britain's first earth-sheltered, self-sufficient housing development. The residents of five homes generate their own clean energy, harvest their own water and recycle waste materials. The homes are among the most energy-efficient dwellings in Europe.

The authors have consolidated a great deal of information on over 80 sustainable housing schemes and eco-centres in the UK into this new A4 book. The main section is essentially a set of individual fact sheets on 31 case studies ranging from single eco-homes to large sustainable developments; low impact settlements to green construction schemes.

Energy – its impact on the environment and society

Published by the DTI (www.dti.gov.uk), free from DTI, tel: 0870 1502 500, email: publications@dti.gsi.gov.uk

This new, 160 page A4 book covers some new ground, examining the social and environmental impact of the production and use of energy. And it's free. The book examines the key influences on the trends in the figures, including the interaction between economic, social, and environmental trends, says the DTI. It also looks at how Government policies have developed to limit the environmental damage caused by by the use of energy.

Sustainable energy - for our children's children

Editor,

It is exactly 40 years since I became President of what was then the Institute of Fuel, and I believed then, as I believe now, that the primary role of the Institute is "to supply the public with heat, light, power and transport essential to a full life – with the minimum use of non-renewable energy sources, and minimum pollution of air, land and water in such a away that we leave the same supply available to our descendants."

I have a personal interest in the legacy we are leaving to our descendants, because it will be the year 2088 when my younger great-grandson reaches my present age! In this connection the Victorian definitions of virtue and vice are extremely relevant:

- virtue = pay now, enjoy later
- vice = enjoy now, pay later.

On these definitions the gross extravagance in fossil fuel use – to which we have become accustomed like spoiled children – and the use of nuclear power are clearly serious vices because they leave harmful legacies to our descendants.

It follows that the three pillars of the work of the Institute must be: fuel economy, pollution avoidance and renewable energy.

Fuel economy – CHP, house insulation, high efficiency light bulbs are going ahead somewhat slowly, but the 'gas guzzler' is still regarded by most people as acceptable and we waste enormous amounts of electricity. The car industry does research on fuel cells and hybrids, but does not try for a really fuel-economical car. We know how to design a four-seater car which could do 100 km on 2 litres of gasoline. I hope that by the time my great grandsons are old they will have all their needs supplied with less than one-third of the energy we use now.

Pollution avoidance – the most serious pollutant resulting from use of fossil carbon is carbon dioxide and our biggest contribution to ameliorating this will be fuel economy. I was horrified to read in Dr Cox's Viewpoint article (*Energy World*, September 2002) that the Selby coalfield is to close, not to replace coal with an energy source giving lower emissions of carbon dioxide, but to replace British coal with a foreign source which is cheaper to mine and import, thus saving direct costs but taking no account of the national losses.

Renewable energy – Britain is, of course, one of the best-endowed countries in the world for wind energy and it is sad that we did not lead the world in this. I hope that by the time my great grandson reaches my age every village will have its own *necessary* electricity generated from wind turbines with stand-by bio-diesel generators for windless periods. The work going on to use coppiced wood for power generation and on wave and tidal energy will also lead to supplies of electricity which will be a major contributor once we have stopped our extravagances.

The use of solar energy to generate electricity by improved photovoltaic cells, and to produce hot water as Dr Archer describes in her Melchett Lecture (*Energy World* September 2002) will certainly be a major source of energy for the future as this is a clear example of a virtue for which payment comes before an indefinite period of benefit.

Med Thring
Past President SFInstE

Householders beware

Editor,

There are a number of companies offering retrofit solar panels for installation on domestic premises. They claim only to provide a source of heat for domestic hot water.

How many householders are aware of the relatively low cost of heating their domestic hot water? The following figures are based on a theoretical family of two parents plus 2.3 children, consuming a total of 175 gallons of water per person per week (the consumption of my family unit). I have made the following assumptions :-

- only 50% of the water used is heated;
- the water is heated through 100°F (40°F to 140°F) by a 20 year old, gas-fired boiler at an efficiency of 60% – this is to allow for loss of heat from a less than perfectly insulted hot water cylinder in addition to boiler losses; and
- the average price of natural gas is 1.25 p/kWh.

My calculations suggest that the cost of heating water totals £119 per year.
The cheapest solar heating system I have seen costs a minimum of £5,000.
This gives a 41 year pay-back period – hardly a financially attractive proposition.

Harry Freeman FInstE

The editor welcomes letters – particularly short ones – which may be edited for publication. Please sent to: 18 Devonshire Street, London, W1G 7AU.

