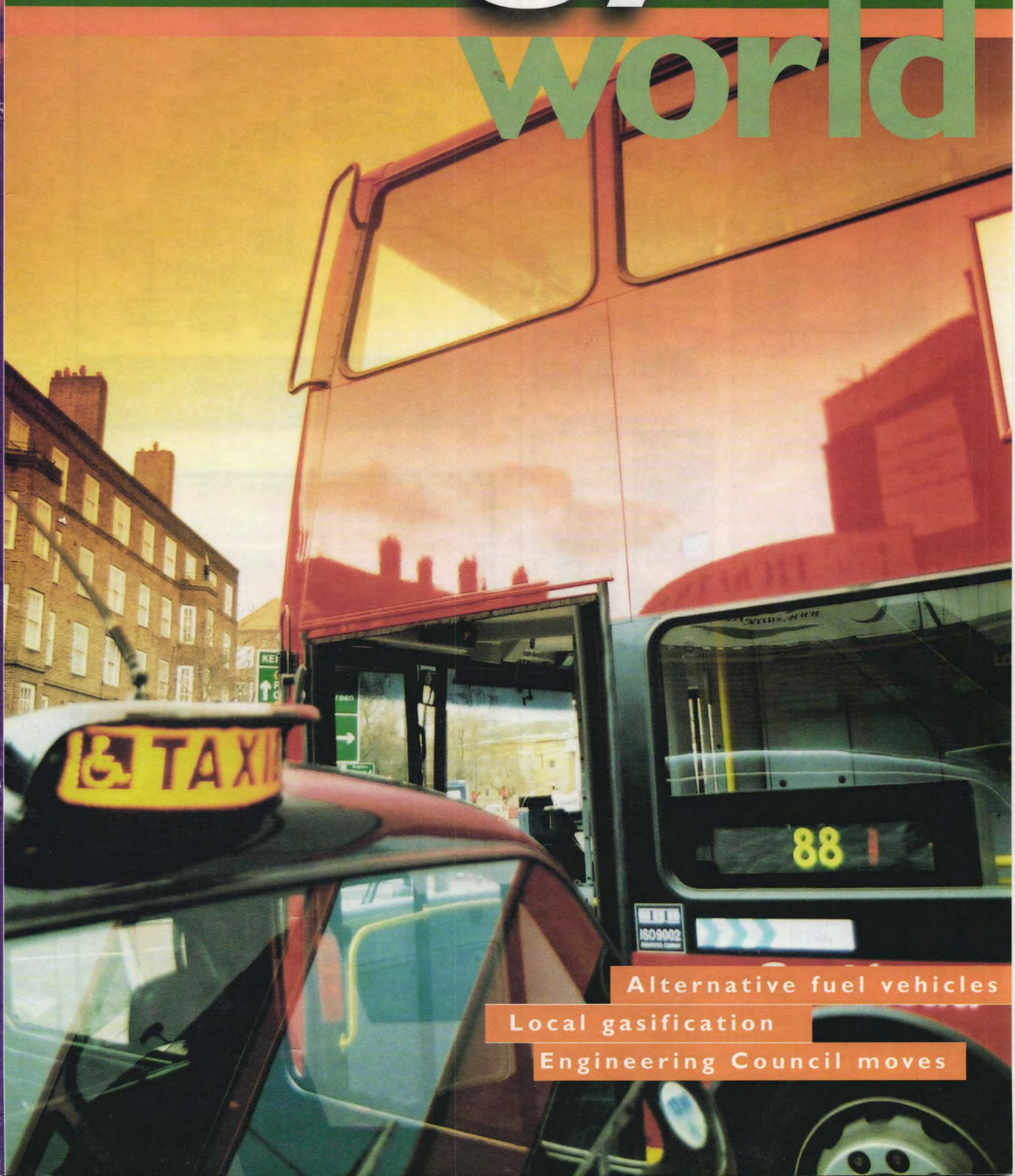
THE MAGAZINE OF THE INSTITUTE OF ENERGY

energy world

the institute of energy

No.288 April 2001

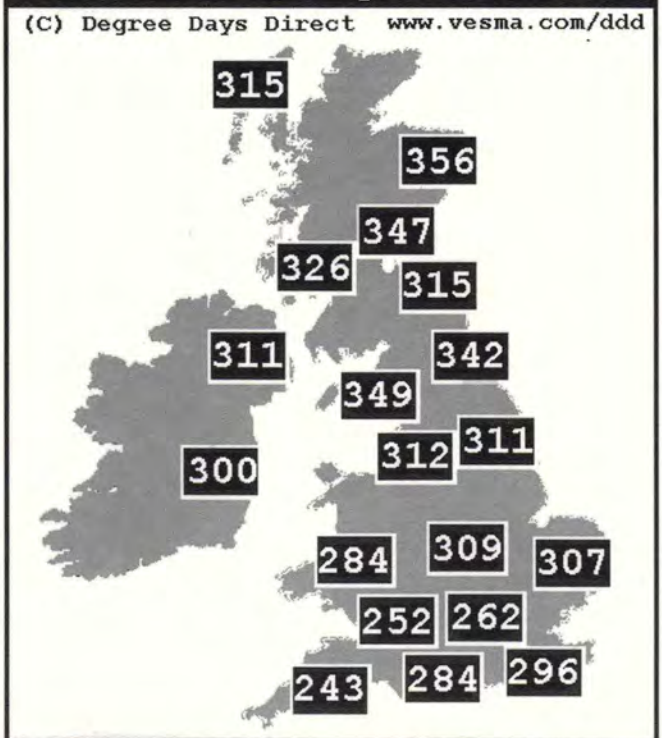


Alternative fuel vehicles

Local gasification

Engineering Council moves

Degree Day Figures February 2001



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LATEST NEWS

The 2001 Melchett Lecture will be given by John Brown, Group Chief Executive of BP Amoco plc. The event is provisionally booked for the evening of the 5th July at a London venue.

For more information contact *events@instenergy.org.uk*

Thank you to everyone who took time to return questionnaires issued in the February 2001 edition of *Energy World*.

The winner was Ms Janine Michael from the Centre for Sustainable Energy, who won a place at the 'Future of Utilities' conference to be held in London.

UK Emissions Trading Scheme: The Official Guide for UK Businesses

An unrivalled opportunity for businesses to learn how to get involved.

Monday 23rd April 2001

9.00am -12.45pm followed by lunch

Venue: Royal Institute of British Architects, 66 Portland Place, London.

Emissions Trading is being predicted as a crucial mechanism to assist UK businesses to achieve their Climate Change commitments, whether as part of a Negotiated Agreement or through voluntary participation in the new UK Scheme. The rules will be published in April and this event is designed to assist business to interpret and understand them to allow full and early participation in UK Emissions Trading. Whether your incentive is revenue generation or identifying cost-effective ways to achieve your CO2 obligations, this is a key event for your diary.

The Institute of Energy, in conjunction with the UK Emissions Trading Group, is providing you with the opportunity to find out exactly how the scheme will work. Together with how your organisation can trade, clearly and concisely, based on the facts. The benefits of participating will also be clearly presented at this half-day event. If you wish to know more about the scheme, are responsible for your organisations potential participation, or you may wish to trade on behalf of others, this event will tell you how to get involved.'

PROGRAMME

9.00-9.25	Registration & Coffee	
9.25-9.30	Welcome Chair: President of The Institute of Energy	**Brian Chamberlain CEng FInstE**
9.30-9.45	Opening Address	**Michael Meacher MP**, Minister for the Environment (invited)
9.45-10.15	How the UK's Emissions Trading Scheme will work	**Margaret Mogford**, Chairperson, UK Emissions, Trading Group
10.15-10.45	The Benefits of Trading	**Nick Hughes**, Manager, Emissions Trading Scheme, BP Amoco
11.00-11.30	How monitoring, reporting and verification will operate	**Gareth Phillips**, Senior Project Officer, SGS
11.30-12.00	The Incentive Pogramme and the business case for Volunteering	**Bridget Rosewall**, Volterra
12.00-12.30	Round Table Discussion and your questions answered.	

Close with buffet lunch.

Organised by:

the institute of energy

In partnership with
The Emissions Trading Group

To register, please complete the form overleaf and return to:

Suzanne Cooper, The Institute of Energy, 18 Devonshire Street, London, W1G 7AU.
Tel: 020 7580 0077 Fax: 020 7580 4420 email: events@instenergy.org.uk

Registration Form

Please return your completed form with payment to The Events Officer.
The Institute of Energy, 18 Devonshire Street, London, W1G 1AG. Fax: 020 7580 4420

Title | Name | Surname

Organisation | Job Title

Address

Post Code

Telephone | Email

Where did you here about this conference?

Energy World ☐ Website (Please specify) _____

Colleague ☐ Other (please specify) _____

Flyer in post ☐

Payment

Category	Price	Number of Tickets	Total
Member of the Institute of Energy	£95		
Non-Member of the Institute of Energy	£125		

I enclose a cheque/credit cards payment payable to the **'INSTITUTE OF ENERGY'** or Please invoice me for the sum of £ | Please send me a receipt (tick) ☐

Credit card payment (tick) Amex ☐ Visa ☐ Mastercard ☐ Dinner Club ☐ Switch ☐

Cardholders Name | Card expiry date

Card Number | Card Issue No.

Signed | Cardholder address

Date

Cancellations received in writing before 14th April 2000 will be subject to a 25% administration charge of the total remittance. No refunds will be made for cancellations received after this date, or for non-attendance. However, we are happy to make substitutions at any time before the event.. **Confirmation of Booking**: We are not able to confirm any bookings until payment has been received. **Terms & Conditions**: The Institute of Energy reserves the right to alter the programme without prior notice.

THE MAGAZINE OF THE INSTITUTE OF ENERGY

Contents

PUBLISHED BY
THE INSTITUTE OF ENERGY
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X-Design
Tel: 020 8874 3774 Web: www.xdesign.co.uk

ADVERTISEMENT SALES
Kirtsy Coles

PRINTED BY
Headley Brothers Ltd, The Invicta Press, Ashford, Kent

ISSN 0307-7942

Energy World is printed on wood-free, chlorine free pulp

COVER

Buses and taxis in London – over 25% of carbon dioxide emissions come from the transport sector, along with a host of other pollutants. But there are alternatives to petrol and diesel and this month's issue takes a careful look at them – from their economic and environmental performance to how they are promoted.

(Picture courtesy of the Energy Saving Trust)

The Carbon Trust
– one of the tools to fight climate change

Phillip Ward, Director of Energy, Environment and Waste at the DETR

One bit of good news about climate change was last month's launch the Carbon Trust.

The new Trust has a central role in moving the UK to a much lower carbon economy. The launch by John Prescott and Ian McAllister – the Trust's first Chairman - had support from all parts of Government, the Scottish Executive and the Welsh and Northern Irish Assemblies, a wide range of businesses and other groups active in climate change issues.

The original idea for a Carbon Trust came from the Advisory Committee on Business and the Environment. The Prime Minister, at his Climate Change seminar in February last year asked ACBE to work up their proposals and the exercise has been driven by them in close partnership with my Directorate in the Department. Easily one of the most interesting exercises I have done in 27 years in the civil service.

Building on best practice

The Trust will have funding from the Climate Change Levy and advise the Government on the use of enhanced capital allowances. Its strong foundation will be the Energy Efficiency Best Practice Programme which will transfer to it. This well respected programme has already stimulated savings worth £800 million per annum for business and public sector, and savings of about 4.5 million tonnes of carbon being released into the atmosphere each year.

This powerful combination will mean that the new Trust will have in one place money to invest in research and development and to fund demonstration schemes, to spread new technologies through best practice and a strong input into tax breaks to incentivise investment in new technologies.

But as a private company it will have the freedoms and flexibility to innovate, develop new business partnerships and bring in new finance. It will be able to hunt out promising new technologies and support their deployment.

Perhaps as important as the money will be the fact that the Trust will bring together a dedicated and expert team with a clear mission to make a difference. It will be set up with good networks into the research councils, the professional institutions and of course Government departments and business leaders. It intends to collocate with the well established Energy Saving Trust and ensure a continuity of coverage from larger industry and commerce, through to small (micro) businesses and the domestic sector.

Negotiated agreements

The launch of the Trust comes as we have concluded the mammoth task of signing negotiated energy efficiency agreements with 42 business sectors. These agreements will give the companies involved an 80% discount from the Climate Change Levy in exchange for commitments to improve energy efficiency. Altogether we can say these agreements will reduce carbon emissions by more than 2.5 million tonnes. Altogether around 10,000 businesses now have commitments to save energy, including a baseline commitment to appoint an energy manager and have an energy plan. Just signing all those documents has been a challenge!

We have also published our list of energy efficient technologies which will attract 100% first year capital allowances. More than 1200 products across the main energy using equipment ranges will, from this month, attract the allowances. And that should interest finance directors in energy efficiency – a subject many of them had long stopped thinking about. The surprise to me was not so much the number of eligible high efficiency products but the number of inefficient ones which are still on the market, and being bought, when better alternatives are available. The Carbon Trust must make a difference to that.

Also coming into play are the arrangements for carbon trading. Many people see this as the key innovation in the long run. Providing a market incentive to reduce emissions and setting a price on carbon savings should drive new investment and innovation.

Energy managers are the key

But the vital ingredient in making all this work will be the energy managers. Good quality advice and expertise will be essential if opportunities are going to be taken. And there are not enough of you around. I am pleased that we are able to work with the Institute to start to look at the availability of skills and I hope we can develop this collaboration, probably through the Carbon Trust to look at the training and recruitment issues. Energy managers – as opposed to energy buyers – are due a day in the sun!

Let's not forget that all this activity is about meeting the challenge – first of reducing carbon dioxide emissions by 20% by 2010 and then beyond that to respond to the challenge set by the Royal Commission on Environmental Pollution to reduce by 60% by 2050.

With these new instruments we are assembling the tools we will need.

On a personal note I am delighted to write this as a Fellow of the Institute. It was a real delight to be invited by the Council to become a Fellow and I shall add FInstE to my business card with pride. I'm even looking forward to the CPD!

