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Beaufort Court, the new headquarters building for wind energy developer Renewable Energy Systems Group. The converted egg farm includes both renewable and energy efficiency technologies to achieve zero net energy use. See page 14 for more details, and page 16 for the story of a contrasting approach to a low energy building – this one for the National Energy Foundation.



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Is this the end of cheap oil?



Chris Skrebowski,
Editor, *Petroleum Review*

The answer to the question is a firm 'probably'. The price of oil is quite extraordinarily unstable with the perception of a small excess of supply driving prices down and the perception of shortage spiking prices upwards. In effect, all oil prices are effectively spot price as virtually all crude is currently sold on a formula – usually related to either the Brent or the West Texas Intermediate (WTI) price. This gives the whole oil market its volatile character. This in turn attracts speculative interest and position-taking which adds further volatility. In the end, however, oil prices have to be related to fundamental supply/demand balances, which mean that, if oil supplies are tight, prices will be high.

A series of factors have been steadily tightening the supply/demand balance over recent years but appear to have come together this year to move the market to a new, higher level.

The first and most widely reported is the vigorous demand growth from countries such as China, India and south east Asia, where increasing wealth has reached the point where cars, refrigerators, air conditioning units etc are becoming widespread purchases. All these countries have static or declining indigenous oil production, so the new demand translates directly into new import demand. For the rest of us this means new competition for existing suppliers – and higher oil prices.

The second, much-touted influence is the so-called insecurity premium. Clearly there is a premium in the oil price to reflect the fact that instability and insecurity in the Middle east raises the risk profile on supplies from that region. Equally, speculators and hedge-fund operators attempt to profit as the assessment of the risk premium swings around. In doing this they further destabilise the market. So how big is this insecurity premium? No one knows – or rather everyone has a different opinion. The market reflects the latest balance of these opinions adding up to \$10/barrel or even \$15/barrel to the price. When people get really nervous about supplies, as they did after the Iranian revolution in 1979, then the sky's the limit. In 1979 that limit proved to be around \$80/barrel in today's money. Now uncertainty about supplies will remain for as long as the Middle East remains unstable and Middle East producers are operating close to capacity. As neither of these factors is likely to change quickly the oil price will continue to be generally high, spiking up or easing back as perceptions swing around.

However, the real reason for believing that oil prices will remain firm, and may move ever higher, is the increasing impact of depletion. Examination of the latest and most public of oil statistics – the *BP Statistical Review of World Energy*

June 2004 – shows that the 2003 production growth of 2.71mn b/d (3.66%) was the third highest, by volume, on record. It was narrowly exceeded in 1978, just before the second oil crisis, and hand-somely exceeded in 1975 as recovery from the first oil crisis got underway. However, in both these earlier periods Opec had significant volumes of spare capacity, while depletion in terms of whole countries being in decline was barely a feature. Currently, Opec has no spare capacity and 18 significant producers, providing nearly 28% of global production, are in decline. While declining production in the 18 is still being hand-somely offset by expansion in the 32 countries still expanding, future supplies are clearly becoming more difficult. Even in areas where production has expanded depletion may be significant. In the latest (August) issue of the International Energy Agency monthly oil report it is noted that "Saudi Arabia previously indicated that some 600 to 800 thousand b/d of new production is required each year to offset field decline". Clearly it is getting ever harder to produce and supply the additional oil the world is requiring.

This in turn means that the oil price will in all probability rise further to ensure supply and demand equate. Although initially uncomfortable for all and likely to depress overall economic activity, high oil prices will bring benefits. It will encourage the development of new supplies of oil and also of all rival energies. It will also drive efficiency in use to higher levels. It should be recognised, however, that there is a time lag before adaptation occurs. For example although new more fuel efficient vehicles and equipment will be developed in response to higher prices it will take a several years for these to really have an impact.

The real question remains as to whether the effects of higher prices will generally be benign (if temporarily uncomfortable) as the economists maintain. Or, as some geologists and the so-called depletionists maintain will demonstrate that we are approaching the oil peak after which oil supply declines relentlessly. Either way the immediate expectation is for oil prices to remain high and maybe move higher amid erratic swings as sentiment ebbs and flows. The possibility that sufficient new production could be developed to seriously depress prices appears remote. The reason for this confidence is that while new production capacity could meet or exceed demand growth in the 2004–2006 period there is a marked shortfall projected for the 2007–2010 period. Given that a major oil development averages six years from discovery to first oil the chances of a price-depressing surplus of capacity before 2010 appear minimal, and unlikely after 2010.

Europe needs adaptation strategies to limit the impact of climate change

The European Environment Agency (EEA) has spelled out in a new report the impacts of global climate change in Europe which are already apparent, or projected to occur over the coming decades. Likely main impacts are:

- more frequent and more economically costly storms, floods, droughts and other extreme weather;
- wetter conditions in northern Europe but drier weather in the south that could threaten agriculture in some areas;
- more frequent and more intense heatwaves, posing a lethal threat to the elderly and frail;
- melting glaciers, with three-quarters of those in the Swiss Alps likely to disappear by 2050; and
- rising sea levels for centuries to come.

The concentration of carbon dioxide,

the main greenhouse gas, in the lower atmosphere is now at its highest for at least 420,000 years – possibly even 20 million years – and stands 34% above its level before the industrial revolution, says the Agency. And the rise has been accelerating since 1950.

The summer floods of 2002 and last year's summer heatwave are recent examples of how destructive extreme weather can be. The serious flooding in 11 countries in August 2002 killed about 80 people, affected more than 600,000 and caused economic losses of at least 15 billion. In the summer 2003 heatwave, western and southern Europe recorded more than 20,000 excess deaths, particularly among elderly people. Crop harvests in many southern countries were down by as much as 30%, and melting reduced the mass of the Alpine glaciers by one-tenth in 2003 alone, says the EEA.

"This report pulls together a wealth of evidence that climate change is already happening and having widespread impacts, many of them with substantial economic costs, on people and ecosystems across Europe," said Professor Jacqueline McGlade, EEA Executive Director. She added: "Europe has to continue to lead worldwide efforts to reduce greenhouse gas emissions, but this report also underlines that strategies are needed, at European, regional, national and local level, to adapt to climate change. This is a phenomenon that will considerably affect our societies and environment for decades and centuries to come."

The extent and rate of the climate changes under way most likely exceed all natural variations in climate over the last thousand years and possibly longer. The 1990s were the warmest decade on record and the three hottest years recorded – 1998, 2002 and 2003 – have occurred in the last six years. The global warming rate is now

almost 0.2°C per decade, says the Agency.

And Europe is warming faster than the global average. The temperature in Europe has risen by an average of 0.95°C in the last hundred years and is projected to climb by a further 2.0–6.3°C this century as emissions of greenhouse gases continue building up.

As a first step towards reversing this trend, the world's governments in 1997 agreed the Kyoto Protocol, an international treaty under which industrialised countries would reduce their emissions of six greenhouse gases by around 5% between 1990 and 2012. So far, 123 countries, including all member states of the European Union, have ratified the treaty but the US, the biggest emitter of greenhouse gases, has decided against doing so. To enter into force the Protocol still needs ratification by Russia.

But climate change does appear to have some positive impacts too, says the report.

- Agriculture in most parts of Europe, particularly the mid latitudes and northern Europe, could potentially benefit from a limited temperature rise. But while Europe's cultivated area may expand northwards, in some parts of southern Europe agriculture could be threatened by water shortages. And more frequent extreme weather, especially heatwaves, could mean more bad harvests.
- The annual growing season for plants, including agricultural crops, lengthened by an average of 10 days between 1962 and 1995 and is projected to continue getting longer.

The report: Impacts of climate change in Europe: An indicator-based assessment, is available at http://reports.eea.eu.int/climate_report_2_2004/en



Modernisation of unit 3 of the Jablanica Hydro Power Station, Bosnia-Herzegovina, 80 km south of Sarajevo, is to be carried out by Austrian hydropower plant equipment supplier VA TECH HYDRO.

The contract follows the successful refurbishment by the same company of four units in the past three successive years for Elektroprivreda Bosne i Hercegovine (EP BiH), Bosnia's largest electricity provider. VA TECH will supply the Jablanica plant, which dates back to 1954, with a new runner, distributor, turbine shaft and a governor with the corresponding hydraulic unit.

The modernisation will increase the plant's peak power by 22%. The hydroelectric power plant in Jablanica provides 18% of Bosnia's power, serving the central and eastern districts of the country.

Meanwhile, having won two contracts this year to manufacture and supply bulb turbine components for the Chinese market, VA TECH HYDRO has secured another order for a major hydropower project in the province of Sichuan, China.

German school hosts PV installation for the Athens Olympics

The German School in Athens, which served as the international media centre for the Olympic Games in August, was the nearest the Games had to a building powered by renewable energy. Germany's RWE SCHOTT Solar began operation of the country's largest rooftop solar-energy unit at the school just in time for the start of the Games.

The Greek Government had been criticised for the lack of renewables used in the new buildings erected for the Olympics (see *Energy World* September 2004).

"With this unit on the roof of the German School in Athens we aim to

encourage the Greek government in introducing an incentive scheme along the lines of the German Feed In Tariff", said Dr Winfried Hoffmann, Spokesman for the Board at RWE SCHOTT Solar and currently President of the European Photovoltaic Industry Association (EPIA).

With its 1,700 hours of sunshine each year, Greece is in an optimal position to generate cost-effective and environmentally-friendly solar electricity. The initial costs for conventional electricity during the peak period around midday are already comparable to those of solar energy, says SCHOTT. Furthermore, the 33 kW

solar roof saves the city over 24 tonnes of carbon dioxide each year.

ECO//SUN, the RWE SCHOTT Solar licenced dealer for Greece and Cyprus in Salonika, installed the solar roof. The project was backed by German Federal Ministry of Economics and Labor (BMWA), the German Energy Agency (dena) and the Greek-German Chamber of Commerce and Industry. In addition, RWE SCHOTT Solar GmbH and its partner Solar-Fabrik AG donated the solar unit, which is worth €200,000.