Subsidies for nuclear

Editor,

It is odd that the Government can give £410 million (later increased to £650 million) to keep our ageing nuclear power stations running (for a few weeks) – when it gives only £20 million in grants for solar electricity (over three years) and when grants for solar hot water, which is far more cost-effective than electricity, are virtually non-existent.

Does renewable energy have to become seriously environmentally threatening instead of seriously environmentally beneficial before the UK Government takes notice?

Barry Johnston
Managing Director, Solartwin

Events

November

InstE Branch Event
A talk from The Carbon Trust
Date tbc, Lisburn
Contact: Northern Ireland Branch - Ciaran McGrath
Email: mcgrathc@belfastcity.gov.uk

Corporate governance
Workshop, 4 November
venue tbc
Contact: Di Hammet
Tel/Fax: 020 8767 9744
Email: beawec@aol.com

Developing, constructing, operating and securing power projects
Conference, 6-7 November
London
Contact: Melanie Crocker
Tel: 020 7881 1886
Email: melanie.crocker@hawksmere.com

Heat transfer - principles and practice
Course, 6-8 November
Teddington
Contact: Robert Angus
Tel: 020 8943 7110
www.npl.co.uk/thermal/heattransfer

InstE Branch Event
Compressed natural gas as a vehicle fuel
Seminar, 7 November
Birmingham
Contact: Midlands Branch - Vian Davys
Tel: 01970 617585
Email: vian.davys@pgen.com

Introduction to electricity trading
Course, 11-13 November
Berkshire
Contact: IPE Training
Tel: 020 7265 3745
Email: training@ipe.uk.com

Risk in uncertainty
Lecture, 13 November, Hatfield
Tel: 01727 813613
www.mybusinesslink.co.uk/risk

InstE Branch Event
Woking fuel cell visit and talk on the CHP consultation
Date tbc
Contact: London & Home Counties Branch - Matt Leach
Email: m.leach@ic.ac.uk
Tel: 020 7594 9328

InstE Branch Event
Green energy trading
Lecture, 13 November
venue tbc
Contact: South Coast Branch - Chris Wilson
Tel: 01252 673570

Mechanical Engineering Congress
17-22 November, USA
Contact: Professor Yildiz Bayazitoglu
Fax: +1 732 348 5423
Email: bayaz@rice.edu

Liberalisation in the natural gas markets
Course, 18-22 November
Berkshire
Contact: IPE Training
Tel: 020 7265 3745
Email: training@ipe.uk.com

Nemex 2002
Conference and exhibition
20-21 November, Birmingham
Contact: Zoe Bragg
Tel: 020 7772 8451
Email: zoe_bragg@mrn.co.uk
Co-sponsored by the Institute of Energy

InstE Branch Event
Combined heat and power
Meeting, 20 November, Preston
Contact: North West Branch - Jim Hindle
Tel: 01282 771355
Email: jimhindle@ukonline.co.uk

Climate policy for the longer term
Conference, 21-22 November
London
Contact: RIIA
Tel: 020 7957 5700
Email: contact@riia.org

InstE Branch Event
Gasification technology
Workshop, 25 November
University of Newcastle
Contact: North East Branch - Andrew Cox
Tel: 0191 261 5274
Email: awcox@eimr.demon.co.uk

Advanced gas and electricity trading
Course, 25-29 November
Berkshire
Contact: IPE Training
Tel: 020 7265 3745
Email: training@ipe.uk.com

National engineering conference
Conference, 27 November
Castle Bromwich
Contact: Ellen Luetchford
Tel: 01257 244910
Email: ellenl@centra.org.uk

InstE Branch Event
Annual social event
Date tbc
Contact: Northern Ireland Branch - Ciaran McGrath
Email: mcgrathc@belfastcity.gov.uk

December

Sales and marketing in a liberalised natural gas market
Course, 2-6 December
Berkshire
Contact: IPE Training
Tel: 020 7265 3745
Email: training@ipe.uk.com

David Hall memorial lecture
5 December
King's College London
Contact: Christiane Buckle
Tel: 01865 484367
Email: uk-ises@brookes.ac.uk

InstE Branch Event
Social event
6 December, Cardiff
Contact: South Wales and West of England Branch - Geoff Spiller
Email: geoff.spiller@babcockbes.co.uk

Britain's younger engineers
Reception, 9 December
London
Contact: Dr Eric Wharton
Tel: 01235 832335
Email: ericw@setforeurope.demon.co.uk