Climate negotiations to resume in July; US to go back to basics

The international climate change negotiations suspended in November last year after countries could not resolve key issues surrounding implementation of the Kyoto Protocol (see *Energy World* January 2001), will resume in Bonn, Germany in mid-July.

Key issues still unresolved include a financial and technology package to help developing countries contribute to global action on climate change, rules for counting certain emissions reductions and a compliance regime.

"I am confident that these new dates will give governments the time they need to prepare themselves for the decisions that must be taken," said Dutch Environment Minister Jan Pronk, who chaired the UN climate change summit at The Hague in November.

Indeed environment ministers from the G8 countries reaffirmed their desire to reach agreement in Bonn at a meeting in Trieste, Italy in March. But the new US administration, under president George W Bush, has said that it is undertaking a full review of US climate change policy and would not be bound by positions taking by the US in The Hague last November. Head of the US Environmental Protection Agency Christine Todd Whitman stressed that the new administration is committed to addressing global environmental issues, but that the US government felt no obligation to return to the compromise that was nearly agreed in November.

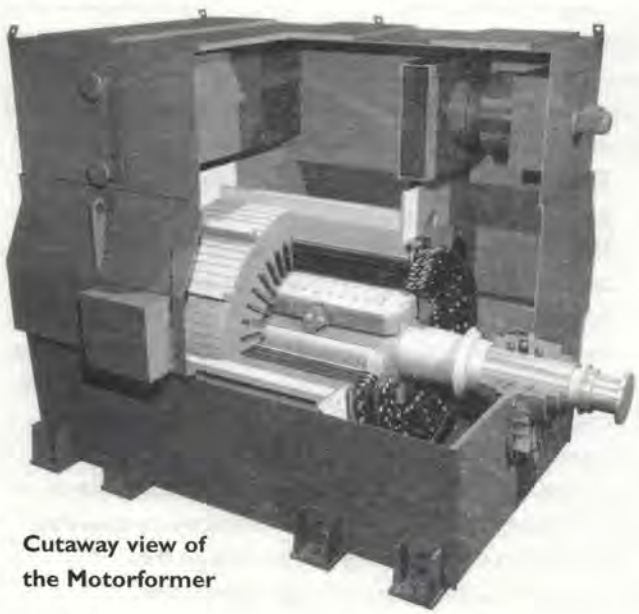
Nevertheless, the G8 environment ministers committed themselves: "to strive to reach agreement on outstanding political issues and to ensure in a cost-effective manner the environmental integrity of the Kyoto Protocol," according to a joint statement which continued: "A successful outcome at [Bonn] is necessary to allow early entry into force of the Kyoto Protocol. For most countries this means no later than 2002."

High voltage motor cuts energy losses

ABB has developed what it calls the world's first high voltage motor, the Motorformer, which can cut energy losses by 25%, according to the company. The first motor, a 40 kW unit, will be installed this autumn at the Stenungsund plant of AGA Gas AB on Sweden's west coast to drive a compressor used in the production of industrial gases.

The device is a synchronous motor based on the innovative cable technology launched three years ago in ABB's high voltage generator, Powerformer. Protected by 200 patents, the new technology enables ABB to omit a number of components normally found in conventional plants with electric motors, including oil-filled transformers. The new motor can be designed for voltages up to 150 kV but will be offered in an output range of 5-45 MW and for voltages up to 66 kV initially.

The new motor can also generate reactive power and can thus have a positive impact on the distribution network. The Motorformer machine to be installed at Stenungsund will supply reactive power (7 Mvar) directly to supplier Vattenfall's distribution network.



Cutaway view of the Motorformer

New composite stainless steel and carbon water tubes from Sandvik Steel have been installed in a new boiler at the Renova municipal waste incineration plant in Gothenburg, Sweden. The new tubes replaced carbon steel tubes normally used in waste incineration boilers. The new composite tubes comprise a stainless steel outer and a carbon tube inner, will repay their higher capital costs through improved resistance to corrosion, says Sandvik. The new boiler will incinerate 15 tonnes of waste per hour, with the energy released being used for electricity generation and local district heating. Renova's three boilers in Gothenburg generate enough electricity to supply 60,000 households, and enough heat to supply 100,000 homes.

Progress on renewables 'not enough to match rise in total consumption'

The EU will not achieve its target to double the contribution of renewable energy to 12% of total consumption by 2010 if increases in gross energy consumption are not reined in by improvements to energy efficiency and demand management. This is the main conclusion of the first bi-annual communication from the European Commission to the Council on progress being made towards the target.

National and Community support mechanisms have succeeded in increasing the output from renewables by a third in the last decade, and slightly increasing the share of renewables in Europe's energy supplies in recent years. However, the latter trend is likely to be swamped by future rises in total energy consumption.

The communication highlights two trends in European renewables; the "undeniable take-off of wind energy" and the higher than average expansion rates achieved by countries with proactive renewables policies.

However, it is "far from sure", says the communication, that the target of a 12% renewables contribution will be achieved in 2010. In particular, "this objective will never be achieved if the gross energy consumption continues to increase in line with current trends".

Energy production from renewable sources in the EU

	1989	1996	1997	1998	Increase 1989-1998 %
Wind	46	417	631	1,037	2,154
Solar	146	294	318	347	138
Hydro	21,900	24,800	25,500	26,300	20
Geothermal	2,215	2,747	2,815	2,992	35
Biomass	40,000	47,800	52,600	54,200	36
Total renewables primary energy production (ktoe)	64,200	76,100	81,800	84,800	32
Total renewables electricity generation (GWh)	273,000	321,000	335,000	353,000	29

Californian winery avoids power crisis

One Californian business, a winery based in Mendocino County, is riding out the energy market storms being felt in the state (see *Energy World* March 2001) through a combination of ambitious energy conservation programmes, its own photovoltaic solar panels, and a policy to buy 100% renewable energy.

While many of California's businesses have struggled to lessen the impact of an out-of-control energy market and skyrocketing costs, Fetzer Vineyards has led moves towards sustainable business practices for the past decade and is now reaping the rewards. The company produces over three million cases of wine each year.

"Our contract for 100% renewable energy continues as usual with Enron Energy Services, so our costs are stable for the green energy we are purchasing," explained Patrick Healy, Environmental Manager at Fetzer. "And we have more conservation programmes coming on-line in 2001 that will result in dramatic usage reductions this year in spite of plans to increase production."

Fetzer also reaps the energy benefit of 90 photovoltaic panels installed on the company's rammed earth administration building, which have generated 56,000 kWh of electricity in the past year, running at 98% efficiency. The electricity generated by the panels fully powered the administration building in 2000.

- The largest rooftop solar power system in the US, a 500 kW system, is currently being installed by the PowerLight Corporation on the roof of the Santa Rita Jail in Dublin, California. A combination of the solar power generation and an upgrade to the jail's air conditioning system is expected to cut total energy costs by $190,000 a year.

Bulgarian n-plants to be upgraded

Two units of the Bulgarian nuclear power plant at Kozloduy are to be comprehensively modernised by the 'European Consortium Kozloduy' (ECK), comprised of Framatome ANP and the Russian company Atomenergoexport, under a contract worth €250 million.

The plant belongs to the state-owned company Kozloduy Nuclear Power Plant (KNPP). Units 5 and 6 belong to the third generation of Russian pressurised water reactors (VVER-1000) and have a power rating of 1000 MW each. The Kozloduy nuclear power plant has been providing more than 40% of the electric power generation in Bulgaria for many years.

The modernisation programme will allow the two units to attain an international safety level and a significantly higher availability, according to Framatome. Modernisation will focus on improvement of long-term cooling of the reactor, radiation and fire protection, instrumentation & control and emergency power supply, and on enhancement of plant operating reliability and availability. Implementation is planned during the annual outages from 2002 to 2005.

The programme is in line with IAEA recommendations for upgrading the safety of Russian design VVER-1000 reactors and is important to allow Bulgaria to qualify for accession to the European Union.

Funding boost for renewables – UK to establish solar roofs programme

The UK's renewable energy industry is to benefit from the injection of a series of policy and funding initiatives from the Government, including a government intention to establish a large-scale solar roofs programme.

The latest announcement, in March, was of £50 million from the National Lottery to support green energy. The money will provide support to the tune of £33 million for new plants to burn energy crops, £10 million of capital grants for offshore wind projects, £3 million for small scale biomass heating and combined heat and power (CHP) schemes.

In total, Government support for renewables has been boosted to over £250 million over the next three years. In addition to the National Lottery support there have also been announcements of:

- £55.5 million from the DTI for renewable energy research and development,
- £39 million from the DTI for support for offshore wind – announced by the Prime Minister last October,
- £100 million for green energy announced by the Prime Minister in his March green speech (see page 7),
- £12 million in grants from MAFF for planting energy crops

The Government also recently announced that it will establish the UK as a credible player in the solar energy market, alongside Germany and Japan. It will particularly concentrate on social housing refurbishment where photovoltaic energy devices can help alleviate fuel poverty.

Energy minister Peter Hain said: "This money emphasises the Government's commitment to bringing green energy into the mainstream. The Government is doing everything it can to help industry meet our target of supplying 10% of our electricity from renewable sources by 2010. With the introduction of the Renewables Obligation, the Government will be establishing an assured market for renewables for the next 25 years".

Ford chairman to head Carbon Trust

Ian McAllister, chairman and managing director of the Ford Motor Company Limited, has accepted an invitation to be the first chairman of the new Carbon Trust. Mr McAllister will be supported by a deputy chairman, Ian Stephenson, Environment Director of Johnson Matthey plc. Mr. Stephenson led the team that designed the Carbon Trust.

Mr McAllister has demonstrated his commitment to low carbon issues by his work on the Cleaner Vehicle task Force and on the Advisory Committee on Business and the Environment, according to the DTI.

A major element of the UK's climate change programme, the Carbon Trust will recycle around £130 million of Climate Change Levy receipts, says the DETR, by developing a range of programmes to promote low carbon research and development and help business invest in energy efficient, low carbon technologies and practices.

Announcing his acceptance of the chairman post, Deputy Prime Minister John Prescott, pointed to Mr McAllister's qualifications: "He is one of the most influential businessmen in the UK today and Ford has one of the most innovative environmental programmes. Ford's commitment should be a wake-up call for UK business to take the threat of climate change seriously".

See also Viewpoint on p.2

Ford uses renewables – PV panels being installed at the company's Bridgend engine plant in 1998

Emissions trading to start in 2002

Chief executives of the FTSE 350 companies have been invited to consider taking part in the first wave of greenhouse gas emissions trading encouraged by the Government and co-ordinated by the UK Emissions Trading Group. Early joiners, who take binding targets on their emissions from calendar year 2002, will receive 'economic incentives' totalling £30 million.

Details of the scheme are due to be announced later this month and the first 'compliance' period should begin in January next year.

Joining the scheme sends a strong corporate message about a company's commitment to the protection of the environment, says the Group. Companies joining the scheme from the start will "gain early mover advantage ahead of the likelihood of increasingly stringent targets in the fight against global warming".

Participating companies will, explains the leaflet:

- choose to take on a binding emissions cap either on carbon dioxide or the six greenhouse gases,
- be allocated emission allowances equal to their annual cap,
- trade all or part of their obligation – without any loss of environmental benefits of the scheme as a whole.

Contact the Emissions Trading Group on tel: 020 7245 8035, e-mail: etgsecretariat@bciplc.com

Sixteen trade associations sign Levy agreements with the DETR

The UK Chemical Industries Association (CIA) has joined fifteen other energy intensive sector trade associations in signing up to formal targets for formal targets for cutting carbon emissions. The chemical sector agreement targets improvements in energy efficiency of 18% between 1998 and 2010, which will deliver savings of over 1 million tonnes of carbon by 2010, the largest single contribution, according to the CIA.

The agreement with the DETR qualifies participating companies for an 80% discount on Levy payments, but the cost of the Climate Change Levy to the chemical sector will still total some £20 million, according to the CIA.

Fifteen other sectors signed similar agreements with the DETR a fortnight previously. Sectors range from maltsters to the cement and steel industries (two of the biggest energy users), from motor manufacturers to mineral wool producers (see *Energy World* March 01 issue). The commitments represent cuts in carbon emissions of 600,000 tonnes of carbon per annum by 2010, says the DETR.

Part of the Government's Climate Change Programme, the Levy is a major element in a package of measures to encourage businesses to become more energy efficient. Business contributed nearly 30% to total UK emissions in 2000. Its role is vital in helping the UK achieve Kyoto targets to cut overall emissions by 12.5% on 1990 levels and carbon dioxide emissions by 20%. The Agreements are expected to save more than 2.5 million tonnes of carbon (MtC) out of a total of 5 MtC for the Climate Change Levy package as a whole, according to the DETR.

The sectors have agreed to targets to be achieved between now and 2010. The agreements have interim two year targets against which progress will be measured. Provided sectors meet each target, they will continue to be eligible for the discount in the rate of Levy.

Less positive notes were sounded by the UK Aluminium Federation, which said that much of the aluminium industry does not qualify for Levy discounts, despite being a major energy user.

Meanwhile the CBI contends that the Climate Change Levy is not the right tool to use for business energy use as it offers discounts only to companies which fall under the Integrated Pollution Prevention Control (IPPC) system.

British Energy turns to wind

Nuclear generator British Energy is to diversify into renewables. It has formed a joint venture company with Renewable Energy Systems Ltd to develop offshore wind power around the UK mainland coast. The new 50:50 joint venture company, Offshore Wind Power Limited, has already applied for its first project to the Crown Estate, which owns the seabed and will offer leases on sites for development.

The new company brings together one of Europe's leading wind energy developers, RES, which is also part of British construction company Sir Robert McAlpine Ltd; with the UK's largest power generator, British Energy, which supplies over 20% of the country's power from eight nuclear power stations and one coal-fired plant.

RES is the largest UK-based wind energy developer with over 1100 MW of capacity on its books at various stages of development in the USA, Europe, Asia and the Caribbean. Plans this year include construction of the world's largest wind farm in Texas, with a capacity of 280 MW.

Peter Hollins, British Energy's Chief Executive said that: "adding generation from wind energy to our nuclear portfolio means the company will continue to make an enormous contribution to the UK achieving and maintaining its climate change commitments."