The main Olympic stadium is visible from the rooftop PV installation



Manhattan bank HQ will include on-site cogen plant

The Bank of America and the Durst Organisation have broken ground on a new high-rise building in midtown Manhattan that aims to set a new standard for environmental responsibility – including a 4.6 MW cogeneration plant. Designers of the Bank of America Tower will strive for it to be the first high-rise office building to earn a platinum rating from the US Green Building Council, in part by cutting energy use to half that of a typical high-rise building.

The building will feature high ceilings and floor-to-ceiling windows to allow maximum daylighting. To avoid unwanted heat gain, the windows will combine double-wall technology and translucent insulating glass. The natural daylighting will be combined with daylight dimming

and LED lights to reduce electricity use, and a planted 'green roof' will reduce the building's contribution to the urban heat island effect in New York City.

The new tower will also include an on-site cogeneration plant to meet part of the building's energy requirements. A thermal storage system will produce ice in the evenings for cooling use next day, which will reduce the building's demand on the city's electrical grid during the day. Each floor will have its own air-handling unit to provide cool air via an under-floor displacement system, and carbon dioxide monitors will automatically introduce more fresh air when necessary.

When completed in 2008, the 52-storey office tower will serve as Bank of America's New York headquarters.

Production record for Canadian oil sands project

Shell Canada has announced that the Athabasca Oil Sands Project achieved record monthly production in August, averaging 182,000 barrels per day of bitumen. After just more than a year of oper-



Loading product at the Athabasca Oil Sands Project

ations, the project has demonstrated its ability to meet and exceed the design rate of 155,000 barrels per day of bitumen on

a sustained basis, says the company.

The August results will offset the lower production in July of 121,000 barrels per day related to unscheduled maintenance work on one of the froth treatment plant settlers. Follow-up maintenance work on the other two settlers is planned for this month and will reduce production by approximately 50% for up to two weeks.

The Athabasca Oil Sands Project consists of the Muskeg River Mine located north of Fort McMurray, Alberta and the Scotford Upgrader located near Edmonton. A joint venture among Shell Canada Limited, Chevron Canada Limited and Western Oil Sands LP, the Athabasca Oil Sands Project is Alberta's first new oil sands mining project in 25 years and can, says Shell, supply 10% of Canada's oil needs.

Upgrading turbines increases output of coal and nuclear plants

Siemens Power Generation is upgrading the 350 MW Farge coal-fired plant in Bremen, Germany and supplying new turbines to the Forsmark 3 nuclear power plant, located north of Stockholm, Sweden.

Under contract to the operator E.ON, Siemens is upgrading the intermediate- and low-pressure steam turbines of the German coal-fired plant in order to increase its power output by approximately 18 MW. With further efficiency-

enhancement work on the steam systems, E.ON hopes to ultimately increase power output by approximately 20 MW with no increase in fuel consumption.

The upgrade of the 35-year-old plant will encompass the partial replacement of the intermediate-pressure cylinder and the two low-pressure turbines. The total investment for the modernisation of the Farge plant is approximately 30 million.

The goal of the modernization and upgrade is to improve the plant's com-

petitiveness. The upgrade also will improve emissions of the plant. According to the operator, carbon dioxide emissions could drop by as much as 100,000 tonnes per year.

Meanwhile, Siemens Power Generation has supplied three new low-pressure turbines to Forsmarks Kraftgrupp AB for the Swedish nuclear power plant Forsmark 3. Following installation of this equipment, the plant is capable of generating approximately 30 MW more electricity with the same fuel consumption, increasing the overall capacity of the plant to 1,230 MW. The boiling water reactor plant, built by ABB/Alstom and first on line in 1985, meets about a sixth of Sweden's total power demand.

Aviation growth threatens greenhouse gas targets

Aviation may be responsible for 15% of the total contribution to climate change by 2050, according to a recent report from the Stockholm Environment Institute (SEI).

Countries throughout the world have set either voluntary or mandatory targets for reducing greenhouse gas emissions, with much of the focus on emissions from industries, power plants, and cars, as well as emissions due to heating and cooling buildings. But, according to the SEI, global efforts to reduce greenhouse gas emissions may be threatened by an international community that has grown to be too... international. Twenty years from now, says the report, there will be twice as many aeroplanes, and they will fly three

times as many miles as are flown today.

The report suggests solutions such as steep environmental taxes on airline flights, greater use of substitutes such as teleconferencing, and government-supported strategies to shift passengers from air transport to rail for journeys of up to about 300 miles. The report notes that using rail as a remedy would be effective in the European Union, where rail infrastructure is plentiful and 45% of all flights travel less than 300 miles. It is unclear, however, whether such policies would work for China, which is currently experiencing an 8-10% annual growth in its aviation industry.

One million solar homes for California

California Governor Arnold Schwarzenegger has unveiled a plan to install solar power systems on one million homes by 2017. The Million Homes Plan initially starts with the state's current incentives for solar power but, beginning in 2008, home builders will offer solar power as an option in any group of 25 houses or more.

The US already has a target to achieve one million solar roofs across the country by 2010.

Californian customers who install solar power systems will pay a time-of-use rate, and will also be able to sell excess power back to the utility at the retail rate. The programme is projected to save California 2,700 MW of peaking power.

Solar power is already proving popular in San Diego County, where 1,500 customers have connected renewable energy systems to the power grid. According to San Diego

Electric and Gas (SDG&E), only 11 customers applied for net-metering connections in 1999, but by 2003, that number grew to 535.

Meanwhile, the US consumption of renewable energy increased by 3% in 2003, according to the US Department of Energy's Energy Information Administration (EIA). The EIA's *Renewable Energy Trends 2003* found that more than half the increase came from a 4% increase in hydropower production, while a 3% increase in biomass use provided most of the remaining growth.

Environment Agency cuts Sellafield radioactive discharge limits

Discharges of technetium-99 (Tc-99) from BNFL's Sellafield plant in Cumbria are to be reduced, following the implementation at the start of this month of a new, strengthened authorisation by the Environment Agency.

The new authorisation will introduce controls on discharges from individual plants as well as the whole site, and require management systems to be in place to ensure compliance with the regulatory requirements. The effect of the regulatory improvements is that the radiological impact from discharges at the new limits will be significantly lowered, says the Agency.

The current levels of radiation exposure that result from radioactive discharges from the Sellafield site are within statutory limits, adds the EA, and discharges have fallen substantially since the 1970s. Now, measures outlined in the new authorisation will lead to further reductions in radiation exposure at the authorised limits of 35% for liquid discharges and almost 60% for gaseous discharges.

The Agency first published its proposals for future regulation of disposals from the site in August 2002, after a review that included wide public consultation. Following submission of the proposals for ministerial review, the decision has since been reviewed and updated by the Agency.

Changes to be implemented through the new authorisation will, says the Agency:

- Reduce the annual site limit for liquid discharges of technetium-99 (Tc-99) to the Irish Sea from 90 TBq to 20 TBq initially, with a further reduction to 10 TBq, expected to be no later than 2006;
- Require BNFL to develop and optimise an integrated waste strategy for the Sellafield site to promote further environmental improvements during clean-up;
- Remove plant and site limits for aerial discharges of argon-41 and sulphur-35 following the closure of the Calder Hall power station in 2003. Discharges of argon-41 to atmosphere from the power station were the main contributor to the radiation exposure of the local community;
- Postpone the introduction of a new site limit for antimony-125 (a radionuclide in liquid discharges with a low impact) to avoid constraining site clean-up work while BNFL provides additional information on arisings of this radionuclide and how they could be reduced. Discharges of antimony-125 will, however, be subject to a reduced site limit and a new plant limit on discharges of total beta radioactivity; and
- Make minor adjustments to several proposed limits for individual facilities (plant limits) at the site, to reflect future clean-up and decommissioning programmes.

Commenting on the issue of the new authorisation, Environment Agency Chief Executive Barbara Young said: "The new and significantly strengthened controls in the authorisation will allow a more transparent and flexible approach to the regulation of the site. This will be very important in the future when the Nuclear Decommissioning Authority takes over site ownership and accelerates the site clean-up programme."

Grants for community heating schemes

Community heating projects proposed by local authorities, housing associations and universities across the country have been awarded over £16 million of grant funding under the Government's £50 million Community Energy programme. The results of this latest funding round, announced by the Energy Saving Trust (EST) and the Carbon Trust, will benefit households, including those suffering from fuel poverty, and reduce carbon emissions.

The community heating and combined heat and power (CHP) system run by Aberdeen City Council is a good example of scheme that has already benefited from the programme. Faced with 'hard to heat' properties and fuel poverty locally, the Council successfully applied for a Community Energy grant to upgrade four multi-storey blocks in Stockethill. The improvements have reduced fuel bills and carbon dioxide emissions by 40% and enabled the Council to meet its obligations under the Home Energy Conservation Act. The Council is now looking towards future schemes to serve buildings including a primary school, leisure complex and university buildings.

The success of schemes such as

Aberdeen's have contributed to an increase in grant applications and the overall success of the programme has meant that, since the scheme's inception in 2001, nearly £44

million of the Government's original £50 million funding has now been allocated.

Flats in Aberdeen benefiting from grant-funded community heating



UK electricity prices 'to rise, but remain low' under EU ETS; aluminium industry a possible loser

UK electricity prices should remain among the lowest in Europe during Phase 1 of the EU Emissions Trading Scheme, according to a new study carried out for the DTI by ILEX/Electrowatt-Ekono. However, the UK is projected to do less well in the retail electricity price rankings than it has done in previous years due to variations in the extent to which the price of carbon is passed through into electricity prices in different countries.

ILEX/Electrowatt-Ekono were commissioned to examine the impact of the forthcoming EU Emissions Trading Scheme (ETS) on the price of electricity to consumers across Europe, focusing on Great Britain, Ireland, Germany, France, the Netherlands, Finland, Sweden, Denmark, Spain and Italy.

The modelling predicts that the UK would have the lowest domestic retail prices of all the countries considered during 2005–2007, either in the absence of the EU ETS or if all countries were to fully pass an assumed €10/tCO₂ cost of carbon through into retail prices. However, when the expected variations in cost pass-through between countries are taken into account, the study predicts that Spanish domestic retail prices would be lower, pushing the UK into second lowest place.