Energy generation and efficiency in buildings
9 December
Southampton University
Contact: Christiane Buckle
Tel: 01865 484367
Email: uk-ises@brookes.ac.uk

InstE Branch Event
Next generation photovoltaic solar power
11 December, London
Contact: London & Home Counties Branch - Matt Leach
Email: m.leach@ic.ac.uk
Tel: 020 7594 9328

InstE Branch Event
The new building regulations (L2) and their implications
12 December, venue tbc
Contact: North West Branch - David Armstrong
Tel: 0161 485 1127
Email: david@armstrong1001.freeserve.co.uk

January 2003

InstE Branch Event
Energy briefing for senior engineers
Date and venue tbc
Contact: South Wales and West of England Branch - Geoff Spiller
Email: gspiller@ntlworld.com

InstE Branch Event
Windfarm developments
Seminar, 9 January, Birmingham
Contact: Midlands Branch - Vian Davys
Tel: 01970 617585
Email: vian.davys@pgen.com

InstE Branch Event
Technical visit - Wrights Buses
15 January, Ballymena
Contact: Northern Ireland Branch - Ciaran McGrath
Email: mcgrathc@belfastcity.gov.uk

InstE Branch Event
Energy efficiency and conservation
Conference, 15-17 January
Hong Kong
Contact: Hong Kong Branch - Raymond Fong
Email: rayfong@hkpc.org

InstE Branch Event
Meeting with Institute of Petroleum
23 January venue tbc
Contact: North West Branch - David Armstrong
Tel: 0161 485 1127
Email: david@armstrong1001.freeserve.co.uk

Energy management
One day course, date tbc
London
Contact: Institute of Energy
Tel: 020 7580 0008
Email: events@instenergy.org.uk

Private utility conference
24-26 January, Exeter
Contact: Turret West Ltd
Tel: 01409 241166
Email: info@privateutility.co.uk

Registering on an event seen here?
If you are registering on an event which you have seen listed here, please don't forget to mention to the organisers that you saw it listed in the Energy World Events Diary.

For further information about events, and to view the Institute of Energy's events calender please click on to our website at: www.instenergy.org.uk/events/calendar.htm

InstE Branch events are open to everyone regardless of the branch they are organised by.

InstE one day courses

Professional development is a key requirement in a rapidly changing world.

Bearing this in mind, the InstE encourages members to attend its one day courses in order to keep knowledge and skills up to date.

In 2003, the InstE will once again be holding its extremely successful Energy Management course, enabling energy professionals and newcomers to the industry to keep up to date with recent developments in energy management and participate in valuable discussion on topical issues. All aspects of energy management are covered including: energy policy; investments for energy efficiency; staff awareness and motivation; energy management structure and accountability; and introduction to site services.

The Professional Practice for Sustainable Development course will also be held again, providing delegates with sustainable development solutions that are technically, socially, economically and environmentally acceptable. Designed to enhance participants' understanding of sustainable development and put learning into practice with the use of case studies from business and industry, this course illustrates how sustainable development principles are currently being applied.

The InstE will also be launching its Advanced Energy Management course in 2003 which will specifically look at: monitoring and targeting; energy auditing; and technical solutions.

The key to all of these courses are their flexible nature. When registering, delegates are encouraged to highlight their concerns and issues, and where possible these will also be incorporated into the programme. PLUS delegates receive follow-up support from the facilitator to assist and advise.

Uncertainty of the world's oil supplies

Many presume that sufficient oil and gas will be available to meet the EU's needs out to 2030, whereas Roger Bentley, Research Fellow at the University of Reading, believes that conventional oil production will peak within 5 to 10 years, combined oil and gas within about 10 years and gas within about 20 years.

For some six years Roger has been involved with a group of scientists, petroleum geologists and engineers who have collaborated on understanding the world situation on oil and gas supply. This research included talking extensively with oil companies, Government, the IEA, the EU and the US Geological Survey.

Both sides of this debate will be discussed at a lively afternoon event, to be held in London in late November.

For more information on this event, please contact Katie Moore at the InstE on 020 7580 0008 or email kmoore@instenergy.org.uk

2003 membership subscriptions

All members are advised that subscription renewal notices will be sent out at the beginning of December. If you do not receive one at this time it means that you entered into membership sometime since last August. Your subscription now fits into our new rolling system and your membership will come up for renewal in March, May, July, September or November.