The DTI anticipates that the offshore wind industry will generate 1.8% of the total UK electricity supply by 2010, although the longer-term potential is far greater.

An end to fuel poverty

The Government's long-awaited strategy to fight fuel poverty will take three million households out of risk by 2010, says the DETR. The new strategy is to include five regions around England becoming 'Warm Zones': Newham, Hull, Sandwell, Northumberland and Stockton are the five new warm zone pilot schemes which will ensure that action to tackle fuel poverty is co-ordinated on the ground.

Around three million households nationwide – 4.5 million people will benefit.

Locally the pilots will create partnerships between the local authority, energy companies, health authority, energy efficiency advice centre, local business and community and voluntary organisations to bring together existing and new fuel poverty programmes in an intensive three year period starting this month. The pilots will help those who cannot afford to heat their own homes and provide people with information about the schemes.

In each zone a core management team will create a comprehensive understanding of the fuel poverty agenda and provide the skills to identify fuel poor households and apply appropriate measures.

The number of fuel poor households has already fallen, from around 5.5 million in 1996 to around 4.5 million in 1999, says the DETR.

Both the regulator, Ofgem, and the National Right to Fuel Campaign welcomed the announcement, although the NRFC suggested that the strategy lacked new money for investment in improving domestic energy efficiency.

Blair outlines 'next steps' on climate change

Environmentalists gave a warm to welcome to a major speech on climate change and sustainable energy delivered by Prime Minister Tony Blair in March, although this was later balanced by criticism that Gordon Brown's subsequent budget failed to follow-up the themes of the speech.

Blair talked of his commitment to attending the 'Rio plus ten' international gathering to be held in South Africa next year, and gave a detailed account of the likely effects of climate change, both in the UK and abroad, as an explanation. He said he hoped that the Kyoto Protocol would be ratified by then.

But most interest centred on Blair's view of the UK government should be, and is, doing about climate change. He listed the Climate Change Levy package and the new Carbon Trust; the renewables obligation; the government's ten year transport plan; and the Home Energy Efficiency Scheme designed to cut domestic energy use.

He then moved on to the business opportunities offered by new, sustainable technologies which, said Blair: "are on the verge of becoming one of the next waves in the knowledge economy revolution".

Blair said: "I want Britain to be a leading player in this coming green industrial revolution. We have many strengths to draw on. Some of the best marine renewable resources in the world - offshore wind, wave energy and tidal power. A strong science base, supporting world-class research in biomass generators, micro technologies such as small wind and gas turbines, domestic CHP based on Stirling engines, fuel cells and other technologies for the storage of energy. We have led the way in integrating environmental and economic goals within a liberalised electricity market. And we are leading the thinking in Europe on how to remove the regulatory barriers to development of renewables."

"I believe the role of Government is to accelerate the development and take up of these new technologies until self-sustaining markets take over. The Government's programme for incentivising renewables will create a new market worth over £500 million through the Renewables Obligation, Climate Change Levy exemptions and the Non Fossil Fuel Obligation. We have already announced £100 million to support offshore wind and energy crops."

"Last year I asked the Performance and Innovation Unit to undertake a major study into the future of UK renewable energy. Today I can announce a further £100 million to support those technologies identified by the report. I know that a number of green groups have been campaigning for a target of 100,000 solar PV installations. This new money will help us to promote solar PV, give a boost to offshore wind, kick start energy crops, and bring on stream other new generation technologies. This investment in renewable technology is a major down-payment in our future, and will help open up huge commercial opportunities for Britain."

Environmentalists particularly praised Blair's strong stance on climate change and welcomed his "down-payment" to support renewable energy – particularly photovoltaics.

Shovelling woodchips into a gasifier/CHP unit in Nottinghamshire – a previous encounter with renewables for Prime Minister Tony Blair

Kensa Engineering has beaten off international competition to win an air conditioning industry Product Of The Year award for its GeoKitten geothermal heat pump system.

The GeoKitten extracts geothermal heat from the ground to heat buildings and provide domestic hot water. It reverses this process in summer, cooling buildings by removing excess heat and using it to warm up domestic hot water with 'free' energy before dispersing the excess heat back into the ground. It can also heat swimming pools. The device pumps heat energy in and out of the ground using a very small amount of off-peak electricity. Trials on a large house have shown running costs cut by over 80% compared to conventional gas boilers, according to Kensa.

Unlike wind energy, solar power or any ordinary air-sourced air conditioning, the GeoKitten needs no planning permission and cannot be seen outside the building. Similar in size to an oil or gas boiler, no regular servicing is ever required.

Clean fuels for road vehicles – alternatives on parade

by Neil Fricker, Avalon Services, and based on a presentation to the Midlands Branch of the Institute of Energy, given in February 2001

Interest in alternatives to petrol and diesel as road vehicle fuels is currently very high. North America, Europe, SE Asia and Japan remain heavily dependent on oil flows from the Middle East. Closer to home, last year's refinery blockades served to heighten public awareness of our critical dependence on the flow of oil products. At the same time, the UK and other national governments have entered into commitments to reduce emissions of carbon dioxide and other global warming gases under the Kyoto protocol. These commitments must be viewed against a forecast increase in use of road vehicles, coupled with the increased public awareness of the potential consequences of global warming brought about by this winter's severe flooding. Alternative road vehicle fuels are one of several options that may contribute to addressing these issues and public concerns. Alternative fuels are known to offer reductions in emissions of global warming gases as well as reducing dependence on Middle East oil. In many cases, they also offer advantages in terms of urban air quality, which, as will become clearer later, should not be overlooked. The claims made for alternative road vehicle fuels and the technologies that accompany them are often framed to highlight specific advantages of the alternative concerned compared to petrol or diesel. They rarely make comparisons between alternative fuels or deal with the downsides of switching fuel. This article seeks to make such comparisons and to draw out some pointers for those considering a switch to an alternative fuel as well as for those making policy.

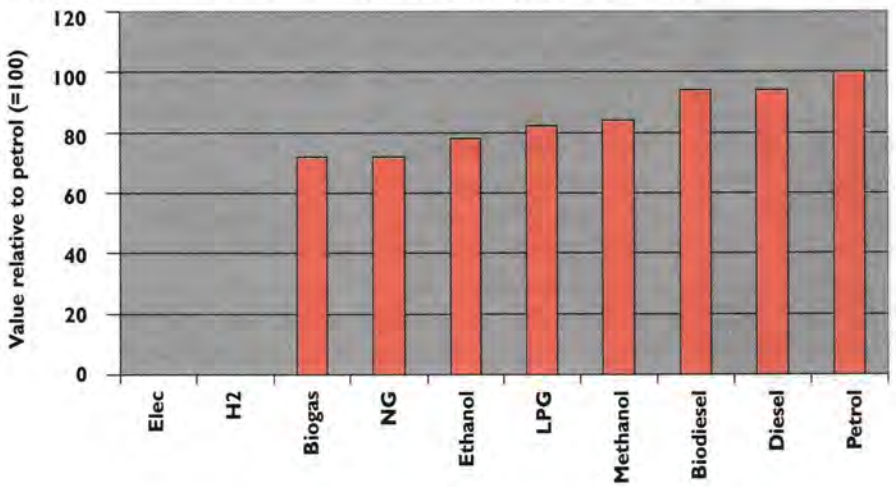
Most liquid or gaseous hydrogen/carbon materials can and do serve as fuels for road vehicles. The main groups are:

- other fossil fuels, such as natural gas, LNG (liquefied natural gas) or LPG (liquefied petroleum or propane gas),
- renewables and waste such as bio-diesel, bio-gas, landfill gas and the alcohols, and
- Derived fuels such as methanol, hydrogen and electricity.

As far as tail pipe emissions are concerned, vehicle manufacturers and vehicle conversion specialists will ensure that conventional road vehicles will meet all current and planned tail pipe emissions limits using petrol, diesel and all the alternatives listed above. While this, in itself, is not a complete solution to the environmental impact of regulated tail-pipe species, it allows us to focus initially in this article on the global warming characteristics of such fuels. This is especially important because carbon dioxide, the main greenhouse gas, is not a regulated tail pipe emission.

A number of alternative fuels are compared in terms of relative (petrol = 100) carbon content per unit of energy content in Figure 1. Moving from liquid fuels through gaseous fuels towards hydrogen and electricity results in a steady reduction in carbon content per unit of energy. In fact, electricity and hydrogen, containing no carbon, appear to be the ideal fuels. They also serve to draw attention to the fact that the carbon emitted to produce and deliver the fuels must be included in order to make meaningful comparisons, the so-called 'well to wheel' or 'fuel-cycle' analysis.

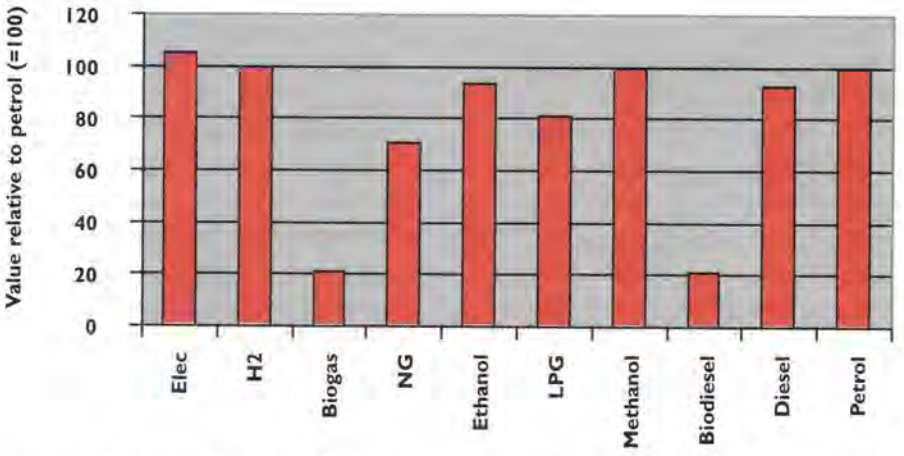
Figure 1 Relative carbon content of road vehicle fuels as carried on the vehicle



The effect of including all the upstream activities is shown in Figure 2. It produces a major change in our view of the fuels, particularly of the 'zero' carbon fuels hydrogen and electricity. The fuel-cycle carbon content of these fuels can take a range of values higher or lower than those indicated in Figure 2, depending on the assumptions made about production efficiencies and the choice of fuel (nuclear, natural gas, oil, coal or renewables) used to create them. It must be stressed that the carbon content for these fuels shown in Figure 2 does not represent current UK generating mix (electricity) or best practice (hydrogen production). Rather, they have been chosen to illustrate just how important it is to know these details when making comparisons between fuels.

From Figure 2, LPG, natural gas and in particular the biofuels emerge as the most attractive options to deliver carbon

Figure 2 'Well to wheel' carbon content of road vehicle fuels



emissions reduction from fuel substitution.

One further step is needed to complete the picture as far as carbon emissions are concerned, namely efficiency in use, which may vary between the different fuels. Although there is now much information available on fuel consumption, road vehicle fuel is sold and taxed on a liquid litres or gallons basis. Fuel consumption is therefore almost universally expressed in litres/100 km (miles per gallon). Calorific value is neither declared nor used in the road fuels industry. Comparisons are therefore difficult for the non-energy literate, since the amount of energy in a litre of fuel varies from fuel to fuel. In the following section, the technologies deployed to use the various alternative fuels are considered, including their implications for efficiency, before returning to the question of carbon emissions.

Technologies needed

Fortunately for us, many of the alternative fuels considered above may be used directly in conventional spark ignition or diesel engines. Thus, by and large, most alternatively fuelled vehicles will look and behave like their petrol or diesel equivalents. Only electricity needs a completely different drive train technology. Hydrogen also offers an option currently unavailable with any other fuel, namely direct use in a fuel cell.

Liquid fuel alternatives, such as biodiesel and methanol will be burned in conventional diesel engines and spark ignition engines respectively. They may be burned neat, or, in the case of methanol, as a mixture with petrol, thereby allowing the alternative fuel to be used on a largely unmodified vehicle. Vehicle performance and fuel economy (on a thermal basis) will not be greatly affected. Tail pipe emissions will change and have to be determined on each fuel or fuel blend used.

Natural gas, biogas, landfill gas, LPG and hydrogen may all be burned in a conventional spark ignition engine vehicle with the addition of appropriate fuel storage and fuel injection systems. Such systems may be retrofitted to existing vehicles (after market conversion) or supplied ex-works (OEM vehicles) or ex-dealer with a full dealer warranty. They may also operate in a dedicated (alternative fuel only) or bi-fuel configuration (both fuels are carried, with the engine running on one or the other, depending on availability). Bi-fuel operation is particularly useful when refuelling infrastructures for alternative fuels are in their infancy.

Relatively minor, but none the less important changes to settings such as spark timing and air/fuel ratio are required when operating conventional engines on gaseous fuels. In a modern stoichiometric engine employing a three-way catalyst, these parameters are set in the engine management system (EMS) after a careful programme of calibration to achieve the desired tail-pipe emissions and performance. It is a relatively easy matter to replace petrol by any of the gaseous fuels listed above. In order, however, to match petrol in emissions and performance, the use of a computer based engine management system calibrated for each fuel is essential.

Broadly speaking, in an unmodified spark ignition engine with a well-calibrated EMS, the fuel consumption (measured on a thermal basis, not litres of fuel) will be the same for petrol and all the alternatives. Where engine modifications are possible (usually only economic for OEM vehicles), fuel consumption may be reduced with natural gas by increasing the engine's compression ratio to exploit the very high octane rating of methane – the main constituent of natural gas.

On the contrary, all gaseous fuels, including LPG when fully vaporised before entry to the engine, will show a small reduction in maximum power output from an unmodified engine when compared to petrol. This is mainly due to the volume occupied by the fuel in the engine during the intake stroke, which reduces the amount of air the engine can aspire, and hence limits the amount of fuel it can burn. In a well-converted vehicle, this loss of peak power should be 10% or less. In fact the power density (kW/litre) of a gas engine is somewhere between that of a spark ignition petrol engine and a diesel engine. On a well-converted engine, this loss of performance is often tolerable. On an OEM supplied vehicle, it is usually compensated by a small increase in engine capacity.