For industrial customers in 2005–2007, the UK is predicted to slip from second to third lowest place for medium sized customers (behind Sweden and Spain), and from second to fourth for extra large customers (behind France, Sweden and Spain). This compares to rankings in 2003 of first, first and third lowest electricity prices among the countries considered for domestic, medium industrial and extra large industrial customers respectively.

Meanwhile, an economic modelling study from the Carbon Trust has concluded that the EU Emissions Trading Scheme will not damage the competitiveness of British industry, with virtually all sectors able to maintain profits. But this is with the proviso that the scheme is implemented in equivalent ways across the EU.

Professor Michael Grubb, Carbon Trust Director of Policy, said, "UK industry has been very concerned that the EU ETS will cause British business to lose out, due to global competition, or because of differences in national allocation plans (NAPs) within Europe. In contrast to this, our study reveals that the EU ETS will not harm the competitiveness of virtually all industry sectors in Europe. Indeed, most sectors will not find it hard, at a minimum

to maintain current levels of profitability once the scheme is in place, and several could gain. However, our study also confirms that current NAPs vary considerably, and some countries give surplus allowances to their companies, which could distort competition between EU countries for some sectors, notably steel."

"Overall, NAPs across the EU are also currently too weak to drive significant carbon abatement activity. This means the scheme will fail to deliver against its objective of helping business to cost effectively reduce their carbon emissions, consistent with the EU's and member states' Kyoto commitments. Weak NAPs will also fail to kick-start the required long-term process of change, leaving companies potentially facing much sharper cutbacks and much higher carbon prices during later stages of the EU ETS and exposing them to considerable risk – something the UK NAP avoids."

Using quantitative economic modelling, the Carbon Trust examined the impact of the EU ETS upon five different UK sectors: electricity, cement, paper (newsprint), steel and aluminium (smelting). The study found that virtually all UK industry sectors, with the exception of aluminium, have the potential to maintain or even increase profits.

First offshore wave power supplied to the UK grid

Somebody, somewhere is running their light bulbs on energy from the sea, following the connection of Ocean Power Delivery's Pelamis floating wave energy converter (WEC) to the UK electricity grid. The device is installed at the newly opened European Marine Energy Centre (EMEC) in Orkney and completed its first week of

electricity generation in August.

Since its launch earlier this year (see *Energy World* April 04) the Pelamis has undergone extensive sea-trials to test and commission systems prior to installation at EMEC and connection to the grid. On 14 August, the anchor-handling vessel towed the machine into position where it was connected to its pre-placed moorings. The first offshore wave energy was sent to the grid the following evening.

Edinburgh-based Ocean Power Delivery Ltd (OPD) has developed the Pelamis system over the past six years. Building on technology developed for the offshore

industry, each Pelamis machine has a rated power output of 750 kW.

The Pelamis WEC is the first full-scale machine to be installed at the test centre, which will eventually provide the facility for independent verification and testing of a range of full-scale, grid connected marine energy machines.

Richard Yemm, Managing Director of OPD said: "We look forward to fully characterising the performance of the machine over the coming months, and to using the results from EMEC to underpin the construction of the first commercial Pelamis wave farms."

NGC to operate 'BETTA' power grid; NGT sells networks

A single electricity market for the whole of Britain has moved a step closer with the appointment of the National Grid Company (NGC) as the GB System Operator under the British Electricity Trading and Transmission Arrangements (BETTA). The new arrangements are intended to create greater competition and choice for Scottish electricity customers, and will give all electricity generators access to a wider British market with a single set of rules.

The appointment also marks the start of the 'go-active' period during which the transition from the existing to the new arrangements will be phased in. GB-wide electricity trading under the new arrangements will 'go-live' in April 2005.

National Grid had been acting as GB

System Operator designate since December 2002, but ministers have now used the BETTA powers in the Energy Act to confirm the company's appointment and to start the warm-up period for BETTA.

The electricity market in Scotland currently operates under different arrangements from those in England and Wales. Under BETTA, the England and Wales trading arrangements will be extended to Scotland, creating a single British wholesale electricity market.

Meanwhile, National Grid Transco plc (NGT) has reached agreement on the sale of four of its regional gas distribution networks for a total of £5.8 billion. The North of England distribution network is to be sold to a consortium led by Cheung Kong Infrastructure Holdings Limited and including

United Utilities PLC for £1.4 billion; the Wales & the West network is to be sold to a consortium led by the Macquarie European Infrastructure Fund for £1.2 billion; and the South of England and Scotland distribution networks are to be sold to a consortium comprising Scottish and Southern Energy plc, Borealis Infrastructure Management Inc and Ontario Teachers Pension Plan for £3.2 billion.

NGT will retain the North West, West Midlands, London and East of England distribution networks. Subject to a range of regulatory consents and approvals, the transactions are due to be completed in April 2005. The purchasers of the distribution networks have confirmed that all existing employee rights, including pension terms, will be safeguarded.

Government committee re-opens debate on environmental taxation

The Environmental Audit Committee has published a scornful report on the Government's efforts to meet carbon reduction targets, concluding that:

- the Government's Climate Change Strategy is seriously off course and current policies have yet to make a significant impact on UK carbon emissions;
- a more imaginative and radical strategy – in particular for transport and domestic energy efficiency – is needed;
- the Treasury cannot expect industry to provide investment in alternative fuels unless it has a long-term strategy itself;
- politicians have failed to make the case for the environmental benefits of taxing fuel and, despite recent oil price rises, petrol is still at least 10% cheaper than four years ago in real terms; and
- the Government should consider recycling the proceeds of future fuel tax increases to subsidise public transport spending and alternatives to conventional fuel.

The Chairman of the Committee, Peter Ainsworth MP, said: "It is increasingly obvious that we are going to fall far short of the UK carbon reduction target, and a key problem area is transport. If the Government's commitment to sustainable development is to be taken seriously, it must take more radical action. It is also disappointing that the Treasury has done so little to promote domestic energy efficiency – despite two consultations on this topic in the last two years. There is an urgent need to look afresh at the scale of the challenges we face and

develop an adequate response."

Some conclusions from the Committee's report are reprinted below.

- As a percentage of total tax, the revenues from environmental taxes have recently been at their lowest level since 1993.
- The continued growth of carbon emissions from transport remains one of the most serious problems we face, and the Government's commitment to sustainable development will be called into question unless it takes steps to confront this issue. We urge the Government to implement the planned rise in fuel duty at the earliest opportunity.
- We are disappointed that the Future of Transport White Paper had nothing new to say on the practical steps the Department for Transport would take to tackle carbon emissions from transport and to promote a shift to a low carbon economy. It will take 10–15 years to introduce road charging on a national basis and such a regime would be far more of a blunt instrument than the present system, where larger differentials in rates of fuel duties and vehicle excise duty can potentially be used to promote a shift to low-carbon vehicles.
- We are sceptical of the figures quoted for emissions savings from Climate Change Agreements and recommend that baseline figures and future assessments, including that for 2004, are independently audited.

But not every organisation shares the

Committee's view. The CBI said that the while the report is right to highlight weaknesses in the Government's approach to green taxes, the Committee had underplayed competitiveness issues. Michael Roberts, CBI Director of Business Environment, said: "The call for higher taxes on fuel fails to recognise that the UK has the highest level of duty on diesel in the EU. This has a real impact on business when moving freight by road. Road user charges may be years away for most drivers but that is not the case for hauliers, who will pay them from 2007. This approach has greater merit than the blunt instrument of fuel duties."

Although the report says that environmental tax revenue has fallen as a share of total tax revenue, the CBI points out that business environmental tax payments have risen in recent years in line with the growth in the total tax take from business. Nearly £1 in every £8 of tax raised from business comes from environmental taxes and firms not only pay road and fuel duties but, unlike the general public, they are also liable for taxes on energy, aggregates and waste, said the employers' organisation.

Meanwhile, the Energy Saving Trust welcomed the call for increased environmental taxation to encourage energy efficiency. The Trust is calling for:

- a revised Stamp Duty system which encourages householders to introduce energy saving measures such as cavity wall insulation;
- a new 10% surcharge on the cost of inefficient domestic appliances – saving consumers £56 million a year in fuel bills; and
- an inefficiency charge of 50 pence on standard tungsten GLS bulbs – which could result in fuel bill savings of around £43 million per year.

UK needs to invest in energy storage to make clean power work

Britain needs to invest millions of pounds in new facilities for storing energy – or it may be unable to meet targets for increasing the proportion of power generated from renewable sources to 15% by 2015. So says power engineering specialist EA Technology, which has been commissioned by the DTI to review candidate storage technologies.

"Energy storage is the only answer to the question of what happens when the wind doesn't blow – given that wind power is likely to be the mainstay of the UK's renewable generation strategy in the short to medium term," said John Baker of EA Technology.

"Until Britain solves this problem, the contribution made by wind power in particular will be patchy at best. It is pointless talking about the contribution of wind

power in optimum conditions. What will happen in practice is that when the wind drops, the shortfall in capacity will continue to be made up by switching on old and inefficient fossil-fuelled generating plant."

Baker detailed at a recent seminar the contribution that could be made from storage technologies which include:

- compressed air energy storage;
- batteries (principally lead acid, nickel cadmium and sodium sulphur);
- flow cells;
- kinetic energy storage (flywheels);
- fuel cell/electrolyser/hydrogen systems.

"Effective power storage technologies already exist. The next stage must be to develop them into commercially viable solutions. This is an opportunity for Britain to take the lead in an area of develop-

ment which will become increasingly important worldwide," added Baker.

EA Technology believes the future of energy storage lies in the development of large numbers of small and medium-scale storage facilities, located close to generating plants and serving regional networks. "The power generation and distribution industries are rapidly becoming more 'distributed' in structure. This trend will certainly increase as the number of relatively small renewable generating plants coming on stream grows."

Mr Baker believes it is unlikely that there will be new individual developments on the scale of the Dinorwig 'electric mountain' pumped water scheme, created in the 1960s in North Wales to provide power storage equivalent to 2.5% of installed UK generating capacity.

Motivation to cut transport emissions

The Suffolk Fire and Rescue Service is the first national fire service to have achieved a four star rating from the Energy Saving Trust's (EST) TransportEnergy BestPractice Motorvate programme.