Reclaiming tax on your subscriptions

Did you know that you can claim tax relief on your membership subscription? Did you also know that no initial proof of subscription payment is required? Only if your assessment is one of those sampled will you be required to provide proof. This proof can comprise a copy of your bank statement listing the direct debit payment (or credit card payment if applicable) and does not need to be a receipt issued by the Institute of Energy. To save on unnecessary postal costs, it will in future be our policy not to issue receipts as a matter of course.

How to go about claiming the tax relief depends on how you pay your tax. If you are:

- in employment and do not receive a self-assessment return - write to your tax office requesting an allowance to be given in your coding. Advise them of the amount to be paid and name the Institute of Energy in your request;
- in employment or self-employed and receiving a self-assessment return - enter the total subscription in the appropriate box on your tax assessment form.

How can we keep you up to date with InstE activities?

Another way in which we can reduce costs to our members is by increasing the use of email communication rather than post or telephone. We do not sell our members' details to marketing companies but you may be contacted by your branch or another member interested in setting up a special interest group. Such communications would be made via the Institute of Energy. In your forthcoming subscription notice you have the option to request that your contact details are not used in this way (by ticking the data protection box on the subscription notice). But we hope that most of our members feel that one of the primary benefits of belonging to a professional body is the opportunity to exchange views and information with fellow members.

Direct Debit

If you have completed a direct debit form, the membership fee for 2003 will be the same as for 2002. If you have already completed your direct debit form you will be sent a letter advising of the amount to be debited from your account at the beginning of January.

If you are a UK member and have not completed a direct debit form your fee will be £5 more than in 2002 and the amount owing will be specified on your subscription notice. However, you still have a few days left to get a completed direct debit mandate back to us (a direct debit form is enclosed with this copy of *Energy World*) to take advantage of the discount offer. If you are an overseas member you should have received a letter enclosed with this copy of *Energy World* explaining how this change will affect you.

As you will be receiving your subscription renewal letters soon it is also timely for us to mention a few other details:

Gift Aid your subscription

Another new feature on your subscription renewal notice will be the offer to have your subscription treated as Gift Aid. If you are retired you are no longer eligible to reclaim tax on your subscription payments. However, if you still pay tax you can Gift Aid your subscription at no cost to you. This means that the Institute of Energy, as a registered charity, can reclaim a valuable tax benefit. (See the October 2002 issue of *Energy World* for further details.)

How do we address you?

Members often ask for their full range of post-nominals to be included on their record but our practice is generally to include only Institute of Energy qualifications and honours bestowed by HM Government. This is because it is very difficult to verify the qualifications awarded by universities or other professional bodies and to ensure that they are up to date. Most professional bodies have strict rules about the use of post-nominals and we only have the capability to check the accuracy and legitimate use of our own qualifications. Rather than run the risk of using post-nominals that may become out of date we prefer to omit them from correspondence sent out by the Institute of Energy.

InstE Journal price for members

Members of the Institute of Energy receive *Energy World* for free and can also receive the *Institute of Energy Journal* for a nominal subscription fee. In the last few years this fee has been set at £10 to cover printing and postage costs only. However the costs of printing and postage have risen considerably since 1998 when the fee was originally set and we regret that the members' subscription price of the Journal will go up to £18 in 2003 (this subscription price is the same for both UK and overseas members). Although we regret having to pass our costs on to you, the membership subscription price is still very heavily subsidised with non-members in the UK paying £150 for a subscription and overseas subscribers paying £170. If you would like to order the *Institute of Energy Journal* or renew your subscription, please remember to tick the relevant box on your subscription renewal notice when you receive it.

Merger Update - November

Members may recall that the last edition of Merger Update, circulated with the September issue of *Energy World*, announced plans for the publication of a Merger Prospectus to be distributed to all current members at the end of September. Unfortunately, there has been a slight delay in publication as a few outstanding points are resolved for inclusion.

We apologise for this delay and would urge you to check the website and *Energy World* for updated information. In the meantime, the October issue of *Energy World* included a schedule of branch meetings at which members are encouraged to meet and discuss the relevant issues. Some of these events have already taken place and again, reflecting the feedback from the members' survey, the vast majority of you have enthusiastically expressed your support for the merger.

Every member who has sent in a survey has had a personal reply and in many cases further discussions have taken place, so please take the time to register your views. For updated details on remaining branch events please check the website and contact the organising member for the event you are interested in attending.

The January 2003 issue of *Energy World* will include letters and comments from members concerning the merger and, as always, your views are important and we would be very pleased to hear from you. It is your Institute and the decision, after all, will be yours.