It is important to stress that this loss in power output is not a sign of reduced engine efficiency. For the purposes of assessing the fuel consumption of gas engines in this article, it is therefore assumed that engine efficiency is unchanged when operating an unmodified engine on gaseous fuels. As with the liquid alternatives, there will be effects (often beneficial) on other emissions, and these must be measured for each fuel on each vehicle/engine type.

Gaseous fuels may also be burned on dual fuel compression ignition (diesel) engines. Ignition is assured by injecting about 10% of the maximum fuel requirement as diesel. Unfortunately, on many dual-fuel systems, the diesel rate does not reduce in proportion to the gas rate, so that at part load and idle, much smaller proportions of diesel are replaced. This reduces the amount of diesel displaced and the environmental benefits. Engine thermal efficiencies are broadly unchanged.

In an electric vehicle, the wheels are driven by a high-efficiency electric motor powered by batteries. Electric vehicles are

therefore an entirely stand alone technology in production and use. This, together with the limitations of battery technology, tends to make them expensive to produce and own. Energy consumption is expressed in kW hours per km or pence/km, and is usually considerably lower than an equivalent petrol or gas vehicle. As was shown above, however, it is essential to take account of the electricity production when making comparisons with other alternatives, as has been done below. A further complication for electric vehicles is the need to consume precious battery energy to run ancillaries as well as heaters or air conditioning whenever required. This is difficult to take account of in citing energy consumption and range of such vehicles.

There are no tail pipe emissions from electric vehicles. They are thus regarded as zero emission vehicles in an urban environment. Nevertheless, as will be shown below, the emissions from upstream generation processes must be considered in assessing the total impact of electric vehicles even in an urban situation.

Hybrid vehicles were first introduced as a range extender for electric vehicles. A small on board generator, usually driven by a conventional engine, is used to continually recharge the battery, which continues to drive the wheels, so called 'series' operation. The hybrid concept has evolved towards a 'parallel' configuration, in which both the engine and the battery drives the wheels. This allows a conventional engine to operate under steadier load/speed conditions with considerable benefits in efficiency and reduced emissions. Peak power, and in some cases urban operation, is provided by the battery. The battery is recharged from the engine during cruising, and may also re-absorb part of the vehicles kinetic energy during braking. The overall results are fuel consumption figures approaching 70 mpg on small passenger vehicles, with corresponding reductions in carbon and other emissions.

Fuel cell vehicles are a particular example of a hybrid vehicle where a fuel cell is used to drive the electric motor and to charge the battery. The battery in turn provides peak power and start up power. Although not the most efficient from an energy conversion standpoint, low temperature proton exchange membrane (PEM) or alkaline fuel cells are the preferred option for vehicle applications. This is due for example to their ability to start up from cold in seconds/minutes rather than hours. On the downside, such fuel cells operate only on hydrogen, and require a fairly pure form of hydrogen to avoid poisoning the catalytic cell materials.

Fuel cell technology has already achieved much, with current development bus engines from Ballard already fitting into the space of a conventional diesel unit. Such buses are on trial in Vancouver and Chicago. A number of co-operative projects and businesses ventures are underway with major vehicle OEMs such as Ford and DaimlerChrysler. Nevertheless, cost of commercially available fuel cells remains very high at present. The potential to further reduce size and costs is excellent, far better than for a battery driven system. The means of producing and storing the hydrogen, whether on-board the vehicle or at stand-alone facilities, are associated technologies required for commercialisation of fuel cell vehicles. Thus for most users, the fuel cell vehicle is a technology for the medium to long term. They are therefore not included in the emissions analysis presented below.

Comparing emissions

It is now routine to monitor the tail pipe emissions of road vehicles against current regulatory limits. Such measurements are made under simulated urban and highway driving conditions on a chassis dynamometer (rolling road) for light duty vehicles, or using a multi-speed/load engine dynamometer test for engines used in heavy duty vehicles. For mass produced vehicles, rather than test every vehicle manufactured, an intense programme of development and testing is undertaken on a limited sample of vehicles. Steps are then taken to ensure conformity of all other vehicles of the same model/engine build with the tested sample.

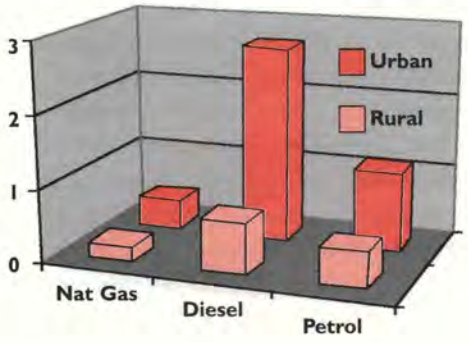
Unfortunately, there are a number of limitations in the way road vehicles are emissions tested that pose problems when trying to assess emissions benefits of alternative vehicle fuels. For example:

- Measuring only tail pipe emissions fails to take account of upstream emissions associated with production and distribution of fuels.
- Carbon dioxide is not a regulated tail pipe gas, and need not be measured, although it is common practice to do so.
- The regulated substances carbon monoxide, nitrogen oxides, total hydrocarbons and particulates over 10 microns (PM10) are monitored. There are, however, diverse environmental effects between these different substances. The picture that emerges is confusing since no fuels are good for all regulated substances, while every fuel can claim benefits in at least one area.
- For a complete understanding of environmental impact, a full speciation of the hydrocarbon emissions is needed. For reasons of time and cost, this is not part of the emissions regulations.

Some years ago, the then British Gas commissioned a detailed study of tail pipe and upstream (well to wheel) emissions from three comparable diesel, petrol and natural gas powered light duty vehicles. The measurements included an extensive speciation of the gaseous emissions. The data were further analysed in terms of the damage costs of the emissions on the urban and rural environment. The results are summarised in Figure 3. Although there were considerable uncertainties about the absolute values of the damage costs, the relative overall environmental impact of the three fuels was clear. It highlighted the problems faced by diesel, especially in urban situations, due to high emissions of NOx and particulates that more than outweigh its global warming benefits compared to petrol.

Unfortunately, only one alternative fuel was included in this assessment. Because of their relatively small numbers, it is often difficult to find a complete data set for comparative vehicles running on a wider range of alternative fuels. In the mid 1990's, ETSU attempted to do just this for a small group of petrol, diesel, CNG, LPG, RME (bio-diesel) and electric light duty vehicles. The results are summarised in Figures 4 and 5. Once again, a confusing picture emerges with each fuel excelling in a

Figure 3 Cost of vehicle emissions (p/km) for diesel, petrol and natural gas vehicles



different specific area.

Although ETSU did not report full speciation of the tail pipe gases or the upstream emissions, it is possible to make a crude estimate of these figures by comparisons with the older data. In this way, an overall comparison of this wider range of alternative fuels may be made (Figure 6). Once again, it is the relative rather than the absolute values of the damage costs that matter.

Figure 4 Fuel cycle carbon dioxide (Carbon dioxide per km)

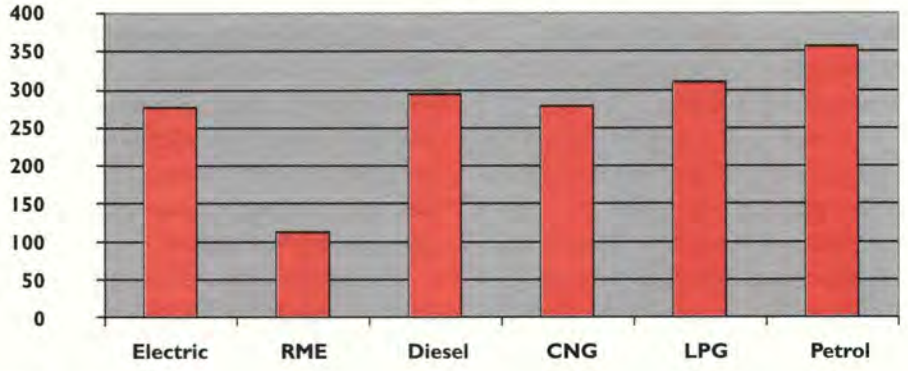


Figure 5 Fuel cycle regulated emissions

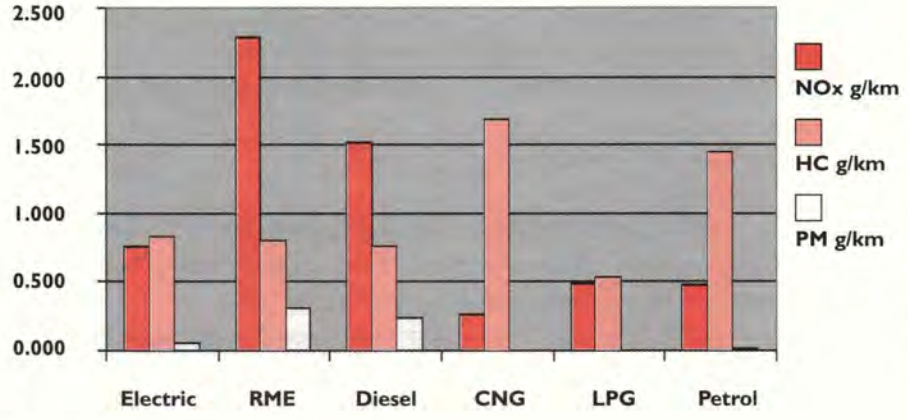
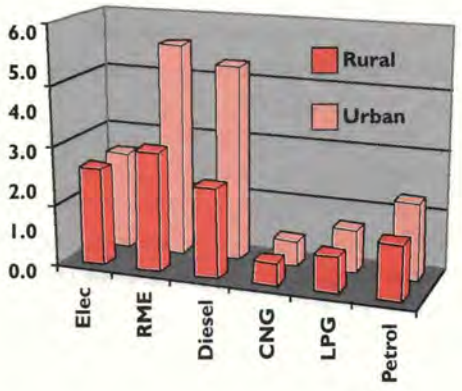


Figure 6 Damage cost of fuel cycle emissions, light duty vehicles (p/km)



Despite the reservations that should be made about this type of analysis and the data upon which it is based, several interesting points arise.

- Diesel emerges as the worst fuel, and is surprisingly joined by RME, despite the latter's excellent credentials as a means of reducing global warming. This is caused by the effect of particulates and NOx, especially in urban areas. NOx and particulates reduction is a priority action for compression ignition engines burning these fuels if the ETSU data and the damage cost analysis are correct.
- Electric vehicles have a higher damage cost than petrol under ETSU's assumptions about the generating mix and upstream emissions. Surprisingly, this conclusion is also true in urban areas where electric vehicles are often seen as the best solution to environmental problems. There is little doubt that these conclusions will not apply today following the increase in the use of gas and nuclear power for electricity generation. They do, nonetheless, serve to stress the importance of improving the environmental credentials of electricity generation if electric vehicles are to deliver their claimed benefits in urban areas.
- In addition to their global warming benefits, the gaseous fuels natural gas and LPG emerge from this analysis as the best clean fuel options overall.

Conclusions

From this review, natural gas, whether as CNG or LNG, emerges as the least damaging fuel from an environmental point of view, and one for which there are no insurmountable technical barriers to widespread use. Despite the existence of a comprehensive national natural gas distribution network in the UK, and the convenience of fast and slow (or even home) refuelling options, the costs of refuelling infrastructure and the limited availability of vehicles remains an obstacle to short term penetration of the road transportation market. Initial growth will probably come from depot based fleets, for whom natural gas fuelling is an immediate option.

Although not as clean as natural gas, LPG offers good environmental benefits compared with petrol and diesel. It is poised for a more immediate and widespread entry into the transport market, particularly for vehicles requiring to use public refuelling facilities.

Without a breakthrough in electricity storage technology, electric vehicles are likely to be used only in low daily mileage urban fleets and niche applications such as

Alternative fuels storage

LPG, usually commercial grade propane, can be stored as a liquid at normal ambient temperatures by pressurising it to a few bars. In energy terms, its density is about half that of diesel. It is normally stored on a vehicle in cylindrical or torroidal (in place of the spare wheel) pressure vessels.

At normal ambient temperatures, the main constituent of natural gas, methane, does not liquefy at any pressure. Natural gas is therefore generally stored on vehicles compressed to a pressure of 200 bar (CNG). Storage vessels are cylinders, or sometimes torroids, as for LPG, but are heavier and thicker to cope with the higher pressure. CNG cylinders are designed to specific CNG vehicle standards, and are lighter in weight than conventional transportable gas cylinders. The cheapest and most commonly used cylinders are plain steel, although these may be fibre-wrapped to reduce weight. Aluminium, glass fibre and carbon fibre cylinders are used in applications where weight is critical, such as on buses and heavy-duty goods vehicles. Typically, the weight and volume of a CNG on-board fuel store is three to five times that of an equivalent (in energy terms) quantity of petrol or diesel.

For heavy duty and/or long range applications where weight and volume are particularly critical (buses and long haul trucks), natural gas may be stored in steel Dewar cylinders as a liquid at reduced temperatures (minus 165°C) and modest pressures.

Electricity storage remains the Achilles heel of the electric vehicle despite over a century of battery development. Even allowing for the higher efficiency in use of an electric motor, the batteries in an electric vehicle will be some 50 times the size and 80 times the weight of an equivalent (this time in vehicle range terms) amount of petrol. This effectively puts an upper limit on the driving range of electric vehicles, as adding more and more batteries becomes self defeating in terms of the additional energy needed to move the batteries!

fork-lift trucks and golf carts. When combined with a clean or renewable generating system, electric vehicles can deliver important environmental benefits. It is, however, essential to consider the power generating mix before drawing any conclusions about their environmental benefits, even in urban areas,

Bio-diesel needs to demonstrate that it can respond to issues associated with NOx and particulate emissions to prevent its global warming benefits from being overshadowed by these less desirable impacts. The issues of setting up an economic and environmentally sound crop growing and processing infrastructure will also need to be addressed in the UK before bio-diesel and other bio-fuels may be considered for transport applications.