Motorvate members commit to achieving a 12% reduction in fuel use, which includes a 3% reduction in mileage over a three-year period. The programme has awarded Suffolk Fire Service this high level accreditation for the significant improvements that it has made in reducing carbon dioxide emissions from its fleet and reducing its fuel consumption, despite an increase in the level of service that it provides to the local community.

Now, HM Customs and Excise, one of central Government's largest fleet operators, has signed up to the programme, which is designed to provide its members with a structured plan to help monitor the environmental performance of their fleet. Members have access to a number of fleet management tools, including



independent benchmarking and auditing systems that help them to implement improvement strategies to reduce fleet costs and increase efficiency.

Richard Tarboton, Head of EST TransportEnergy, said, "Reducing vehicle emissions is not just about clean vehicle technology, the way that we drive our vehicles also has a huge impact. TransportEnergy BestPractice has helped to reduce carbon dioxide emissions by over 143,000 tonnes since its inception."

Despite more safety inspections and call-outs, Suffolk's Fire and Rescue Service is keeping its mileage and carbon emissions under control

Renewables industry welcomes 'limited' review of the RO

Renewables organisations have expressed relief that the Government's upcoming review of the workings of the Renewables Obligation (RO) will not upset the investment appalcart by proposing destabilising major changes. The review is due to start later this year. The RO ensures that all electricity suppliers produce a specified and increasing amount of energy from renewable sources.

Publishing the review's draft terms of reference, Energy Minister Stephen Timms reiterated the Government's long-term commitment to the Obligation as the central part of our policy for stimulating the expansion of renewables in the UK.

The British Wind Energy Association welcomed publication of the terms of reference, and reassurances that the basic structure will remain intact and that no reductions are to be contemplated in the duration and level of the Obligation, or for the 'buy-out price'.

BWEA Chief Executive Marcus Rand said:

"Investor confidence is key if the renewable technologies, and wind in particular, are to deliver on the targets that the Government has set. The announcement of the review last year had threatened to introduce uncertainty into the market while the mechanism was re-examined. However, the draft terms of reference have removed almost all of the 'downside' risk of the review, allowing our 330 company members to continue their business uninterrupted in the confidence that they will not be negatively affected."

The review does propose to examine:

- the effectiveness of the RO since it

began in April 2002;

- all aspects of the working arrangements of the RO;
- the levels of the RO beyond 2015/16;
- the potential impact of the EU Emissions Trading Scheme on carbon, and prices and the future cost competitiveness of renewable technologies; and
- energy from mixed wastes.

The level of the RO was 3% when it was introduced and now stands at 4.9% for 2004/5, and will increase each year to reach 10.4% in 2010/11. Secondary legislation will shortly be introduced to increase that figure to 15.4% by 2015/16.

O'Brien replaces Timms as Energy Minister

Mike O'Brien is the new DTI Minister for E-Commerce, Energy and Competitiveness, following a Government reshuffle in which Stephen Timms moved to the Treasury. O'Brien, MP for North Warwickshire, was previously at the Foreign Office.

Bold steps to tackle energy efficiency in housing

The latest proposed amendments to Part L of the Building Regulations and the implementation of the EU's Energy Performance of Buildings directive are packed full of bold and dramatic ideas to tackle the conservation of energy in both new homes and the existing housing stock. Here, Austin Baggett of NES highlights four of the most exciting changes proposed, and the implications that will have to be weighed up by the Government once its consultation concludes later this month.

On 22 October, the Government's consultation period on the proposed amendments to Part L of the Building Regulations and on the implementation of the EU Energy Performance of Buildings directive comes to a close. The consultation document itself runs to an inch thick, even printed double sided, and it is hard to over-emphasise just how dramatic its proposals are for tackling the energy efficiency of all buildings, especially new and existing homes.

The amendments to Part L were promised in both the Government's Energy White Paper (February 2003) and in the Action Plan for Energy Efficiency (April 2004). Both policy documents recognised that about a half of all the UK's carbon dioxide emissions come from buildings – about 30% from the 24 million dwellings in the UK and about 20% from other buildings. Significant improvements in Part L were seen as a major contributor towards achieving the target of a 20% reduction in carbon emissions by 2010.

The Government has already committed to one key action – raising the standard required for new and replacement domestic boilers to the level of the most efficient boiler types (A and B rated condensing boilers) – and this will be effective from 1 April 2005. But if all goes to plan, the second stage of amendments to Part L will be far more substantial and would be in place by 31 December 2005, in time to meet the directive's deadline of 4 January 2006.

So just how substantial are these amendments? Let me take you through just four of the proposed major changes, and you will begin to see the significance to everyone involved in energy efficiency, let alone the home owning public in general.

Targeting 24 million existing homes

The first major revision is some creative proposals for improving the efficiency of the existing housing stock. Historically, Building Regulations have focused primarily on forcing through energy efficiency improvement in the new build sector. However, statistics suggest that new dwellings are being created faster than existing ones are being demolished. This means that we are only really managing to slow the rate of growth of national carbon dioxide emissions, rather than tackling it wholesale.

Achieving an average 0.5% year-on-year reduction in the carbon emissions from space heating and hot water in the existing stock of 24 million dwellings would achieve about the same in national carbon dioxide terms as requiring carbon-free space heating and hot water in all future dwellings.

This highlights the importance of addressing the existing stock, and the proposed amendments make a serious attempt to do just that. The concept of applying Regulations to work in existing

dwellings was introduced in the 2002 regulations, and has been greatly extended in these proposals.

Probably the most radical aspect of the proposals for existing dwellings is that where the cost of any major building work exceeds £8,000 (such as extensions, refurbishments, alterations and the sort of work that might usually require Building Control approval), opportunities should be taken to improve the energy efficiency of the dwelling as a whole wherever it is practical and cost-effective to do so.

For instance, if you were building an extension to your home, as well as making sure that the extension was built to the latest standards, you could also be required to make reasonable provision to improve the energy performance of other aspects of your home – such as insulating the roof or any unfilled cavity walls. Similarly, a local authority or housing association undertaking large refurbishment programmes would also have to add on energy improvements to their list of building work. To identify these improvements a survey would need to be commissioned by an appropriately qualified and accredited expert to provide a financial and technical assessment of their viability.

But how could the Government enforce such a regulation? For many home owners, the temptation will surely increase to employ a builder to do work that is unreported and hence unregulated – or simply to ensure that no individual building contract ever gets over the £8,000 threshold!

One solution may already be on the horizon. The Housing Bill currently passing through Parliament provides for a small army of Home Inspectors who, by January 2007 will be licensed and trained to produce Home Information Packs (including condition reports) whenever a home is put up for sale in England and Wales.

Admittedly, the opportunity for Home Inspectors to take on the job of actively identifying and reporting on the compliance of recent building work in every home for sale is not straightforward – they would have to become expert in many aspects of the regulations, not just Part L. But the alternatives of relying on conveyancers, building control inspectors or just nosy neighbours to check that building work has been approved and includes the necessary energy efficiency improvements are not exactly ideal either.

Because this proposal in the Government's consultation document goes well beyond both the existing remit of the Building Act and the requirements of the directive (which requires such proposals only for buildings over 1,000m²), it is dependent upon new primary legislation being passed to enable the regulations to be introduced. The Sustainable and Secure Buildings Bill currently going through Parliament is intended to provide such a legislative backbone.

New whole-house carbon calculations

The second radical amendment to the regulations is only to allow compliance based on a whole-building energy performance calculation. This has been entirely driven by the requirements of the directive.

The current regulations allow builders to demonstrate compliance by any one of three methods – Elemental, Target U-value, and Carbon Index. It has led to quite a mess. Earlier this year, FAERO (the Federation of Authorised Energy Rating Organisations) carried out a comparison of energy ratings achieved in over 5,500 new build homes that complied with the current regulations. It found that the range of achieved SAP ratings was vast – from a low of 50 to a high of 120. Remember, all these homes had been accepted by building control as providing reasonable provision for the conservation of fuel and power, as required by regulations.

Under the new proposals, the Elemental and Target U-value methods will no longer exist and the only way to show compliance will be to demonstrate a minimum level of whole house energy performance. A new rating has been introduced for this purpose – the Dwelling Carbon Emission Rate (a derivative from the SAP calculation). The DCER will have to be calculated and then compared to the Target Carbon Emission Rate (TCER). If the DCER is lower than the TCER, then the dwelling complies. If it is higher, then it fails.

This system offers two big benefits. First it makes the process of checking compliance simpler and more transparent for building control authorities; second it allows designers flexibility in their approach to compliance (although there will be minimum acceptable standards for the principal building fabric, heating and lighting services).

Building new homes the way they were designed to be built

It will hardly surprise you to know that for many years now there has been a growing concern about the potential shortfall between a new home's design as approved by building control and the actual delivered performance on site.

Research undertaken earlier this year showed that only one in four houses were actually being built to the required standard for air tightness. This suggests that the majority of new homes currently being built are more energy guzzling than they (legally) should be, with a detrimental impact on the new homebuyer's energy bills, and on the UK's carbon saving targets.

This shortfall between design intent and delivered performance on site was brought out in the Energy White Paper and subsequently by the Sustainable Buildings Task Group, and the proposed new regulations make some serious attempts to address this problem.

Quality of construction is to be confirmed



by one of two means – through a builder's use of 'Robust Details' (essentially a pattern book of pre-approved construction techniques) or via testing of a home before it is completed. Critically, both approaches require pressure tests; the difference is in the sampling rate. Should a new home fail to meet the standard when tested, remedial measures will need to be undertaken to ensure the air tightness standard is achieved.

Unless on-site construction practices improve drastically, many house builders could quickly see big dents in their profits, since applying remedial measures is not easy and not cheap, and is not even guaranteed to be successful.

This proposed new regulation will be a huge challenge for UK house builders, but one that is essential if this latest set of revisions will bring about the intended 25% reduction in carbon emissions from new build housing.

New homes will be required to demonstrate a minimum level of whole house energy consumption to comply with revised Building Regulations – and existing homes are to be targeted for the first time

More Competent Persons schemes

I want to go back to the issue of compliance again – because if we fail to put in place the proper mechanism for enforcement, the regulations will fail in their intended objectives.