Notice to all Members, Graduates and Students

Before the new year arrives it might be a good time to take a good look at your career development over the past few years and consider whether you should be thinking about transferring your membership to another grade. For Members, if you are now over the age of 33 and have over five years' experience at a senior level you may be eligible for Fellowship. For Graduates, this interim grade is intended to give you the time to develop your skills and knowledge in a work context for the first few years of your career. If you have been in this grade for three or four years you may now feel that you are ready to go for full membership and gain the professional recognition that you deserve.

Finally, there are many Students who have recently completed their degrees and who may now be about to enter (or already have entered) the world of work. Particularly for those who are intending to register as engineers under SARTOR 3 it is important to establish your requirements for a matching section and begin your period of initial professional development as soon as possible. To be sure of completing your professional development in the most effective and timely way possible it is vital to transfer to Graduate status and seek guidance from the Institute of Energy at an early stage. ***For further information and guidance contact Holly Naisbitt on 020 7580 0077 or info@instenergy.org.uk***

Sponsorship and the InstE

Raising sponsorship for some of our meetings enables us to keep down the costs of those events to members. It can also bring in valuable expertise from suppliers of goods and services in the energy market.

The Institute of Energy has taken a more professional approach to raising sponsorship this year and to this end, the Marketing and Communications team have been working with a Sponsorship Consultant - Simon Whitney, to increase the level of sponsorship obtained. Simon works with a number of membership organisations, helping them to generate income.

Some success was achieved this year and we are now working on the schedule for 2003 and raising sponsorship for some of our key events such as the Melchett Lecture and products such as the TEMOL training package. ***If you know of a company that may be interested in promoting itself to the energy industry or you would like information on the events and products available to sponsorship, please contact Joanna Heke on jheke@instenergy.org.uk, or Simon Whitney on 01344303165, email events@instenergy.org.uk***

People

'People' is a new section we are adding to *Energy World* to bring you up to date with new appointments, promotions and positions.

David Strong

Dr David Strong CEng FInstE, Managing Director of BRE's Energy Division, has accepted a position as an honorary visiting Special Professor in the School of the Built Environment at Nottingham University.

Tami Haskell

Tami Haskell started working at the InstE at the end of July as the new Executive Administrator. To get in touch with Tami tel: 020 7580 7124 or email: secretariat@instenergy.org.uk

Corin Millais

Corin Millais has been

appointed Chief Executive of the European Wind Energy Association, based in Brussels. Mr Millais takes up the position after 12 years at Greenpeace.

If you would like to have information included, please send details and a photo to Energy World People, 18 Devonshire Street, London W1G 7AU or email: energyworld@instenergy.org.uk.

New Members

London and Home Counties

Mr P C Piddington FInstE
BP Energy
Mr M E Smith MInstE
EnTech Energy Consultants Ltd
Mrs E Salazar-Gonzalez MInstE
Atkins Consultants Ltd
Mr A Aguilo, Graduate
BRE
Ms A Fernandez, Graduate
Arup Energy
Mr M Hingston, Graduate
Haden Building Management Ltd

South Coast

Mr D Shortland, Graduate

Scotland

Mr C Risbridger MInstE
Highlands and Islands Enterprise
Mr A M McKeown MInstE
Graham Mather Associates
Mr R Hill AMInstE
North Lanakshire Council
Mr M Tamburrini, Graduate
Campbell Palmer Partnership Ltd
Mr C J Clark, Graduate
Davie and McCulloch Consultants

Northern Ireland

Mr R F Haughey, Graduate
Patrick McCaul Environmental Consulting Engineers

Midlands

Mr I H Gregory MInstE
University of Birmingham
Mr P J Cowling MInstE
Chelsfield Plc

North Western

Mr C Reed MInstE
PB Power Ltd
Mr J A Marsden MInstE
Greater Manchester Fire Service
Mr I Ahmed, Graduate

East Midlands

Mr A N Gough, Graduate
PECT
Mr N Dyas, Graduate
HBS

South Wales and West of England

Mr S Davies, Affiliate
Hereford Council
Mr E F Bardouille, Graduate
Dalkia Utilities Services Plc
Mr D Thomas, Student
Cardiff University
Yorkshire
Mr M Ayoub, Student
University of Central Lancashire

Deceased Members
Mr Richard Elks MInstE
Mr R W Clouston MBE MInstE
Dr E A C Chamberlain OBE SFInstE

Situations vacant / Wanted

ROXBY Limited (REF ROX203)