Hydrogen faces a tough challenge when used on conventional vehicles due to its on-board storage requirements. In combination with fuel cells, however, it offers exciting prospects for the medium and longer term. In the very short term, the high price and very limited availability of fuel cell vehicles as well as the lack of a hydrogen fuelling infrastructure mean that hydrogen should be discounted as an immediate option for vehicle users.

By reducing fuel consumption to about 60-70% of conventional petrol or diesel vehicles, hybrid vehicles will offer similar environmental benefits to LPG. They require no new refuelling infrastructure. They are, however, expensive to purchase and even costlier to manufacture. Availability is immediate but numbers of makers/models is limited.

In conclusion, although the data and the approach deployed in this article need further development, it seems clear that natural gas and LPG offer the best immediate opportunity to reduce the overall environmental impact of depot based fleets and light duty vehicles.

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Where and how to refuel

We have become accustomed to having effectively unlimited supplies of petrol and diesel on most street corners and highways, although the recent refinery blockades have reminded us just how vulnerable to disruption these fuel supplies may be.

The picture is not as rosy for alternative fuels. Technically, it is possible to refuel with gas, whatever its form, in roughly the same times as petrol or diesel. LPG, LNG and CNG may be dispensed from fast fill hoses on filling station forecourts. The cost of fast fill stations is, however, very high for CNG, and this is a barrier to the development of a public refilling network.

LPG, on the other hand, requires a relatively modest investment on the forecourt. LPG refuelling stations are increasingly common in parts of Europe, and becoming more so in the UK with about 600 public filling points. The availability of bi-fuel LPG and CNG vehicles is an important asset in allowing the development of local gas fuelling networks while retaining the petrol option for journeys into non-gas areas.

For fleet operators with vehicles operating out of a central depot, or between a small number of fixed points, the decision to install a private fast fill facility for LPG, LNG or CNG may be made solely on the basis of economics. Such fleets represent a market entry opportunity for LNG and CNG.

There are two important advantages that natural gas holds over all other alternatives.

- The fuel already arrives by pipeline in all but the most sparsely populated parts of the UK. Delivery of this pipeline gas is highly reliable and less prone to disruption than tankered fuels.
- Natural gas vehicles may be slow-filled overnight from the gas mains with a relatively simple compressor system for fleets or single vehicles. In particular, a home refuelling option exists giving yet more independence from fuel supply disruptions.

Electric vehicles must of necessity slow charge over several hours. This can also be done at any point where the vehicle can park near a single-phase 250 V supply. Unfortunately, the limited range of electric vehicles makes it desirable to have the option to refuel a vehicle at any stopping point throughout its journey. In the UK, the infrastructure to achieve this still needs to be installed.

India aims for 15,000 gas-powered buses

Ashok Leyland, India's leading city bus manufacturer, has placed a $4 million order with US-based alternative fuel systems company IMPCO Technologies for natural gas fuel systems to be delivered this year for India's growing country-wide natural gas city bus programme.

India already has over 500 natural gas powered buses in daily operation in the capital Delhi, although these are just a small portion of the over 9 million buses on the road in the country. All of these are potential targets for conversion to natural gas and, by the end of 2001 India should have the world's largest fleet of dedicated natural gas buses designed for city transit use.

The main drivers are continued reduction of major city air pollution and the expansion of the country's energy self-reliance policy - both by government decree. The economics are also favourable with natural gas 50% the cost of diesel and gasoline fuels locally.

According to IMPCO Technologies' Robert Stemmler, Indian government regulations require all major cities with air pollution problems to change to natural gas powered propulsion systems in their transit vehicles. By the summer of 2001, the world's largest natural gas powered bus fleet will be in India. In the coming two years over 15,000 buses are planned for India's major cities, all using natural gas.

IMPCO is supplying both fuel and exhaust catalyst systems and further projects are on the way for new engine families and bus concepts for the future, in close co-operation with and Ashok Leyland's product development department in Ennore, India.

BMW adds auxiliary solid oxide fuel cell unit

BMW and the US-based Delphi Automotive Systems have unveiled in Munich what they call the first development vehicle to be equipped with a solid oxide fuel cell (SOFC). After nearly two years of the companies working closely together on the groundbreaking programme, the vehicle has shown encouraging operational results.

The development vehicle uses the SOFC as the key component in an *auxiliary* power unit (APU), which could generate electrical energy for a wide range of potential vehicle systems and allows for the addition of further electrical features. The SOFC/APU provides sufficient energy for existing mechanically-driven sub-systems, such as air conditioning and water pumps, to be driven electrically. This allows for more efficient operation and provides a much higher level of control, says Delphi.

Explaining his company's strategy, BMW's Dr Burkhard Goeschel said: "Generator outputs have had to go up by about 30% and battery capacities by about 200% in the last 30 years. If we reflect that before long our cars will have electric water pumps, electric power steering and electrically actuated brakes as well as the whole range of modern communication equipment, then we must expect current consumption at least to double again in coming years."

Using a conventional, mechanically driven generator, supplying 1 kW of electricity requires around 1.5 litres of fuel per hundred kilometres. Using the first production SOFC/APU will cause a reduction of 46%, leading to substantial fuel economy and environmental benefits, adds Delphi, which is working with BMW to bring the system to market in a passenger car.

Another important use of the APU will be to provide more power than can be reasonably supplied by a battery when the vehicle's engine is switched off. In commercial vehicles, an APU could be used to run refrigeration units or air conditioning while the vehicle is parked overnight or stopped for deliveries. Delphi is developing reformers that can convert either diesel or gasoline into hydrogen to fuel the APU.

Former student Anthony Wallis (pictured), and his supervisor at the University of Plymouth, Dr Murray Bell, are confident that their radical, low friction reciprocating Joule cycle engine design is the way for the future. Wallis was awarded an Audi Foundation grant worth £3,500 to build a working model of the engine while studying at the Department of Mechanical and Marine Engineering a year ago.

Wallis and Bell believe that their fundamentally new engine design, which features a rocking-to-rotary motion converter plus new valve and lubrication systems, will increase the mechanical and thermal efficiency over an conventional internal combustion engine. The design also features a novel flywheel and timing mechanism.

Wallis, who graduated with a first class honours degree and has now moved on to the Heriot Watt University in Edinburgh. The Audi-funded model was a small but vital step in demonstrating whether the design merits further investigation.

Wallis and Bell are now looking to interest manufacturing companies to assist in the next stage, which would be to build a prototype module that could be tested realistically using appropriate materials and real combustion.

Action on tran
– promoting the alternatives

by Jonathan Murray Head of TransportAction, Energy Saving Trust

Motorists up and down the country are talking about moving away from petrol and diesel towards cleaner alternatives. Jonathan Murray, Head of TransportAction, explains why.

Following the Earth Summit at Rio de Janeiro in 1992, the UK government set up the Energy Saving Trust - a non-profit organisation funded by government and the private sector with one main objective in mind – to reduce carbon dioxide emissions in the UK.

Over 25% of manmade carbon dioxide comes from transport, which is why the government later set up TransportAction PowerShift and TransportAction CleanUp. Although the programme is run by the EST, it is funded by the DETR.

TransportAction CleanUp

The TransportAction CleanUp campaign aims to improve air quality in pollution 'hotspots' by encouraging the fitting of emissions reduction equipment to the most polluting vehicles such as buses and taxis. The campaign will target the nine worst pollution areas in the country: London, West Midlands, Greater Manchester, West Yorkshire, Tyneside, Liverpool, Sheffield, Nottingham and Bristol.

The campaign has received a budget of £6 million in its first year, with a further £30 million allocated to the initiative for the next three years (2001 - 2004). The budget will be administered to ensure that PM10 and NOx emissions are reduced as cost effectively as possible.

Already, the programme has had an impact on local air quality. Thanks to a CleanUp grant, London Transport will be fitting particulate traps to 800 of its buses, which will result in a significant improvement in local air quality.

TransportAction PowerShift

Launched in 1996, the TransportAction PowerShift programme has been set up with the aim of 'kick-starting' the market for CFVs (clean fuel vehicles) in the UK. This includes vehicles powered by LPG (liquefied petroleum gas), NG (natural gas) and electricity. CFVs can reduce the output of carbon dioxide, as well as limiting the negative impact of vehicles on local air quality by cutting emissions of other pollutants such as NOx and PM10. PowerShift aims to transform the markets for clean fuel vehicles in the UK by breaking down the barriers to their development.

PowerShift has started this by developing a grant system that aims to reduce the capital cost of the LPG equipment. The scheme initially targeted fleets, thereby encouraging whole organisations to switch to LPG. In turn, these vehicles created local demand for the fuel and encouraged the development of the refuelling infrastructure.

Anyone can apply for a PowerShift grant, providing the vehicle to be bought or converted meets the criteria set. Briefly, vehicles must be less than 12 months old and have less than 25,000 miles on the clock. Also, vehicles must appear on the PowerShift Register, as the programme only funds vehicles for which suitable conversion options are available and which are proven to offer emissions benefits. Simply switching to a cleaner fuel does not offer guaranteed emissions benefits, although you will of course be able to benefit from a fuel that is half the price of petrol.

Most petrol engines are suited to LPG conversions, and most diesel engines are suited to NG conversions. Electric vehicles usually have a much lower range than LPG or NG powered ones, and so these are best suited for use in urban areas.

Grants are only available for vehicles less than 12 months old because technology and equipment designed for these vehicles has a longer life and is most likely to meet the highest standards for emissions. Vehicles less than one year old will also have a longer road-life and therefore contribute to reducing emissions over a longer period of time.

As a result of the grant scheme, more and more vehicles are powered by LPG, and a new LPG refuelling site is opening roughly every working day. In January 2000 there were 350 LPG refuelling sites in mainland Britain, by the middle of February 2001 there were 679.

Indeed, LPG has proved to be the most popular alternative energy source, while interest in NG has been concentrated in heavy vehicle markets. The new petrol/electric hybrid vehicles, such as the Toyota Prius and Honda Insight, also show potential for significant uptake. One of the reasons for this is that they don't need to be 'plugged in' to recharge the batteries – they are automatically recharged when the petrol engine kicks in.

Take up of LPG vehicles has so far mainly been from local authorities, delivery/courier companies, service engineers and sales fleets. As you can see in the tables, we expect the number of clean fuel vehicles to approximately double next year, the majority of which will be LPG. As a follow up to vehicles that have been converted, PowerShift monitors a cross-section of vehicles and operates a 'conformity of production' scheme to check that emissions and build quality standards for vehicles are being set.

The government is further encouraging the use of clean fuels by lowering the duty on them. LPG costs around 40p per litre – half that of petrol or diesel. There is no noticeable loss in performance when a vehicle is converted, assuming the conversion is performed correctly. However, fuel consumption is increased by around 15 to 20%.

There are over a million NG vehicles in

sport

the world today, over four million running on LPG and a few thousand on electricity. In the UK there are a few thousand alternative fuel vehicles in total but the market is growing fast, as illustrated in the tables.

Approximately 60,000 NG vehicles are on US roads today. They also have a long-established record in Europe, Canada, New Zealand and Australia as well. Italy has been using natural gas as a vehicular fuel since the 1940s, and now has more than 300,000 NG vehicles. In Canada, nearly 40,000 NG vehicles operate with a network of 125 public fuelling stations. Argentina has 285,000 NG vehicles and Russia has more than 300,000, with plans to convert one million vehicles by the end of this decade. Other countries with significant numbers of CFVs include Uzbekistan, Venezuela, Mexico, the Philippines and Indonesia.

In 1996 – when the programme was started – PowerShift had a budget of just £800,000, but late last year the Chancellor confirmed a budget of £10 million a year for the next three years, along with the same amount for PowerShift's sister programme CleanUp and a further £9 million for hybrids and new technology.

Year	2000	2001*	2002*
No of LPG new vehicle sales/conversions	14,139	47,000	54,000
No of NG new vehicle sales/conversions	347	770	700
No of electric new vehicle sales/conversions	231	680	470

Year	No of vehicles receiving a PowerShift grant
1997/8	295
1998/9	809
1999/2000	1,735
2000/1*	7,500
2001/2*	12,000

*Predicted figures

Alternatives to petrol and diesel are beginning to take off

How to apply for a grant from TransportAction PowerShift

TransportAction PowerShift can offer grants worth from 40 to 75% of the additional cost of buying a clean fuel vehicle or converting an existing vehicle. Grants are available to help with the purchase of approved vehicles running on liquefied petroleum gas (LPG), natural gas and electricity (including hybrids). PowerShift grants can range in value from a few hundred pounds for a clean fuel car to many thousands of pounds for a refuse vehicle or bus.

GRANTS – KEY FACTS

- Vehicles seeking funding must be new or, if converted, less than one year old and have less than 25,000 miles on the clock.
- Vehicles must be included on the PowerShift Register. Listed vehicles must have significant, proven emissions benefits, as PowerShift's ultimate goal is to help reduce tailpipe emissions of road transport.
- Applicants must have secured, or be aware of where they can obtain, an LPG or NG fuel supply. This is to ensure that PowerShift does not receive applications from people who are unable to refuel – amazingly, this has happened in the past.
- Applications must be made in advance of ordering or purchasing a vehicle or conversion.
- Grants will normally be paid to the vehicle operator but with written approval of the operator it can be paid to a finance house, vehicle manufacturer or converter. The vehicle operator must make the initial grant application.

STEP ONE - APPLICATION

- Make sure you read and understand the Key Facts above. For more detailed information on grants and the PowerShift programme download the document 'How to Apply' from the PowerShift web-site – www.transportaction.org.uk and click on the PowerShift link, or call the Hotline on 0845 6021425.
- Visit the PowerShift Register on-line database to find out if the vehicle you wish to purchase or convert is eligible for a grant and at which level (40, 60 or 75%). Make a note of the unique ID number of the vehicle.
- Make sure that you will be able to refuel your vehicle at a convenient location (see refuelling map for LPG sites or contact the relevant fuel suppliers).
- If you are happy that your intended purchase or conversion is eligible for a grant and that fuel is available locally, it's time to download the application form from the PowerShift web-site. You should also download the instructions on obtaining PowerShift funding.