Evidence to date has shown us that we cannot simply rely on the existing framework of under-resourced and over-stretched building control officers to take on the burden alone. The Office of the Deputy Prime Minister (ODPM) recognises this, and in the consultation specifically asks for suggestions and observations on what could be done to improve enforcement and/or relieve the regulatory burden.

Part L consultation

To read the ODPM's consultation on the new regulations, go to www.odpm.gov.uk and follow links to the Building Regulations. Responses should be sent by 22 October to partl.consultation@fabermaunsell.com using the response form provided.

More information is available on the NHER website – go to www.nher.co.uk and follow the links to European Directive and Home Information Pack. A full analysis of the Part L consultation is also available on NHER's subscription information service, e-info, on www.nher.co.uk/e-info.shtml. The NHER scheme is always interested in the views of professionals involved in the housebuilding industry.

Appliances in new homes add to carbon dioxide problems

As highlighted in the main article, an interim change to the Building Regulations will take effect in April 2005 that will effectively remove the market for inefficient boilers – only A or B rated condensing boilers will be allowed in new or retrofit applications. However, there are currently no proposals to incorporate builder-fitted appliances within the Building Regulations.

This is not good news. Research by the NHER scheme and the Pilkington Energy Efficiency Trust found that house builders' failure to install the most efficient appliances and boilers in brand new homes is costing home owners over £4 million every year.

It is environmentally damaging too, with new homes churning out over 18,800 tonnes of extra carbon dioxide every year just because they are not fitted with the most efficient fridges, washing machines, boilers and other standard home appliances.

Most white goods and appliances such as refrigerators, freezers, fridge-freezers, ovens, washing machines, tumble dryers, washer-dryers and dishwashers, are sold with energy labels rating their efficiency on a scale of A to G. The

difference in cost for house builders between providing an A-rated and C-rated appliance is insignificant, and in some cases A-rated appliances are cheaper.

Although the NHER's research findings suggested that nearly 80% of all appliances typically installed in new homes have an energy rating of B or above, the difference between the ideal situation – where all new homes are fitted with A-rated appliances – and the situation NHER found in its research produces over 2,800 tonnes of carbon dioxide annually.

The irony is, brand new homes are very well insulated and designed to be energy efficient, and they still perform head and shoulders better than older properties. But while some house builders are capitalising on this advantage and installing the best A-rated appliances and boilers in their homes for sale, there is no consistency in the market and the failure of other builders is costing the public – and the planet – dear.

Copies of The Appliance of Science research report are available free from the NHER scheme, tel. 01908 672787, or download a copy from www.nher.co.uk.

We believe that the adoption of competent persons schemes would fit well with the building regulations framework and would also provide an effective implementation mechanism for the EU directive on the energy performance of buildings.

Multiple competent persons schemes should be encouraged to develop, each complying with a common, nationally approved, technical standard. A nationally recognised qualification for each scheme (such as the ability to 'sign off' the SAP and DEC ratings for new build housing) would encourage professionals to gain Competent Persons status. A robust monitoring and quality assurance framework would ensure that an individual is consistently applying the standards, and would engender trust among house builders and home owners alike.

In summary, the proposed changes to the building regulations and the implementation of the EU directive offers huge opportunities for all those involved in buildings and energy efficiency. The ODPM's ideas are to be applauded as a robust framework for delivering better buildings – buildings that emit less carbon, are cheaper to run, and offer consumers better value. It is now up to the industry to help deliver workable solutions for implementation.

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Inefficient fridges cost more to run



Newcastle monitors domestic PV installed for tenants

Using a grant of £250,000 from the DTI's £20 million Solar Grants Programme, Newcastle upon Tyne City Council has managed a pilot project to install a major photovoltaic (PV) array at a three-storey block of flats at Westerhope, Newcastle. The Council is thus now gaining hands-on experience with PV with a view to exploiting this sustainable technology in more of its developments. Performance of the new system will be monitored continually over a two year period, writes *Ernie Johnson, Energy Officer with Newcastle City Council*.

The total project comprises of 25 PV arrays set on the roof of a three-storey block of flats. The block is orientated to the south with all 25 roof-integrated units having a south, southeast or southwest facing aspect. Each roof is inclined



Site work included the addition of new boarding and a waterproof membrane beneath the PV modules

approximately 30° from horizontal. The 25 individual systems are up to 1.5 kW peak (kWp) in size, installed as four sub-arrays, giving a total installed capacity of 38.25 kWp.

Newcastle City Council first strengthened the roofs, work which included removing the existing clay tiles from the south/south west sides and fixing new boarding. A waterproofing membrane was laid prior to installation of the arrays. The BP 585 laminates were then mounted onto each roof using a system developed by PV Systems Ltd. Wiring from the solar panels was installed via inverters to individual electricity consumer units and metering, as well as to monitoring equipment.

Each flat is served by one of four models of inverter, depending on the system power, located in the loft space along with a DC isolator. AC cabling from each inverter will be connected to an adjacent switched fused spur routed to the distribution board/consumer unit location of each flat. In the distribution board the spur cable is connected through a 16A kWh meter and then into a circuit breaker. A small energy meter is installed for each flat and tenants can monitor instantaneous power generated and the total generated output produced by their system.

Contact *Ernie Johnson* on tel 0191 211 5764, e: ernest.johnson@newcastle.gov.uk

IT Power subsidiary company, Sustainable Energy Installations, has completed the installation of a PV system at Ringmer Community College in East Sussex.

The company installed a 7.9 kWp, grid connected system at the environmentally conscious Ringmer school which used a bolt-on mounting system,



66 Kyocera 120 Wp polycrystalline modules and three Fronius IG30 inverters. A data link was also installed to allow data to be downloaded via a PC in the science laboratory for use in classes. SEI also installed a large display to provide information on the electricity generated to date and live output from the system. The system was officially opened in May.

Contact *Sustainable Energy Installations* at www.itpower.co.uk

Thought to be the largest domestic PV installation in the UK, the 157.5 kWp installation distributed over three buildings at the Peabody Trust's Priors Estate in London was completed in March this year.

Installer solarcentury designed a solution using Sharp monocrystalline modules, where the framing system and modules were easily retro-fitted to the roof, have a high power density and thus maximise the electricity generated from the available roof space. The 1200 m² array is expected



to generate 130 MWh per year and avoid the emission of 56 tonnes of carbon dioxide annually.

Contact *solarcentury* at www.solarcentury.co.uk

New, zero emissions headquarters for Renewable Energy Systems

Commended at its official opening by Minister for Energy Stephen Timms and lauded by the Royal Institute of British Architects when it won the RIBA 2004 award for the East region, Beaufort Court has certainly made its presence known. But why has it had such an impact? Here, its owner, Renewable Energy Systems Group (RES), explains how several groundbreaking uses of renewable and energy efficiency technologies help the building to achieve zero net energy use.



Overview of the new HQ building complex, showing the pre-used 225 kW wind turbine

Beaufort Court used to house the Ovaltine Egg Farm. It has been transformed into an energy self-sufficient, zero emissions office using a combination of the most advanced energy efficient building design and on-site renewable energy generation. It is the first time in the world that a historical building has been refurbished as a zero emissions commercial development. It's a landmark in the integration of renewable energy technology into the built environment and a living case study for sustainability.

Leap of faith

The Ovaltine Egg Farm occupied the site in Kings Langley, Hertfordshire, in 1929 to provide eggs for the manufacture of the famous malted drink. In the 1960s, chicken rearing ceased and the Arts & Crafts-style buildings lay empty until 2000 when the expanding Renewable Energy Systems Group (RES) came across them in their search for a new UK headquarters. It was, as RES managing director Ian Mays put it, "a leap of faith to see the potential in what was a virtually derelict site, albeit one with great character and heritage that demanded to be preserved".

Beaufort Court was designed for RES by Studio E Architects and consulting engineers Max Fordham. The brief was to provide modern, stylish office space that was energy self-sufficient and produced zero emissions. Applying this brief to the whole design and build process, every aspect of design construction was undertaken with minimal environmental impact, from harnessing natural light and making optimal use of natural ventilation to using recycled materials and those that require low levels of energy to manufacture.

In order to achieve its aim of being energy self-sufficient and zero emissions, renewable energy technology has been harnessed in a unique way.

Wind turbine

The on-site 225 kW wind turbine has a hub height of 36 m and a rotor diameter of 29 m and is a Vestas V29 model previously in operation in the Netherlands. The turbine is connected to the buildings' electrical distribution network and to the national grid. It is expected to generate 250 MWh annually, which is greater than the anticipated building consumption, and excess power is exported to the grid. The electricity is sold to Hertfordshire-based renewable electricity supplier, Green Energy (UK) plc.

Despite the site having a relatively low wind speed, the turbine is performing beyond expectations. RES also reports that the local community's response to the wind turbine has been overwhelmingly positive. At a recent community open day attended by over 3,000 people, the wind turbine was the main attraction with a number of people saying they felt it was a striking landmark for the area.

Biomass

The buildings' heating needs will primarily be met by a biomass boiler fuelled by the energy crop miscanthus, or 'elephant grass', 5 hectares of which have been planted on the site. Biomass is carbon neutral, as the carbon dioxide emitted during combustion is balanced by the carbon dioxide absorbed by the crop. The crop is harvested annually in late winter with conventional harvesting equipment and stored as bales until needed in the crop store, the only new building on site and situated beneath the solar panel array, which limits its visual impact. The bales are shredded before being fed into the biomass boiler. The field is expected to

yield 60 oven-dried tonnes per year with a calorific value of 17 GJ/tonne.

The 100 kW biomass boiler was provided by Talbott's Heating. It is 80–85% efficient and can modulate down to 25% of full load. The shredded bales are fed into the boiler by a mechanical screw auger.

Environmentally-friendly office cooling

Water from the local chalk aquifer is used to cool the buildings during the summer. Water is extracted from the ground at 12°C via a 75 m deep borehole in the courtyard of the building. First it is used to cool and dehumidify the incoming air to the buildings in the air handling units. The water is then circulated at 15°C through chilled beams (finned tubes) at high level in the offices. Finally, the water is used to irrigate the energy crop before it eventually returns to the ground.