Contract energy survey and conservation engineers required for current and forthcoming contracts throughout the UK. Applications on the basis of PAYE or Ltd company are welcome. Possibilities exist for associate engineer appointment depending on experience and status. Requirements- Visiting customer's site and performing energy conservation surveys, writing reports on the findings, making recommendations and presenting them to the customer up to boardroom level. Ideally degree qualified with 5+ years previous experience in visiting industrial and commercial sites and performing energy surveys/audits (Typically SEAs and SMAs). Good analytical and report writing skills. We would also be interested to here from less experienced/qualified engineers within the energy and utilities field. Please send a copy of your CV to: FAO Business Development Manager, email: recruitment@roxby.com

Enthusiastic Energy Consultant educated to MSc level needs new challenge.
With six years experience in all aspects of combating fuel poverty and domestic energy conservation programmes.
Please contact Sam on:
07930362703 or 020 8959 5707
Email: s.a@btopenworld.com

energy 121.com

Energy Consultant Required
Freelance or Ltd. for six month contract [extendable]. Extensive worldwide travel.
Identify, quantify, and implement utility savings.
Circa £56k p.a. pro rata, plus expenses.
Serious enquiries only to Steve Howe [agency].
Email: line6@energy121.com

Freelance Engineer Required
Experienced in Energy Management, including B E M S plus Mechanical, and Electrical [Regs. desired]
hands on atitude.
Extensive UK travel, frequently O/N.
Minimum 12 months contract.
Remuneration up to circa £25k pa, plus Fully Expensed Car, laptop, mobile, subsistence etc.
M/S Word attached CVs to Steve Howe [agency].
Email: line7@energy121.com

Robert Gevargiz, MSc CEng MInstE MBA Available for consulting assignments
Energy surveys – SEAs/SMAs, Energy management, Facilities management, Facilities strategy, Managing facilities change programmes, Contract management, Project management, Senior management seminars and staff training and Business development. To enquire: Tel: 01525 862 835, Email: robert.gevargiz@adian.co.uk

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Energy World 2003 editorial features list

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Education, training and careers
June
Energy management and purchasing
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Fossil fuels - oil, gas and coal
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Sustainable energy international
October
Energy in buildings and homes
November/December
Nuclear energy, electricity

For more information please email: eworld@instenergy.org.uk

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Interactive CD Planner

Included with this edition of Energy World please find your copy of the Interactive Planner CD, an updated version of last year's CD.

The Interactive Planner CD is a free membership service provided by the Institute of Energy. You can use it in the office or on the move to plan your work more effectively, mapping out and planning your career in the CPD Zone and viewing and printing complete schedules. Other features include a fully editable year planner programme, industry contacts with live web links and preloaded InstE events.

Once you have had a chance to utilise your 2003 CD, if you have any feedback or suggestions for improvements please email: jheke@instenergy.org.uk



www.instenergy.org.uk

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Yearbook and Directory 2003

The InstE Yearbook and Directory 2003, the UK's leading energy directory will be posted out to you in December.

The annual Yearbook and Directory is a highly regarded reference guide that provides up-to-date information to help you manage, purchase and control energy in your organisation. It contains technical data, information on energy courses and details of InstE services. Plus, the 2003 edition, in a handy A5 format, gives you unrivalled coverage with a comprehensive alphabetical list of over 1000 key suppliers of products and services, training organisations and consultants.




www.instenergy.org.uk

Action Energy establishes new arrangements for Consultant Registration

Last month a new project was initiated with the Institute of Energy (InstE), following a competitive tendering process, to develop Consultant Registration for the mutual benefit of Energy Consultants and the Action Energy programme.

Action Energy is a Government programme that works with organisations large and small to reduce costs and improve environmental performance. Since it started in 1989, Action Energy has helped the UK economy to save up to £800 million per annum - equivalent to over 3 million tonnes of carbon per year. To operate a number of its services Action Energy requires access to a qualified body of skilled Energy Consultants. Over the coming months, the InstE will work with Action Energy, to transfer currently registered consultants to the new Registration System which it is hoped will operate without financial support from the programme from April 2003.

Consultants who are currently registered will see little change in the short term, but it is anticipated that the Register could have broader uses in the future becoming the equivalent to a 'kite mark' of the Energy Consultancy profession. This development is one that a number of energy consultants called for as a result of a pilot registration project conducted in 2001 for the former Energy Efficiency Best Practice programme. The new registration system will operate on the basis of self-regulation with processes involving peer review and independent quality assurance - established and agreed by consultants and customers, for consultants and customers, to reflect a market driven approach.

For further information please email services@instenergy.org.uk