Local gasification

by Geoff Loram

The search for new forms of renewable energy over recent years has led to technology being developed to gasify energy crops and some wastes. The Swedes have been gasifying biomass in fluidised bed gasifiers for some years and five years ago two small experimental plants in England and Northern Ireland successfully gasified coppice wood, using the gas in modified diesel engines. Currently the much larger ARBRE plant at Eggborough in Yorkshire, which uses Swedish FB technology, is about to commission and it is hoped to report on that installation in these pages shortly.

Energy World has been to see two new examples of gasification technology, both of them generating electricity, the first from sewage sludge and the second from municipal waste.

Waste to Energy Ltd have come to gasification from a background in ventilation, drying and engine technology for agricultural and industrial applications. The company sees its patented gasifier design as meeting a market need for small generating and CHP plants operating on a wide range of natural fuels derived from agricultural and forestry wastes. Fuels as diverse as packaging waste, poultry litter, corn husks and coconut shells feature in their list, which also includes sewage sludge and refuse derived fuels (RDF). The feature of all these fuels – even RDF - is that they have a high degree of homogeneity, that being essential to successful gasification - large plants attempting to gasify unprocessed municipal solid waste (MSW) in the 1970s foundered on the rock of heterogeneity.

At the plant at Broadholme sewage treatment works near Wellingborough in Northants, primary sludge is taken from the works at 25% dry solids and passed through a dryer which reduces it to 90% DS. The dried sludge is then formed into briquettes, 70mm in diameter and 80mm long, which are fed directly into the gasifier.

Gas leaves the gasifier at around 400°C and is rapidly quenched in a wet scrubber which removes all the tars, acids and particulates; the scrubbing medium is taken from the final effluent from the STW and is returned to the works. This effluent is also used to condense the moisture-laden gas from the dryer and to scrub that gas before discharge to atmosphere. The scrubbed gas from the gasifier is used to drive the gas engine generator set and to supply heat for the dryer which is supplemented by the exhaust from the engine.

The generator provides all the power required to run the plant and a small surplus; the economics of the plant lie in it the fact that the cost of disposing of the sludge amounts to the amortisation of the modest capital cost of the plant, a small wage bill and the small cost of landfilling the ash. Utilising the ash as a building aggregate by employing an appropriate binder can further reduce the cost.

The Waste to Energy gasifier design is based on the downdraught principle but includes an additional feature that is the subject of the company's patent. Fuel is fed into the top of the reactor where the temperature is 500°C and the most volatile elements are pyrolised. As the feedstock progresses down the reactor the temperature increases to 800°C and the remaining volatiles are driven off in the carbonisation zone. This gas is drawn down through the descending feedstock by an extractor fan connected to the base of the reactor; the air needed to oxidise part of the feedstock to provide the heat for pyrolysis is introduced round the base of the reactor and this is where the patented feature is introduced.

Air is introduced via a manifold at the base of the throat which has a dual advantage of preheating the air prior to entering the reactor and cooling the hottest zone, therefore eliminating the need for ceramic materials in the reactor construction. The air from the manifold enters the reactor via specially designed nozzles that cause a vortex in the oxidisation zone, intensifying the process and raising the temperature to 1,200°C. At this temperature the remaining carbonaceous solids are gasified as they are drawn out of the reactor into the reduction zone. The process here is endothermic and the gas leaves the gasifier at a temperature in the range of 350-500°C and is rapidly quenched to below 50°C, thus preventing the reformation of dioxins and furans. The small amount of ash is taken to normal landfill.

Containerised gasification plant from Waste to Energy Ltd

Compact Power – Avonmouth

Compact Power is a private company supported by a number of individual investors, which has its origins in work done by Professor John Sharpe at CRE.

The Avonmouth plant has been designed to serve several purposes; it can probably best be described as a commercial scale demonstration plant that will pay its way through a waste disposal contract with Bristol City. It is a waste processing plant whose front end is a materials recovery

projects take off

facility (MRF) in which materials for which there is a market will be recovered for recycling, and in which items unsuitable as a fuel will be removed and disposed of to landfill. It is also capable of being used as a research tool to investigate the gasification of a range of materials and also allied thermo-chemical processes. It will take in up to 6,000 tonnes per annum of Bristol's municipal waste and the gasification plant is sized to be able to treat all of that.

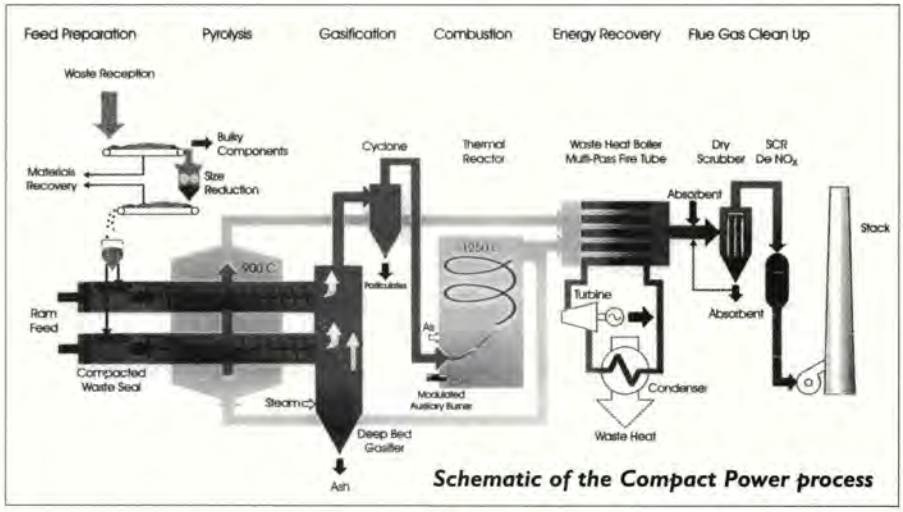
The design of the plant is based on the concept of a pyrolysis tube through which the material to be gasified is passed whilst the tube is heated externally to a temperature sufficient to drive off the volatile content. This is not a new idea but it is thought that this is the first commercial scale application of the concept. The size of plants built to this design is varied by the number of tubes employed, up to a maximum of eight; the standard diameter of the tubes is 650 mm and one considerable advantage of the concept is that, by using one standard tube, the great majority of the development work could be done at what was virtually full commercial scale.

The flow diagram shows the principles of the design for a twin tube plant, though there are some minor differences in the design as built at Avonmouth. Trial work has shown that the size reduction stage would not be required and the combustible wastes from the MRF will be fed direct into the hoppers of the pyrolysis tubes which drop it into heavy duty compacting screws – not rams as shown – that compact it against adjustable nozzles. This provides the seal needed and the compacted fuel is fed into the top of the pyrolysis tubes which run from outside the pyrolysis section through it and the gasification section which are, in practice, square boxes. The augers run the length of the tubes and have their bearings outside of the hot zones. The residence time of the fuel as it is passed through the tubes is approximately 40 minutes.

In the gasification chamber the tubes have ports top and bottom through which the char falls and the gases rise; steam and air are fed into the bottom of this chamber to gasify the hot char leaving only inert ash to be discharged at the base. (Ignore the vertical arrow in the pyrolysis section). The gases are passed through a cyclone, for the removal of particulates, to a thermal reactor where they are combusted in very turbulent conditions with the air being fed in tangentially; this allows excess air to /be kept low at less than 6% excess oxygen. At this stage the heat recovery of the thermal energy in the fuel is 95%.

Hot gases from the thermal reactor are passed are split into two flows: one provides the pyrolysing heat to the tubes and is then passed on to the boiler and the second flow goes to the boiler direct. In this scale of plant it is difficult to incorporate efficient steam equipment; the boiler is a simple fire tube waste heat type, producing steam at 25 Bar and 200°C, and the turbine is a simple Pelton wheel design. The generator has an output of 250 kW, most of which will be consumed by the plant and the surplus used by the Bristol City waste treatment plant on whose site the plant is situated.

Flue gas cleaning is effected by a injecting an absorbent – in this case, rather unusually, sodium bicarbonate – into the gas stream immediately before a baghouse filter. The thermal NOx produced by the high temperatures in the reactor - the gasification process avoids the production of fuel NOx - will be removed by a selective catalytic reactor using a new catalyst which operates effectively at 200°C. An ID fan draws the gases through the system, maintaining it at a negative pressure, and discharges them to the stack.



Schematic of the Compact Power process

THE FUTURE

Increasing interest is being shown in the idea of quite small generating plants fuelled by various wastes or biomass, serving a locality to deal with its wastes and generate power locally, thus saving on transport and transmission losses. It makes sense for some of these plants to compete in the retail electricity market, which would improve the economics. These two plants may well be the first of this new generation of small generating plants though the technology has to prove itself economically.

The capital cost, at around £1,000/kW of capacity is favourable but the energy conversion efficiency is low – not much better than 20%. With wastes much will depend on disposal costs; Bristol's municipal waste, for instance, is sent by rail to Bedfordshire at a considerable cost. Larger versions may be able to use scrubbed gas in a CCGT generating plant – as in the ARBRE project – and the final goal would be to be able to 'hot clean' the gas so as not to incur the loss of energy due to scrubbing; efficiencies could then be substantially increased.

Energy efficiency 'cannot cut consumption'

by Dr John McCullough, CEng, FIMechE, FInstE, Chairman, Cadogan Consultants

Current energy efficiency policy is doomed to failure, writes Dr John McCullough, as energy efficiency cannot cut energy consumption, in absolute terms, or the emission of carbon dioxide.

The logic and reasoning of engineers, environmentalists and politicians who believe that an increase in efficiency will lead to a reduction in consumption and pollution at the macro economic level (ie nationally and globally) is fatally flawed.

Energy efficiency has much to commend it as it reduces waste, consumption and pollution at the level of individual businesses and households. It also saves money and is generally good for the economy. My company actively promotes energy efficiency to industrial and commercial clients.

However, energy efficiency cannot of itself reduce fossil consumption at national or global level. It has been unable to do so in the past and will not do so in the future.

The reason why the efficient use of energy does not lead to a reduction in consumption at the macro economic level is difficult to grasp. Yet, the evidence is quite conclusive if expressed in absolute terms; million tonnes of oil equivalent (MTOE) and not as percentages or ratios (eg energy/gross domestic product (GDP) ratio).

The promotion of efficiency has never led to a reduction in consumption (and pollution) at national or global level. Indeed available evidence expressed in absolute terms (MTOE) would seem to suggest that the converse is the case. It would seem that to use energy or fuel more efficiently is effectively to lower its cost, and thereby increase demand for it.

The problem arises because an increase in energy efficiency leads to a saving in operational costs. The money saved by individual businesses or people is re-invested in other business activities, or luxuries, which consume energy and generate pollution both in their production and end use. Energy is only saved from one use to be employed in another. Therefore savings at the micro economic level do not prevent an increase in consumption (and pollution) at the macro level.

Falls in the energy/GDP ratio are often misinterpreted as falls, or downward trends, in overall consumption. The comforting illusion is created that consumption can be decoupled from economic growth. This is confusing and unhelpful and, in the context of climate change, dangerous since it diverts attention away from the problem which confronts all nations, whether industrialised or developing.

From, 1973 to 1986 most industrialised countries including those of the EC were able to show a reduction of about 20% in energy/GDP ratio. Yet for the EC countries as a whole the actual consumption of energy increased by 5% over the same period.

Energy efficiency has increased considerably since the turn of the last century, yet for industrialised countries the consumption per capita has increased by a factor of five. A saturation level will be reached even with unrestrained economic growth but it is likely to top-out somewhere above the current level for the USA. In the USA the usage per capita is about 6 tonnes of oil equivalent per year compared to about three in Europe and below one in some developing countries.

Any reductions in absolute consumption which have been achieved by individual nations from time to time have been due to changes in industrial structure or down-turns in economy. For example, in the UK the total primary energy consumption in 1970 was 215 MTOE whereas in 1985 it was 202 MTOE. During this period there was a shift away from energy-intensive industries such as heavy engineering, and there was also a fall in value added manufacturing.

In 1991 the primary energy consumption for the UK was 219 MTOE so the reduction in the 70s and early 80s had not been sustained. In 1998 it had risen to 228 MTOE.

Reference to world energy statistics shows an upward trend in total consumption of primary energy for most individual nations and groups of nations. In 1966 total world primary energy consumption was around 3900 MTOE; in 1991 it had risen to around 7800 MTOE and in 1998 it was 8477 MTOE. A small fall of 0.1% occurred in 1998, the first fall since 1982, as a result of decline in demand from the Asia Pacific region.

Yet throughout the last 30 years energy efficiency had been increasing and industrial nations have had energy efficiency campaigns.

If global climate change is a serious threat then governments throughout the world cannot hide their heads in the sand and pretend that the promotion of efficiency will reduce (or even stabilise) emission levels of carbon dioxide. Nor will the exploitation of renewable sources or fiscal measures (eg a carbon tax) have any appreciable effect.

All renewable sources should be promoted when their exploitation will not have other adverse environmental consequences. However, the maximum potential for these sources will be about 20% of anticipated demand. Therefore renewables cannot be relied upon to reduce significantly or stabilise the consumption of fossil fuels and emissions of carbon dioxide.

Governments are on the horns of a dilemma because economic growth is essential for political stability and efficiency is essential to reduce waste. Whilst fossil fuels form the major proportion of available energy, and they must for the foreseeable long term future, consumption and carbon dioxide emissions cannot be decoupled from economic growth.

The Climate Change Levy or indeed any type of fuel, energy or carbon tax seems likely to fail in its objectives to reduce emissions. The money raised will inevitably find its way into the economy where it will stimulate economic growth which will increase overall energy consumption and emissions of carbon dioxide.

New 'Engineering and Technology Board' is first response to Hawley report

Science Minister Lord Sainsbury has announced the creation of the *Engineering and Technology Board (ETB)*, a new body that will support the engineering and technology sector and assist professionals in marketing their skills in a rapidly changing marketplace.

The new *Board* is the first initiative to be introduced in response to findings presented by The Hawley Group, a task force chaired by Chairman of the Engineering Council Dr Robert Hawley, (see *Energy World* February 2001).