Solar PV/thermal array

The 170 m² solar array comprises 54 m² of photovoltaic/thermal (PVT) panels and 116 m² of solar thermal panels. The array consists of a photovoltaic panel that converts light into electricity with a copper heat exchanger laminated to capture the thermal energy which would otherwise go to waste. The PVT panels have been developed by ECN in the Netherlands, incorporating Shell Solar PV polycrystalline silicon cells. Zen Solar incorporated the PVT laminates into modules the same size as the thermal modules which the company also manufactured. All the modules were then plumbed together to provide hot water for the heat store and the PVT modules were wired together to provide electricity for the building.

The hybrid PVT panels (generating both heat and electricity) are thought to be the first of their kind in the world.

Seasonal underground heat store

The underground heat store is a 1400 m³ body of water that stores the heat generated by the PVT and solar thermal panels for use in the buildings during the colder

months. The top of the store is insulated with a floating lid of 500 mm of expanded polystyrene. It is hinged around the perimeter to allow for the expansion and contraction of the water and the design also incorporates a suspension system to support the roof should the water level reduce. The sloping sides are uninsulated. As long as the ground around the store is kept dry, it will act as an insulator and additional thermal mass, increasing the capacity of the store. The high specific heat capacity of water (4.2 kJ/kg°C) makes it a good choice for storing heat.

During the summer there will be little or no demand for heat in the building, so the heat generated by the PVT array will be stored in the heat store. In the autumn some of the solar heat generated will be used directly in the buildings and the excess will be added to the heat store. The temperature of the water in the store will gradually rise over the summer and early autumn. During the winter the solar heat generated will be less than the buildings' heat load, and heat will be extracted from the heat store to heat the incoming air to the building. The temperature of the water in the store will drop as the heat is extracted. Some heat will also be lost to the surroundings. This is estimated to be about 50% of the total heat put into the store over the summer. The relatively low-grade heat from the store can be used to preheat the incoming air to the building, as the outside air will be at a lower temperature than the water.

The system was designed and built by the Portuguese company Jardim Vista and environmental consultants EPG and this is the first time that this particular design of heat store has been used anywhere in the world. There are many different kinds of deep-water storage, floating covers and water re-use schemes, but none where so many technologies have been incorporated into a single project.

Sharing lessons learned

Although the main business of RES is wind farm development, construction and operation, the company specified that Beaufort Court should also be an information resource on renewable energy as a



Interior detail – natural daylighting has been used extensively

whole. A visitor facility will open in late 2004 so that people can come to the site and see sustainability in action. RES is also sharing detailed information (see www.beaufortcourt.com) on the techniques used to build Beaufort Court and the performance data of the energy-generating systems to inform other renewable energy project teams. The DTI has provided a grant to support information dissemination.

There are a number of unique elements to Beaufort Court. As well as the world firsts, one of the most unusual aspects is that a commercial organisation chose this route to a new headquarters. EU funding certainly helped and there is no doubt that being in the industry must have helped, but it does indeed take a leap of faith to be this visionary.

Contact RES www.res-ltd.com

Hybrid photovoltaic and solar thermal (PVT) panels have been used, alongside more conventional solar thermal panels, for the first time



National Energy Foundation's phase 2 expansion opts for lightweight construction

Ian Byrne, Deputy Director, National Energy Foundation describes the design and construction of a second low energy building recently opened by a highly visible sustainable energy organisation. Following on from the new HQ building for a wind energy developer, this is the account of a second building erected to accommodate the National Energy Foundation and its subsidiary. While innovation at the RES HQ, created from an old structure, lay mainly in its building services, the emphasis at the NEF building was as much on a thermally lightweight building structure as to how it was to be supplied with energy.

In 1999 the National Energy Foundation, a charity established to encourage the more sustainable use and generation of energy, moved into a new, purpose built office building of 1,000 m² floor area. This was designed to demonstrate best practice in naturally ventilated office buildings, and was built with a very high thermal mass to provide temperature stability. The building performed well to target, but had been constructed using large amounts of concrete, with a consequent high level of embodied energy.

By late 2002, it was clear that the Foundation and its trading subsidiary, National Energy Services Ltd, were going to need additional space. After some internal discussion, the Foundation decided to work with the project management team from the first building at Avebury International to create a new, low-energy building, but with a different strategy. In particular, it was decided to have a lower thermal mass and much lower embodied energy, by moving to a more lightweight timber frame.

The first building had been heated very successfully by a 35 kW fully modulating gas condensing boiler. As part of the strategy to demonstrate alternative approaches to a low energy office, it was agreed not to extend gas into the new building,

but to use a ground source heat pump (GSHP) instead as the principal heat source. Although there were obvious additional costs in using a GSHP, it would permit a low temperature underfloor wet heating system to be used, saving valuable wall space which had been lost to radiators in the older building. The decision was also eased by the availability of a 50% grant towards the plant cost from the Government's Clear Skies programme.

Initial plans for the Phase II building centred on a single storey office, but it was calculated that the Foundation needed a gross floor area of around 430 m² able to be able to accommodate up to 36 people, including storage and limited meeting space. This has increased the total occupancy capacity of the National Energy Centre to almost 100 people. This was solved by incorporating a mezzanine floor, allowing the building footprint to stay at 300 m², on the designated location. This also permitted the roof to be angled, opening up the volume in the building and allowing a cross-flow of air from high-level secure vents, that could be used in summer to provide night time purging.

As it was also hoped to incorporate photovoltaics, the roof also had to be angled to the south, providing a net angle that permits PV to perform at around 97% of optimal output.

Exterior view showing the tilted roof



Building element	Construction details	U-values required by building regs (Wm ⁻² K)	Design U-values achieved (Wm ⁻² K)
Foundations	Suspended 200 mm pre-cast concrete beams above a minimum 225 mm void		
Floor	35 mm screed above insulation (see below)	0.25	0.18
Walls	Timber frame with yellow wool insulation	0.35	0.18
Roof	Rheinzink skin on timber frame with a 90 mm air gap and 300 mm yellow wool insulation	0.25	0.12
Glazing	Low-e coated double glazing in softwood frames	2.0	1.1

Table 1. Elemental U-values for non-domestic buildings as set out in Approved Document Part L2 of the 2002 Building Regulations

Building envelope

Construction started in summer 2003 and was sufficiently complete to allow occupation in February 2004. The building was constructed using a timber frame, with brick walls below the windows and, on the north and south aspects, to provide additional thermal protection against summer heat. Elsewhere, low maintenance 'Thermowood' cladding, produced from sustainable (Scandinavian) timber, has been used. The east and west elevations of the building have glazed areas beneath high level natural ventilation. On the west side, horizontal overshadowing is designed to allow winter sun in, but to prevent direct summer sun.

The east elevation is partly buried to achieve thermal stability and reduce the visual impact from the office area of the Phase I building – the ground is sloped towards the building to provide shielding up to a height of approximately 1 metre.

The timber frame posed an interesting challenge for the manufacturers, due to the double tilting of the roof. Some 20,000 nails were used in its construction, but this allowed a single span roof, unsupported in the centre of the building. The original concept had been to have north-lights in the roof, but these proved impossible to locate due to the positioning of the internal framing timbers and were replaced by eight Monodraught Sunpipes (light tubes) in the centre of the building. These protrude minimally above the Rheinzink roof, but provide a significant level of internal illumination – of up to 500 W equivalent each on a sunny day.

Rheinzink, supplied through Boss Metals, was specified to provide the surface covering on the roof, in part to match the Phase I building, but also due to its workability around fixings for the PV. The roof and walls also benefited from 300 mm of glass wool insulation, resulting in very low U-values – see Table 1. All elements are insulated to a level above current building regulations, and special care was taken during the construction phase to produce a building that was airtight.

The floor consists of several layers to maximise energy performance. From the ground up, it starts with 250 mm suspend-

ed concrete beams, which offer limited summer cooling from their thermal mass. The beams are insulated with two layers of insulation: 100 mm of expanded polystyrene beneath 25 mm of polyurethane foam, with a heat reflecting coating on each side. Underfloor heating pipes were laid above this in a screed of heat transmitting 'Gyvlon'. Screedmasters laid Rehau Universal pipe into a Gyvlon floor screed on the ground floor. The self-levelling screed was a nominal 35 mm thick, allowing greater responsiveness from the system and enhanced insulation.

On the mezzanine, the heating pipes needed to be set above timber joists, so were set into Rehau's high conductivity aluminium plates. In all, there are three underfloor heating circuits, individually controlled through zone thermostats, fed from the top of the buffer tank.

A 13 kW heat pump unit feeds the underfloor heating system



Low energy buildings



A 6.47 kWp PV array has been fitted on the south facing roof

for hot water circuits, the system (for kitchen, toilets and a shower for cyclists) is electric, pre-heated by water from by a two m² evacuated tube solar panel, generously donated by Thermomax Ltd.

A 6.47 kWp grid-connected photovoltaic array has been fitted on the south facing roof leaves, part funded by the PV Solar Grants programme. On bright days, this is adequate to power the heat pump (which uses 3–4 kW of electrical input to provide 13 kW output) with some surplus for use in office equipment; artificial lighting is not needed when the sun is out.

Other sustainability features

The Foundation was also keen that the building should demonstrate other environmental features. As much construction spoil as possible was retained on site, enhancing the existing bund. Water-based paints were specified (but not universally used!) and the floors are carpeted throughout with Interface Entropy carpet tiles, which incorporate fibres from recycled materials. An additional benefit is that they can be laid in a random pattern, permitting easy replacement of any areas that become worn.

The building also incorporates a rain-water recovery and storage system. Rainwater is channelled into a 3,300 litre underground storage tank and is then pumped and filtered before use in flushing toilets.

Contact Ian Byrne at the National Energy Foundation, www.natenergy.org.uk

Heat pump heating system

Underfloor heating works best with the relatively low output temperatures (35–40°) from a ground source heat pump. Soil temperature remains almost constant year round deeper than around 1 m below the ground surface. Ground source heat pumps capture solar energy by exploiting this effect, using a long, water-filled coil to extract heat from the ground.

The Foundation needed to calculate the heat demand from the building very carefully, as on both cost and performance grounds it was important to avoid over-sizing the system. Calculations suggested a total fabric heat loss from the building of around 7 kW (as a design temperature difference of 27 K), with a similar maximum loss from ventilation. It was decided to specify a 13 kW Viessmann Vitocal 300 heat pump unit to be installed by Geoscience Ltd, which, although theoretically very slightly under-sized, should operate at a high load for much of the time.

The heat pump collects heat from ground loops containing a water/antifreeze mixture laid into three 50 m trenches. Each trench contains approximately 250 m of polyethylene pipe coiled into a 'slinky' of around 1 metre in diameter, laid horizontally at a depth of 1.4 m. The external loops are pumped by a Wilo Salmsen TOP S30/7 high efficiency pump.

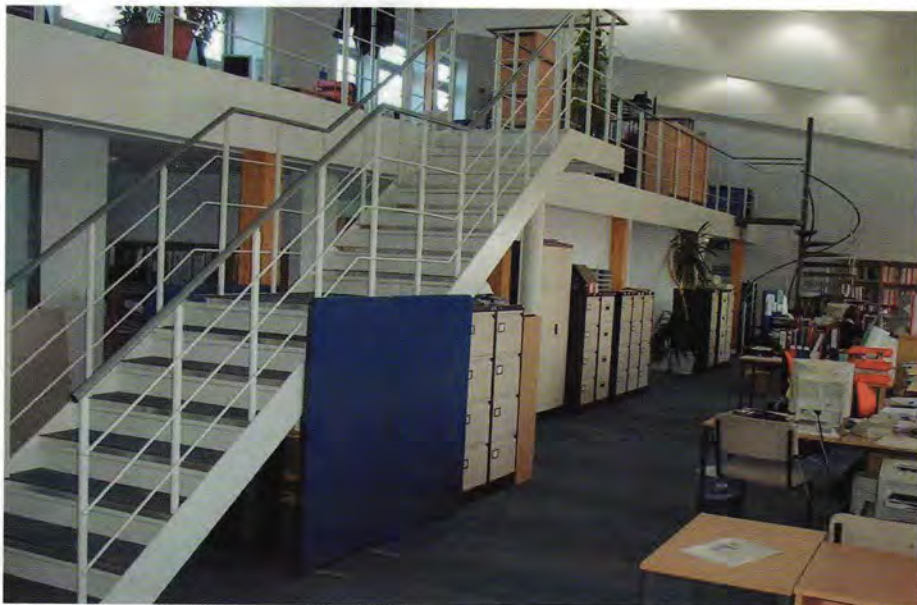
Biomass and PV

The heat pump feeds a 200 litre buffer tank, from which a secondary circuit supplies the underfloor heating. To deal with exceptionally cold weather, a manually operated, 3 kW immersion heater is installed in the top of the buffer tank, but

in the first winter of operation it did not prove necessary to use it. The building also has a biomass pellet stove as back-up heating. This is located quite close to the main entrance to the building, where the air is likely to be coolest, and well away from the thermostats controlling the main heating system. The stove is an Enviro Evolution, capable of delivering 7.2 kW of heat at 82% efficiency.

Sustainably produced wood pellets are fed from an integral hopper into the stove, and the output can be adjusted by a variable speed augur changing the volume of pellets delivered. A convection fan helps distribute heat into the building.

As heat pumps are less effective in raising water to the temperature necessary



Interior, showing the mezzanine floor

Government relies on insulation to deliver energy efficiency

*By Gillian Alder,
Director, National
Insulation Association*

Significantly improved levels of energy efficiency in buildings lie at the core of the Government's strategy to cut carbon dioxide emissions. Put simply, this implies better thermal insulation being installed in existing and new homes on a massive scale.

The Government recognises this. In his message to the Association's recent conference, Lord Whitty, Minister for Food, Farming and Sustainable Energy, spoke of the Government: "putting a lot of faith in the insulation industry – we are depending on you to deliver the most important elements of our plans for energy efficiency in the domestic sector and this must be done efficiently and cost-effectively. We expect the insulation industry to proactively take up this challenge and prove itself as the effective delivery mechanism for economical carbon abatement in households".

Insulation measures are to play a major part in the expansion of the Energy Efficiency Commitment (EEC) – an obligation on energy suppliers to improve domestic energy efficiency. The EEC 2005-2008, with cavity wall insulation being the dominant measure, will run at twice the current level of activity of EEC1 – with loft insulation to triple, and draughtproofing to play its part.

This extension of the EEC will naturally precipitate demand for cost-effective, simple energy saving measures such as

wall insulation, loft insulation to the current specified depth, draughtproofing and flexible thermal linings. The investment cost of those measures is generally recovered in savings within a few years.

There is also talk of extending the EEC to the non-domestic sector. This would, of course, have considerable bearing on the implementation of the new EU Directive on the energy performance of buildings, which reflects major changes to improve energy efficiency. This Directive – which comes into force in 2006 – covers homes alongside business and the public sector.

As some 70% of the total UK domestic sector is owner occupied, the great majority of which are not in fuel poverty, the step change in insulation needs to occur in these households. In 2002-3 only 80,000 households not on low incomes installed cavity wall insulation. This annual return rate needs to increase by a factor of five or six. The insulation industry maintains that this will only be achieved by either requiring insulation by regulation (eg at the time of sale of a property) or by increasing the demand from householders (a long term-culture change).

There are around 25 million existing dwellings and the average SAP rating of this stock is around 44. New dwellings built to the 1995 standards were achieving SAP ratings on average around 80 or more, and those being designed to the 2002 standards may be achieving SAP ratings on average around 90. However, less than 200,000 new dwellings are built in the UK each year.

The severity of the situation is illustrated by the vast number of existing homes that just do not have acceptable levels of insulation. For example, there are over eight million homes in urgent need of, and currently suitable for, injected cavity wall insulation; an estimated ten million homes in need of loft insulation topped up to a 250 mm/270 mm thickness; and nine million homes in need of draughtproofing to achieve a balanced internal environment.

It is anticipated that constantly changing thermal insulation requirements within Building Regulations will push up the demand for insulation even further. Currently proposed revisions suggest that improved insulation standards will not only apply to new houses, but also to existing ones when "material alterations" are carried out.

Filling cavities

However, whilst UK houses are desperately in need of insulation to bring them in line with current Part L Building Regulations, recent research undertaken by the Energy Saving Trust (EST) reveals that one of the reasons why these homes are not being insulated is because consumers hold misconceptions about cavity wall insulation and think it is difficult to find a reliable installer.



Applying insulated thermal lining – a step change in home insulation levels will be essential for meeting carbon dioxide reduction targets

These findings were the result of a recent EST marketing campaign designed to make consumers aware of the benefits of cavity wall insulation and provide clear information on how to contact registered installers.

Because of the volume of homes with unfilled cavity walls in the UK, the Government is proposing to encourage the insulation of more than 400,000 cavity walled homes in the next year. Irina Townsend, EST cavity wall insulation campaign manager, said: "Householders need to do their homework before choosing an insulation installer, as it is a highly skilled job, which should be undertaken by a specialist with knowledge of the widely differing building structures in the UK".

The National Insulation Association (NIA) is working closely with the Trust to help change people's perceptions on the reliability of installers as well as encouraging the uptake of cavity wall insulation.

The Government recognises consumer apathy towards energy efficiency and announced a new energy efficiency incentive in the March Budget which will benefit private tenants. A private landlords' energy saving allowance will provide upfront tax relief on capital expenditure for the insulation of cavity wall and loft insulation in rented accommodation. The fiscal incentive will help tenants lower their heating bills and improve their comfort. ●

Contact Gillian Alder at the National Insulation Association, tel 01428 654011, or via the website www.insulationassociation.org.uk

Indigenous fuel production down; consumption rose in 2004

Published in the summer by the DTI, the 2004 Digest of United Kingdom Energy Statistics (often known as Dukes) provides a comprehensive account of energy supply and demand in the UK for 2003. Here, we reproduce the main headlines.

Energy production and trade

- Primary fuel production in 2003, at 244.8 million tonnes of oil equivalent, was 1.5% higher than in 2002 – although total indigenous production was 4.5% lower than in 2002.
- Natural gas production fell a further 1% in 2003; this follows falls in the previous two years. Of total gas production, exports net of imports accounted for 8% in 2003. This was similar to 2002 and a decline from 2000 and 2001.
- Crude oil production in 2003 fell by 8.5%, and now accounts for 45% of indigenous fuel production.
- Coal production was down 6% in 2003 compared to 2002. Imports of coal increased by 11%, however they still constituted 51% of the UK coal supply.

Energy consumption

- UK energy consumption in 2003 increased by 1.5%.
- Energy consumption by final users (ie after conversion to secondary fuels, such as electricity or road transport fuels) at 170 million tonnes of oil equivalent, rose by 1.2% in 2003. Consumption increased in the transport, domestic and industry sectors and non-energy uses, while it decreased in the service sector.
- Overall gas consumption rose by 1%. However, gas demand for electricity generation fell by 1.5% taking gas' share of the UK's supply of electricity down to almost 38%.
- Total oil consumption in the UK rose by 3% in 2003 to 79 million tonnes of oil equivalent. The majority of this, 70%, was consumed in the transport sector.
- Coal consumption rose by 6.5% in 2003. There was an 11.5% increase in consumption by major power producers (consumers of 83% of total coal demand). Disposals of coal to final users such as industry and households fell to their lowest ever levels and the domestic sector only accounts for 1.5% of total coal consumption.

Electricity generation and supply

- Total electricity demand in the UK in 2003 was 400 TWh, an increase of 1.2% on 2002. However, indigenous electricity supply increased by almost 3% because there was a reduction in net imports of electricity to 2 TWh: gross imports decreased by 44% and exports almost quadrupled.
- The domestic sector was the largest electricity consumer in 2003 (116 TWh), although industry was a close second (114 TWh). The domestic sector grew by 1% and the industrial sector by 1.5% in 2003.
- Total electrical capacity of good quality CHP plants in the UK in 2003 was 4,849 MWe, an increase of 30 MWe from 2001. There were 8 new schemes but 43 ceased to operate. Electrical

output from CHP fell by 1%, and was 8.5% below the record level of 2000.