The Group was established with Government backing to set the course that the Engineering Council should follow in order to maximise the value of engineering and technology skills in the 21st Century economy. Its December 2000 report suggested that the UK engineering profession is in need of a major overhaul to include engineers broadening their skills horizon and a more 'relevant and credible' Engineering Council.

Lord Sainsbury said: "If engineering and technology are to achieve their potential in terms of their contribution to our economy and society, there are a number of changes that the engineering community are going to have to make. We must make sure that all our young scientists and engineers have the chance to gain managerial and entrepreneurial skills when they are young. And we must make certain that engineers of all kinds have the opportunity to keep their skills up-to-date in the rapidly changing world in which we live."

Lord Sainsbury and Dr Hawley intend the new *Board* to be fully up and running by October. To make this a reality, a shadow board, chaired by Dr Hawley is to be established, together with six working groups, chaired by senior industry figures, academics and representatives of the engineering profession. The groups will look at:

- the constitution and governance of the new Board,
- business and industry needs,
- communication,
- attracting greater membership of institutions and registration,
- education and training, and
- continuing professional development.

Out of a talent pool of 2 million people across the engineering and technology community, just 600,000 are currently members of the 34 professional institutions, which oversee engineers' continuing professional development, says the Engineering Council.

Lord Sainsbury (left) and Dr Hawley launch the new Board

Institute of Energy Secretary and Chief Executive Louise Kingham has taken a close interest in the work of the Hawley Group, and is convinced that the Institute is among only a small number of professional bodies which have already 'moved with the times'. "There is no doubt that the world of professional institutions concerned need to shake the dust off, whilst still remembering their objects and history. Indeed trying to stay in the past will jeopardise an institution's future" says Mrs Kingham.

"The Institute of Energy has already changed and is now benefiting from that process. However, even forward-looking institutions continue to need to support of individuals who are working, studying or just interested in the relevant field to take out membership in order to keep the organisations viable. We can be radical in reorganising our institutions, but to succeed we need to be met halfway with support from individual members and organisations."

Mrs Kingham has now been nominated to be a member of the Engineering Council's constitution and governance working group of the new ETB, while the Institute's Tracey Fisher has been nominated to sit on the education and training working group.

Environment Award for engineers

With a total prize of £5,000 for the overall winner, and a £3,000 cash prize for individual class winners, it's time to enter this year's *Environment Award For Engineers*. Closing date for entries is 17 May.

An initiative of the Engineering Council, the *Environment Awards For Engineers* recognises best practice in the protection and enhancement of the environment that results from the work of engineers or technicians. There are three classes for entry in the 2001 Awards:

Sustainable engineering – covers solutions which provide for example, better energy use, improved environmental performance through lower emissions, improved use of resources and long-term financial viability.

Engineering alternatives – designed to recognise talent within alternative technologies and techniques. For example, alternatives to current thinking within transport, energy and the construction sectors.

Engineering in the natural environment – projects that encourage native species and habitats to flourish.

Entry to this year's Awards is open to individual engineers or technicians who are full members of one of the engineering Institutions affiliated to the Engineering Council or by a team with includes at least one full member. Closing date for entries is 17 May with the Awards made at a presentation ceremony in October.

For an entry form and further details, please call the Engineering Council on 020 7557 6437.

Events

April 2001

Assessing building energy use
CIBSE CPD course, 4 April, London
Details from Maggie Procopi, tel: 01442 866378, e-mail: maggie@cibsecpd.com

EFACTS 2001
Conference on energy efficiency and the CCL, 4 April, Portsmouth
Details from the Surrey & Sussex Energy & Environmental Group, tel: 01293 526410

Inst Energy Midlands Branch event
Fuelling the future – the case for hydrogen
Talk by Mr M Koefman, 5 April, Birmingham
Details from Harry Freeman, tel: 0121 353 2397, e-mail: hfreeman@talk21.com

Inst Energy North West Branch event
Annual general meeting
5 April, Warrington
Details from Eric Curd, tel: 0151 625 6744, e-mail: eric.f.curd@btinternet.com

Inst Energy Scotland Branch event
AGM and annual dinner
6 April
Details from John Currie, tel: 0131 455 2253, e-mail: j.currie@napier.ac.uk

Coal UK 2001 – changing markets, new players
Seminar, 10 April, London, £350 + VAT
Details from McCloskey Coal Information Services, tel: 01730 265095, e-mail: lisa@coal-ink.com

Coaltrans Russia
Conference and exhibition, 23-24 April, Moscow Details from Coaltrans Conferences tel: 0207 779 8945 e-mail: coaltrans@euromoneyplc.com

Distributed power
Conference, 23-25 April, Washington, US
Details from Intertech Conferences, tel: +1 207 781 9800, e-mail: olmstead@intertechusa.com

The Training of Engineers for the 21st century
24 April at the International Engineers Club, Brussels. Institute of Energy Members welcome. Further details available at www.imeche.org.uk or www.imechebenelux.org

Understanding heat treatment
Course, 24-26 April, Birmingham
Details from the Wolfson Heat Treatment Centre, tel: 0121 359 3611, e-mail: whtc@aston.ac.uk

Inst Energy Yorkshire Branch event
Eggborough biomass gas turbine
Visit, 25 April, reserve place by application
Details from Andrew Mallallieu, tel: 0113 276 8888 ext: 2324

Advance your presentations
Approved by the Institute of Energy CPD course, 25 April, London £395 + VAT
Details from Speakfirst Training, tel: 0870 841 4111

CHP in buildings
CIBSE CPD course, 25 April, London
Details from Maggie Procopi, tel: 01442 866378, e-mail: maggie@cibsecpd.com

Asset management for utilities
Conference, 30 April – 1 May, London
Details from IQPC, tel: 020 7368 9300, e-mail: assetmgmt@iqpc.co.uk

Utilities Act
Conference, 30 April – 1 May, London, £1099 + VAT
Details from IIR Ltd, tel: 020 7915 5055, e-mail: registration@iir-conferences.com

May 2001

Heat pumps – development and application
Course, 1 May, London, £245
Details from Mid career College, tel: 01223 880016, e-mail: course@mid-career-college.ac.uk

Energy saver
Course, 1-3 May, Swindon, £750 + VAT
Details from NIFES Consulting Group, tel: 0115 984 4944, e-mail: training@nifes.co.uk

Inst Energy Northern Ireland Branch event
Renewable energy in maritime and island climates
ISES conference, 3-4 May, Belfast
Details from David McIlveen-Wright, e-mail: dmcilveenw@aol.com

Inst Energy South Wales & West of England Branch event
Automotive fuel options
Talk by Roger Martin, 6 May, Chepstow
Details from John Whitehead, e-mail: ehe@uk.packardbell.org

Small-scale CHP
Course, 8-9 May, £355
Details from the Institute of Environmental Engineering, tel: 020 7815 7675, e-mail: fuadp@vax.sbu.ac.uk

Sustain 2001
Exhibition and conference, 8-10 May, Amsterdam
Details from Amsterdam Rai, tel: +31 20 549 1212, e-mail: sustain2001@rai.nl

Inst Energy South Coast Branch event
Edling Tide Mill
Visit followed by AGM, 9 May, Southampton
Details from Chris Wilson, tel: 01252 374663, e-mail: cwwilson@ntlworld.com

Inst Energy Midlands Branch event
Ellis Memorial Lecture
By Anna Walker, DTI, 9 May, Solihull
Details from Details from Harry Freeman, tel: 0121 353 2397, e-mail: hfreeman@talk21.com

The growing market for CHP and distributed generation
Symposium, 9-10 May, Amsterdam
Details from website: www.2ndchpsymposium.com

Furnaces Italy 2001
Exhibition,
9-10 May,
Milan, Italy
Details from DMG World Media,
tel: 01737 855145,
e-mail: hannahwebb@uk.dmgworldmedia.com

Inst Energy North West Branch event
Annual dinner and ladies evening
11 May, Haydock.
Details from Eric Curd,
tel: 0151 625 6744, e-mail: eric.f.curd@btinternet.com

Inst Energy Yorkshire Branch event
AGM and annual dinner
11 May
Details from Andrew Mallallieu,
tel: 0113 276 8888 ext: 2324

Well-to-wheels 2001
Conference, 14-16 May,
Portland, Maine, USA
Details from Intertech,
tel: +1 207 781 9617, e-mail: jscheld@intertechusa.com

Radiation dose management in the nuclear industry
Conference, 14-16 May,
Windermere
Details from the British Nuclear Energy Society,
tel: 020 7665 2315,
e-mail: sue.frye@bnes.org.uk

Efficient use of electricity in buildings
Course, 15 May, London, £245
Details from Mid career College, tel: 01223 880016,
e-mail: course@mid-career-college.ac.uk

Emissions management strategies
Conference, 16-17 May,
London, £829 + VAT
Details from Global Business Network, tel: 020 7291 1030,
e-mail: info@gbnuk.com

Distributed power – turning vision into reality
Conference 16-18 May,
Nice, France. Details from Intertech,
tel: +1 207 781 9800, e-mail: olmstead@intertechusa.com

Electricity demand forecasting under NETA
Conference, 23-24 May,
London, £1099 + VAT. Details from IIR Ltd,
tel: 020 7915 5055,
e-mail: registration@iir-conferences.com

Power-gen Europe 2001
Exhibition, 29-31 May, Brussels
Details from PennWell,
tel: +1 918 831 9160,
e-mail: powergeneurope@pennwell.com

Thermal mass in buildings
Course, 31 May, London, £35
Details from Oxford Brookes University, tel: 01865 483413,
e-mail: vmkwalker@brookes.ac.uk

Electric vehicles in Hong Kong

Albert Tang, BEng(Hons) CEng MInstE FIFireE MSFPE

In Hong Kong, like anywhere else, the quality of the environment has a direct impact on the quality of life. For years, the government of the Hong Kong SAR has been running a comprehensive programme to improve the quality of the environment.

On the transport front, the use of environmentally friendly fuel is a vital step in reducing air pollution due to diesel emissions. Those types of diesel vehicle where there are readily available alternatives that run on much cleaner fuel are being phased out gradually.

The 12-month trial of LPG taxis conducted in 1997-98 has concluded that LPG taxis are technically suitable to operate in the local environment. An incentive scheme was then introduced to encourage taxi owners to switch to LPG, including cash grants and no duty on auto LPG, with a view to converting all diesel taxis to LPG taxis by 2006.

The trial of alternative fuelled public light buses was launched in mid last year involving a trial fleet of 11 LPG light buses and five electric light buses. The purpose of the trial is to collect local operational data of alternatively fuelled light buses and to ascertain whether these vehicles can meet the local commercial operating conditions. If the trial is successful, a scheme will be implemented to phase out diesel public light buses.

Apart from the above, the possibility and suitability of introducing trolley bus system in Hong Kong is being studied.

Mr. C.P. Lo is an engineer by training, has an MSc in System Engineering and an MSc in Operations Research. He has been the mastermind of the electric vehicle development in Hong Kong since 1994, specialising in the introduction of zero emission transportation system.

On 9 January this year, the Hong Kong Branch had the honour to have invited Mr. C.P. Lo to share his experience at the Branch's technical seminar on 'electrical vehicle'.

Our branch members learnt a lot from his presentation: the development of electric vehicles in the world, comparison between electric vehicle and internal combustion vehicle, the benefit of electric vehicle, how electric vehicles could be implemented in Hong Kong, the government's alternative fuel public light bus test scheme, etc.

Neath & Port Talbot County Borough Council

Many local authorities have achieved success under the Energy Efficiency Accreditation Scheme however until recently this had not extended into Wales. Now that has all changed and Peter Morgan, the Energy Officer at Neath and Port Talbot County Borough Council, has taken his local authority successfully through to full accreditation. He was ably supported by an enthusiastic team in their Energy Conservation Management unit that is part of their Architectural & Building Services department.

Peter was able to demonstrate the wide range of opportunities that local authorities can pursue as they support domestic, commercial, and industrial initiatives to reduce overall energy consumption. Their new Energy Park at Baglan Bay is expected to be an excellent exemplar for other local authorities as the latest building technology and efficient building designs are incorporated into their new build programme.

Peter is an active member of a group promoting energy efficiency throughout Wales via best practice and has already motivated a number of other South Wales authorities to seek accreditation.

The Government Climate Change UK Programme, November 2000 has stated that "The Energy Efficiency Accreditation Award is the national benchmark standard in energy efficiency". It is therefore clearly recognised as the definitive demonstration of effective best practice in energy management for all to aspire to.

Obituary: Bertie John Follett

Bertie Follett left school at the age of 14 and initially worked in the Coke & Chemical Industry. He studied part time, finally obtaining his degree. He was a member of the Institute since 1944.

At the end of the Second World War he was seconded to the control commission and studied the workings of the Coke & Chemical Industry in Germany for a number of years before returning to the industry in the UK.

In 1965 the National Coal Board formed a new Fuel Technology Department and B J Follett became Senior Fuel Technologist for the Yorkshire Region, eventually retiring in 1972.

He died peacefully in hospital in his sleep last May at the age of 86.

He was a staunch supporter of the Yorkshire Branch of the Institute, serving as Chairman in 1971. His last appearance at an Institute function was the AGM of the Branch two weeks previously.