- In 2003 the proportion of UK electricity generated from renewables was 2.7%. This was lower than the 2002 proportion because 2003 was a dry year and generation from hydro fell by 33%. On the basis of the policy measurement of the contribution of renewables eligible under the Renewables Obligation to UK electricity sales, 2003 showed continued growth with the percentage increasing from 1.5% in 2001 to 1.8% in 2002 and 2.2% in 2003. Installed generating capacity of renewable sources rose by 12.5% in 2003, mainly as a result of a 28% increase in wind capacity and a 17% increase in the capacity of sites fuelled by biofuels and wastes.

Consumption details

- The overall increase in energy consumption between 1990 and 2003 was 10.7 million tonnes of oil equivalent. The changes in the main sectors, between 1990 and 2002 were: industry: -10%, domestic: +17.5%, transport: +15%, services and agriculture: +1%.
- Growth in energy consumption in the transport sector is slowing. By 2003, transport energy consumption had nearly doubled since 1970, but only 15% of that increase had taken place since 1990. The largest increase between 1990 and 2003 occurred in the air transport sector, where consumption rose by 63% to meet growing demand for international air travel.
- Domestic energy consumption increased by 17.5% between 1990 and 2003. During this period the number of households increased by 11%, the population by 3% and household disposable income by 44%. Space heating accounted for about three-fifths of all energy consumed in the domestic sector and it is estimated that over the last thirty years, if savings from insulation and heating efficiency improvements had not been made, then energy consumption for space heating would be twice current levels.
- In 2003, the largest sub-sector in the industrial sector was chemicals, which accounted for 21% of all industrial energy consumption. Since 1990 energy consumption in the chemicals sector has increased by 22%.
- In the service sector, energy consumption in the private sector increased by 14% between 1990 and 2003, but fell by 10% in the public sector. At the same time, output, measured as the contribution made to the UK economy, increased by 56% in the private sector and by 25% in the public sector.

The Digest is available both in hard copy from the Stationery Office and free on the Internet at:
www.dti.gov.uk/energy/inform/dukes/

Competitive European energy markets – a pipedream?

The liberalisation of the European energy market has advanced only slowly over the past eight years. Three months on from the latest directive deadline, Salman Wasti, Senior Utilities Analyst at Datamonitor, reviews how uncertainty over the EU constitution could create a new barrier to progress.

A central objective of the European Commission has been to secure the advantages associated with a large, efficient, and competitive single market for European citizens and businesses. However, the consummation of Europe's liberalised energy market remains as far away as ever. From the inception of the First Electricity Directive 96/92/EC in December 1996, and the following gas directive in 1998, the road to establishing a competitive energy market in each member state has been nothing if not tortuous. Even before the First Directive, a num-

ber of member states had started to implement the required internal legislation to establish a competitive energy market. The UK and Scandinavian governments both set guidelines for their markets to ensure a fair and open structure, even though they had adopted different market models.

However, other governments and industry players read the Directive differently. In Germany, the market was technically opened in 1998 but, given the lack of a designated regulator, many participants and observers believe the country has yet to see a fair and open market. In France meanwhile, the government was typically intransigent. It only signed up to the Directive at the last minute, and even then Paris was vague on its date for full market opening.

Towards the Second Directive

Since then, the energy liberalisation bandwagon has been gathering momentum. The European Commission, supported by the UK and the Netherlands, has coerced France into agreeing to open its market earlier, and Germany to appoint an official regulator. These objectives are all contained within the extended framework of the Second Directive, Directive 2003/54/EC and Directive 2003/55/EC, adopted by the Council and Parliament in June 2003.

The Second Directive states that:

- network operators have to be separated effectively from the parts of the gas and electricity activities where competition is possible, mainly production and supply;
- all Member States have to appoint an independent regulator to prevent any discrimination; and
- Member States have to impose public service obligations, including security and regularity of supply, quality and price of supplies and environmental protection.

The law establishes a framework for a competitive energy market that has in principle allowed Europe's commercial consumers to choose their energy supplier, from 1 July, 2004.

However, by that date, only the Netherlands and Slovenia of the 25 EU member states had fully complied with the Second Directive, passing national legislation set out by the Directive and informing the European Commission. A number of other member states, including the UK, Denmark, Hungary and Lithuania, were close to complying, having transposed most of the provisions into national law. The remaining member states are legally bound to enact the Second Directive and the likelihood is that most will comply by 2005.

Yet going forward, a bigger question remains: to what extent will they comply with the Second Directive in opening their markets for households by 1 July 2007?

Compliance is likely to be patchy for three reasons:

- the protracted struggle between incumbent energy companies and the national government ministry or regulator to gain agreement on the exact nature of regulation;
- national governments' own priorities in setting energy regulation and energy policy; and
- the potential for a eurosceptic backlash in a number of member states.

The regulatory battleground

Across all Europe's markets, whether open or not, the incumbent energy companies have looked to retain a preferential status. They have tried to provide data and supporting evidence to retain higher margins over price, network charges and generation costs. However, the common rules for an open energy market require governments to act in creating a fair and open marketplace.

In this respect it is often propounded that some states have acted more in the spirit of reform than others. For example, compare the UK Government to its German counterpart: one has adopted a forceful regulator while the other has still to appoint a regulator at all.

In addition, each national government has its own priorities and industries to support. This will influence the level of government backing for any particular industry. The level of political support a national energy industry receives can be gauged from the size of funding and the level of staffing provided to the national regulator or government ministry. For example, the UK independent regulator, Ofgem, has a budget of €54 million: three times the size of the member state with the next largest regulatory budget, Italy.

Pan-European market liberalisation is only workable for those politicians that see it as being intrinsically linked with national interests. Differing views on national self-interest are likely to re-emerge as a major influence on policy. Indeed, in France this issue has always been close to the surface, with Paris's drive to comply with the Second Directive (including partial privatisation of EdF and GdF) prompting significant controversy, especially among incensed trade unions.

The French case could prove to be a watershed in determining whether other member states, especially those recently joined, make a stand to protect their energy interests, going against compliance with the directive. A large proportion of the 10 new member states have a high number of coal and oil power plants. With ancillary EU regulation such as the large combustion plants directive, sulphur and carbon emissions quotas, these states may feel the price of compliance with the directive and other EU regulations is simply too high.

Contact Datamonitor
www.datamonitor.com

Saving energy with compressed air

By Geoff Taylor,
Managing Director of
BOGE Compressors Ltd

Much has been written about the lifetime power costs in conjunction with the overall lifetime compressor costs (nominally a 10 year period). Since the advent of the rotary screw compressor package it has been widely accepted that as much as 80% of the input power could be recovered in the form of heat. Often this heat could be utilised in the simplest way, by ducting air to supplement space heating costs in the workplace or warehouse space adjacent to the compressor house.

A more controllable utilisation of recovering the input energy has been by installing a heat exchanger system whereby preheated water is used to reduce the energy costs in a boiler room or in a central heating system. The simple truth is that industry, as a whole, has never bought into this concept.

Power to generate compressed air consumes as much as 10% of the electrical energy supplied to industry. Compressed air leakage – one form of energy wastage – alone accounts for up to 30% of this figure. Such facts coupled with the Climate Change Levy have bought fresh impetus to ensure that the power used to generate compressed air is optimised.

One area conceived by the Government at the outset was the ECA – Enhanced Capital Allowance scheme. This encouraged manufacturers to utilise EFF1 (high efficiency) motors as well as to develop new technology in the form of frequency controlled compressors and compressor control systems.

The ECA scheme provides an incentive for the end user to purchase this type of



Avelair Compressors has switched to the new Unidrive SP, from Control Techniques, for its variable-speed range, designed to save energy. "The choice of Unidrive SP, with its integral PLC, has enabled us to offer a more compact, more efficient and more price-competitive product," says Managing Director, Brian Wood, "and the user is assured of optimum efficiency at all times, with the compressor constantly matching output to demand."

The Avelair range of VSD compressors can operate as stand-alone units or work in conjunction with fixed-speed units that provide the base-load required, with the variable speed unit providing additional air as demand requires. "This saves energy in two ways," explains Brian Wood. "Firstly, obviously the air system only provides as much air as is required. But, with fixed speed systems, the air pressure is usually set just above the required pressure – for example if 8-Bar is needed, the compressors are set to provide 9-Bar – to give a margin. With a system that includes a VSD compressor, the pressures would be set at 8-Bar – a further reduction of waste energy across the system."

technology. The end user can claim 100% first year capital allowance on investments (depending on compressor size) providing significant corporation tax benefits.

The same applies with inverter controlled compressors. Not only can the end user benefit from an ECA but also in terms of lifetime power cost savings. This type of technology ensures that compressor pressure and volume is optimised at all times, which reduces the energy used and in turn dramatically reduces the lifetime power costs.

Virtually all manufacturers now provide sophisticated compressor controllers to manage each compressor as efficiently as possible. Technology has again moved on and multiple compressor installations can now be supervised by non-intrusive management systems that optimise both volume and pressure whilst utilising the most efficient combination of compressors at all times. Such systems not only reduce pressure to the minimum whilst maintaining the required flow, but also graphically identify areas of misuse and wastage.

For bigger air users with multiple compressor installations energy management is now a prerequisite. Employing an

energy management system is without doubt the biggest tangible method of reducing energy usage on a site.

History has demonstrated that there is a great deal of apathy and complacency when it comes to utilising energy in compressed air efficiently. The packaged concept of the industrial rotary compressor always provided plant managers with the ideal opportunity to save energy right from the outset. For more than 30 years few compressor users have ever had energy savings on their agenda. Today, however, energy saving is on everyone's agenda. To stay competitive, increase shareholder value and maximise profit, many boards now recognise the benefits of tackling the energy usage issue.

Industry has recently taken one significant hike in the cost of power and undoubtedly most users will know that further increases are imminent. There has never been a better time to investigate the potential energy savings in relation to compressed air.

Contact BOGE Compressors
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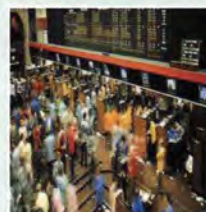
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