NEW MEMBERS

NORTH EASTERN

Mr J Slater Student
UCLAN

NORTH WESTERN

Mr G Stone Associate
Hi Spec

LONDON & HOME COUNTIES

Mr G S Anderson MInstE
Sizewell B Power Station
Mr L P Hargreaves AMInstE
The Symonds Group
Mr J R Izzard MInstE
London Borough of Hammersmith and Fulham
Ms S Jones Associate
Entech Energy Consultants Ltd
Dr D S Lee FInstE
DERA
Mrs E V Salazar-Gonzalez Graduate
W S Atkins Ltd
Mr G Scott Graduate
Raynesway Construction Southern Ltd
Mr P D Ward FInstE
DETR

SCOTTISH

Mr C J Flanagan MInstE
ScottishPower
Ms P M Flett MInstE
P11
Mr A Owen Student
Robert Gordon University

SOUTH COAST

Mr M T Bilton MInstE
BAA PLC

SOUTH WALES AND WEST OF ENGLAND

Mr P A Baker AMInstE
Roberts and Partners
Miss L Edwards Student
Cardiff University
Mr A Howarth MInstE
The Blackwell Partnership
British Energy Generation Ltd
Group Member Level 1

YORKSHIRE

Mr A Barnett Graduate
Hull City Council
Mr S Fotios MInstE
Sheffield Hallam University
Mr S P Goodhead Student
Leeds University
Mr T Morikawa Graduate
Sheffield University
Mr N V Russell MInstE
Sheffield University
Mr B C Sang Student
Leeds University
Mr J S G Sordo Student
Leeds University
Mr A Stagles Associate
Carrillion Services Ltd

EAST MIDLANDS

Mr P Dolby AMInstE
Bassetlaw District Council

MIDLANDS

Mr P A Bamford Student
UCLAN
John Taylor High School
Academic Affiliate

HONG KONG

Mr Y K Ku MInstE
Hip Hing Construction Ltd

DECEASED MEMBERS

HALL, Geoffrey Ronald CBE FRENG, SFInstE, STH

TEMPERLEY, Tom Groome OBE, C ENG, FInstE, NWE

CASTLE, John Frederick C ENG, MInstE, SWW

COUNCIL ELECTIONS 2001/2002

Presidential Officers and honorary officers 2000/2001

The under-mentioned have been nominated by Council to take office following the Annual General Meeting on 28 June 2001.

MR J E INGHAM CENG FINSTE to become President;
MR J BLACKHALL CENG FINSTE to become President Elect;
EUR ING R I WILKIE CENG MINSTE – Honorary Secretary;
MR D BARBER CENG FINSTE – Honorary Treasurer.

Following the AGM, the under-mentioned will retire and are not eligible for re-election:

MR M A W BAKER CBE FINSTE;
MR M C ROBERTS OBE CENG FINSTE;
PROF. N SYRED CENG FINSTE.

Following the AGM, the under-mentioned will retire but are eligible for re-election:

MR J MOSLEY CENG MINSTE;
MR RI TAYLOR CENG MINSTE;
MR S WILCE CENG MINSTE;
MR M HOGGARTH CENG MINSTE.

Ten corporate members have nominated the under-mentioned to be elected following the AGM: MR D F BRENNAN CENG FINSTE

Any ten Corporate Members may nominate in writing any duly qualified person to serve on Council. Any three Corporate or Associate Members may also nominate in writing an Incorporated Engineer to serve on Council. A vote for Associate Members would be by Associate Members only. All nominations, together with the written consent of the nominee to serve, should reach the Secretary of the Institute not later than eight weeks before the AGM but preferably earlier. (Members are not, however, permitted to join in the nomination of more than three persons in any one year).

ANNUAL GENERAL MEETING

Notice is hereby given that the seventy-fourth Annual General Meeting of The Institute of Energy will be held at the Institute of Energy at 11.45am on Thursday 28 June 2001, to transact the following business:

1 To sign the minutes of the 73rd AGM, held on 22 June 2000.
2 To receive the Annual Report and Accounts of the Institute for the year ended 31 December 2000, together with the report of the auditors.
3 To receive the Annual Report and Accounts of the Benevolent Fund of the Institute for the year ended 31 December 2000, together with the report of the auditors.
4 To re-elect Kernon & Co., Chartered Accountants, to serve as auditors for the ensuing year and to agree that their remuneration be agreed by the Executive Committee.
5 To approve the level of annual subscriptions payable by individual grades of membership for 2002.
6 To announce the names of new members of Council.
7 Any other business (Council require 21 days notice, Bye-law 93).

Dated this 9th day of March 2001. By order of the Council.
Mrs L A Kingham MInstE Secretary & Chief Executive

SPECIAL GENERAL MEETING NOTICE

Notice is hereby given that a Special General Meeting of the Institute of Energy will be held at the Institute of Energy's offices in London at 3pm on Tuesday 24 April 2001 to transact the following business:

1 To determine minor amendments to the Royal Charter.
2 To determine a number of bye-law amendments to comply with modern business practices.

Details of the amendments can be obtained from the Secretary & Chief Executive upon request made in writing. Should you wish to attend the meeting please email lkingham@instenergy.org.uk

We are here to help!

Our dedicated staff team is available during office hours to assist with any enquiry you may have.

Type of enquiry	e-mail	Telephone
Membership applications & Engineering Council registration	membership@instenergy.org.uk	020 7580 0077
Membership services	services@instenergy.org.uk	
Conferences/short courses/events	events@instenergy.org.uk	
Marketing & Communications	communications@instenergy.org.uk	
General enquiries including publications	info@instenergy.org.uk	020 7580 0008
Energy World advertising	eworld@instenergy.org.uk	
Energy World editorial	steve_hodgson@compuserve.com	01298 77601
Journal – editorial	janice_gordon@email.msn.com	01353 720938
Receipts/ payments/orders/room bookings	finance@instenergy.org.uk	
Other finance matters	accounts@instenergy.org.uk	020 7580 7124
Education and Training Services	education@instenergy.org.uk	
Benevolent Fund Awards	secretariat@instenergy.org.uk	
Secretary & Chief Executive	lkingham@instenergy.org.uk	
Deputy Secretary & Chief Executive	tfisher@instenergy.org.uk	

Fax 020 7580 4420. Please note some of the e-mail addresses have changed- see full list above.

SITUATIONS VACANT / WANTED

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A bespoke Introduction Service, operating across all Engineering & other appropriate Institutions.
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Under no obligation, enquire in confidence to
Steve Howe BSc, MBA, CEng, MInstE
Email: line8@energy121.com

Boiler Specialists seek PAYE posts

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Enquiries in confidence to Steve Howe.
Email: line6@energy121.com

Climate Change Levy

Are you minimising its impact? Help is available from Energy Practitioners: Freelance / Limited / Corporate – Providers. Enquiries in confidence to Steve Howe.
Email: line7@energy121.com

Student placements required

I am looking for up to 20 student projects lasting 4-5 months starting in May. The students are currently studying for an MSc course in Clean Technology and have good first degrees in science or engineering. The course provides training in environmental management and sustainable development in an industrial context. It covers the environmental issues surrounding industrial processes, including the legislative framework and explains how to minimise pollution and resource usage whilst operating a productive company. The students are taught for seven months and then complete a research project which is usually industry based, this counts 33% towards their final mark.

Details of the course are at

http://www.ncl.ac.uk/~nchempe/cleantech

Contact Dr Sue Haile, Department of Chemical and Process Engineering, Newcastle University, NE1 7RU

Tel 0191 222 7279 Fax 0191 222 5292

nifes CONSULTING GROUP

NIFES Consulting Group is the leading energy consultancy in the UK serving a range of clients including many of the foremost UK companies and organisations.

ENERGY DIVISION

Due to the rapid growth of energy business in the UK, NIFES have vacancies for energy specialists with experience in one or more of the following areas:

- Energy Management
- Energy Conservation Technologies in Industry, Buildings or Transport
- Renewable Energy
- Energy Policy and Strategy
- Supply or Demand-Side Energy Management
- Energy Surveys and Audits
- Energy Supply Contracting and Purchasing
- Combined Heat and Power

Positions exist for project engineers (2-5 years experience) and for senior project/principal engineers and consultants (5 years+ experience). Candidates should be self-motivated and possess good communication skills. Experience in consultancy would be advantageous. Knowledge of related environmental, climate change and regulatory issues would be important. Candidates should possess as a minimum an appropriate technical degree or equivalent.

DESIGN DIVISION

There are also vacancies in our Design Division for both mechanical and electrical design engineers with experience in commercial and industrial energy services, including CHP, HVAC, HV and LV distribution. Candidates should have 5 years+ relevant experience, preferably with chartered membership of a professional body.

Location could be in our Bishop's Stortford, Nottingham or Altrincham offices.

Salaries would be negotiable depending upon qualifications and experience.

POSITION REFERENCES:

- **Energy Consultants** (2-5 years experience) *ref. EGY1*
- **Energy Consultants** (5+ years experience) *ref. EGY2*
- **Design – Mechanical** *ref. MECH1*
- **Design – Electrical** *ref. ELEC1*

Applicants should send their CV, stating position reference, to: Mrs ILONA BERRY, Administration Manager, Energy Division, NIFES Consulting Group, Charringtons House North, The Causeway, Bishop's Stortford, Hertfordshire CM23 2ER

UWE BRISTOL

Building Services Engineer (Mechanical)

www.uwe.ac.uk/jobs

The University of the West of England is one of Britain's largest Universities and the Estates Department is responsible for the building facilities of 9 Faculties including Art Media & Design, Sciences, Engineering and Built Environment, currently covering 120,000 square metres on five main campus locations around Bristol.

We wish to recruit a Building Services Engineer to undertake duties on a wide variety of works, including energy management and mechanical services design.

We are keen to receive applications from qualified engineers with experience of design, specification, project management and maintenance of HVAC systems BMS controls and the management of energy purchase and utilisation including water. Your duties will also include feasibility studies and making recommendations for alteration and strategic maintenance works. The post is fixed term for three years. Salary will be in the range £23,800 -£29,600 depending on qualifications and experience.

The Estates Department actively supports career development in all of our staff to as high a level as possible. If you would like to discuss the above position, please contact Mark Bagnall, Principal Engineer on 0117 344 2595.

Visit our Website to see full details and to complete an on-line application form, or telephone our 24 hour answerphone service on 0117 976 3813 to request documents by post. Closing date for applications is 20 April 2001.

Please quote reference A/414/EW

University of the West of England, Bristol

FIRST ANNOUNCEMENT

INSTITUTE OF ENERGY ANNUAL ENERGY POLICY CONFERENCE:

'Redefining Energy Policy: junking the meter?'

5th June 2001 – CBI Conference Centre London

The theme of the 2001 conference is that, to make energy services accessible, available, and acceptable to all (the goal endorsed by the World Energy Council) we need to redefine and expand energy policy itself, to identify and respond more effectively to the challenges and opportunities now before us. What we currently call 'energy policy' is really just 'fuel and power policy', preoccupied with the supply and use of commercial energy carriers – oil, coal, natural gas, electricity – measured and priced by the unit. True 'energy policy', however, must deal explicitly with physical infrastructure – not only the assets that deliver commercial energy carriers, but also those that deliver the energy services we actually require. The exciting programme, incorporating the government and financial services perspective, with major players in the energy supply and services industries, aims to take a new look at the fundamental preconceptions underlying energy policy itself and to re-define its parameters to meet the challenges which face us.

SPEAKERS INCLUDE:

- **Anna Walker, DTI**
- **John Chesshire, SPRU**
- **Walt Patterson, RIIA**
- **TXU**

KEY-NOTE SESSIONS ARE:

Redefining Energy Policy

Widening policy areas: supplier and consumer expectations, tax regimes, company law, regulation and policy levers to improve energy service infrastructure.

Redefining Energy Investment

Reshaping risks and rewards: new valuation procedures and financial structures to foster energy service infrastructure investment.

Redefining Energy Analysis

Moving from focus on measured units of measurable energy carriers to performance of infrastructure delivering energy services; new indicators, indices, value structures.

Redefining Energy Business

Moving from short-term commodity transactions in fuel and electricity by the unit, to longer-term contract provision of energy services, and long-term relations between companies and customers.

Redefining the Energy Company

Moving on from companies defined by owning physical assets; managing energy systems, including not only commodity flows but also capital and energy assets; new models for revenue and profit.

Redefining Energy Governance

Changing policy levers; tax regimes, company law, regulation, standards – shifting focus from infrastructure that delivers energy carriers to infrastructure that delivers energy services.

Energy Policy Redefined

Transforming language and concepts to match policy objectives and processes; rethinking energy in human society.

For further information and a registration form, please contact Suzanne Cooper, Events Officer.

Tel: **020 7580 0077** or e-mail: **events@instenergy.org.uk**

Calling all Engineering and IT/Computing specialists...

Looking to improve your career? NER is the perfect opportunity to discuss your job prospects with over 60 blue chip organisations looking to recruit a wide range of graduate and experienced engineers.

Free visitor attractions include:

- Careers seminars on a wide range of subjects including: how to conduct job interviews, how to write a job-winning curriculum vitae, job search techniques
- CV workshop
- Company presentations

OVER 60 RECRUITERS*

Exhibitors are recruiting from the following disciplines:

• aerospace • civil • chemical • electrical • electronic • hardware • • manufacturing • mechanical • software • systems • telecom • test • • and others

Over 60 recruiters* exhibiting at one or more NER exhibition

- Alcatel Submarine Networks
- Alstom Transport Service
- Alten
- Analog Devices
- Arrow Electronics
- Astrium
- BAE SYSTEMS
- BOC Edwards
- Bookham Technology
- Cable & Wireless Communications
- Cambridge Silicon Radio
- Cisco Systems
- Cobham
- Contact Singapore
- Cranfield University
- Earth Tech
- Energis
- Honda of the U.K. Manufacturing
- Hunting Technical Support
- Infraco JNP
- Lockheed Martin
- Marconi Communications
- Mind Work
- National Air Traffic Services
- Nortel Networks
- Norwest Holst Group
- One 2 One
- Oxford Instruments
- Ove Arup
- Panasonic
- Parsons Brinckerhoff
- The Patent Office
- Raytheon
- Renishaw
- Ricardo Consulting Engineers
- Riversoft
- Royal Air Force
- Royal Navy
- Sendo
- Sensei
- Southampton Photonics
- STS Recruitment
- Teacher Training Agency
- Thales
- The Technology Partnership
- TRW Automotive
- Viasystems
- Vodafone
- Wynnwith

*Correct at time of going to press

The National Engineering Recruitment Exhibition NER

27 - 28 April 2001 • NEC • Birmingham

11 - 12 May 2001 • Wembley • London

19 - 20 October 2001 • Wembley • London

23 - 24 November 2001 • NEC • Birmingham

For more details about exhibiting please call Grant Teasdale on 020 8394 5227 or Corrie Thompson on 020 8394 5267

For more information about visiting including a full list of exhibitors call 0870 870 7411 or visit www.engineerjobs.co.uk

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