LANCASTER UNIVERSITY

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Will the lights go out?

A one day conference on UK Energy Policy

Tuesday 14th December, Lancaster University, Lancaster, UK

www.lancs.ac.uk

Summary of conference proceedings

Roger Kemp

Sponsored by

Northwest Regional Development Agency

Government Office for the North West

Northwest Energy Council

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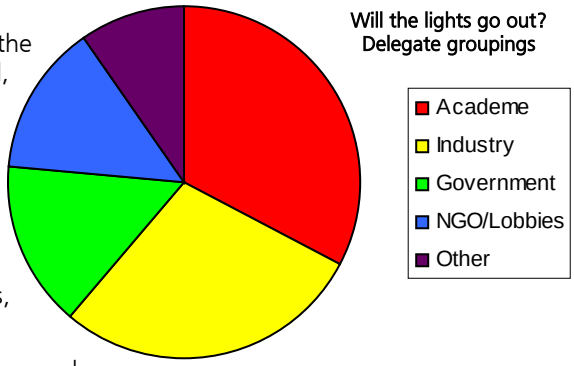
Foreward

"*Will the lights go out?*" Recent major changes in energy availability are making people see this as a serious question. In recent years dramatic and large scale electricity power cuts affected London and south east England. These were, however, minor compared with massive cuts across Europe and North America. With prices on the world oil market rising substantially as a result of global political unrest, and growing world demand, it is easy to see that our electricity supply infrastructure is inadequate.

Governments are expected to provide the answer. Everyone agrees that a sound energy policy is crucial for a modern economy, but such a policy is difficult to devise, maintain and implement. It is especially difficult as, for the twenty years since the oil crises of 1974 and the 1980's, we have enjoyed an extended period of general calm which has lulled us into not even thinking of energy. Cheap, guaranteed fuel is now not an option.

The 2003 Energy White Paper and the recent Energy Bill have challenged the UK to review its energy policy and how this is used. Public debate on energy policy and how it affects us in the North West in these early years of the 21st century and beyond is essential. We need to understand issues such as the objectives and implications of the Kyoto Protocol and how they will affect us. To this end, a wide range of expert and authoritative speakers were assembled to present a one-day Conference with a holistic character.

Over 240 delegates from the UK, France and the USA attended the conference on Tuesday 14th December 2004, with academic, industrial, governmental and public sectors all well represented. A feedback questionnaire was distributed after the conference and the responses obtained are summarised at the end of this publication.



Lancaster University, the North West Energy Council and the Government Office for the North West sponsored the Conference which was chaired by Professor Sue Cox. Delegates had the opportunity to contribute in the three question-and-answer sessions, and in the Open Debate at the end.

This document provides a summary of the main points expressed by the speakers on the day, it also incorporates some of the significant points raised by the panellists and the delegates during the discussion sessions and final open debate.

Conference Programme

09:30 Introduction
by Sue Cox

Energy - is a crisis looming?

09:35 Energy: the challenges in the 21st Century
Cristóbal Burgos-Alonso (EC)

10:00 Is Britain living in a fool's paradise?
Sir Christopher Audland

10:25 Discussion

10:40 Coffee break

What are our options?

11:05 How can we cut demand,
at home and in industry?
Brenda Boardman (ECI, Oxford University)

11:35 The facts and fiction of renewable energy
George Aggidis (Lancaster University)

12:05 Panel discussion

12:30 Lunch

What are our options? (continued)

13:30 What is the future for fossil fuels?
Keith Anderson (Scottish Power)

13:50 Can nuclear power come back?
Richard Mayson (BNFL)

14:10 Can the grid deliver?
Nick Jenkins (University of Manchester)

14:30 Moving towards hydrogen?
Keith Ross (University of Salford)

15:00 Panel discussion

15:20 Tea

What is stopping us?

15:45 Societal, ecological & political dilemmas
Sir Martin Holdgate

16:05 Open debate
Introduced by Joe Flanagan (NWEC)

Résumé

16:50 Summing up
by the conference rapporteur
Roger Kemp (Lancaster University)

17:00 Close

Conference Speakers

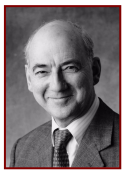
Professor Sue Cox

Sue is Dean of the Management School at Lancaster University, where she holds a Chair in Safety and Risk Management. Sue acts as a government advisor and actively contributes to a number of nuclear safety advisory committees in relation to organisational strategy and management.

Mr Cristóbal Burgos-Alonso

Cristóbal has been working in the European Commission since 1987 with financial control of structural funds. He joined the Directorate General for Energy in 1992 and became responsible for the EC Gas Unit in 1997. In 2001 he was nominated Head of Unit responsible for Security of Supply - internal and external, and the follow-up of the Green Paper debate. In October 2003 Cristóbal was appointed Adviser to the EC Conventional Energies' Directorate.

Sir Christopher Audland



Christopher was Director-General for Energy of the European Commission from 1981 to 1986. As such, he attended all meetings of Western Economic Summits, the European Council, the European Parliament, and the Council of Ministers, when Energy was debated: and also all top level meetings of the IEA and IAEA. He was also the Commission's Co-ordinator for all work arising from the Chernobyl accident. He later became Executive President of Europa Nostra, the key pan-European NGO for Heritage questions (including the built and natural heritage).

Dr Brenda Boardman

Brenda is head of the Lower Carbon Futures team at Oxford University's Environmental Change Institute. Her main research focus is on energy efficiency and the way that energy is used in British homes, particularly by low income households, i.e. fuel poverty. She has been a member of the DTI's Energy Advisory Panel and is widely viewed as one of the most experienced in her field. She was awarded an MBE in 1998 for her work on energy issues.

Sir Martin Holdgate

Martin has been Chairman of the Government's Energy Advisory Panel, Member of the UN Task Force on Environment and Human Settlements and a Trustee of the UK National Heritage Memorial Fund/Heritage Lottery Fund. He was been President of the Zoological Society of London from 1994 to 2003, and is also Chairman of the International Institute for Environment and Development and a member of the Royal Commission on Environmental Pollution.

Mr Keith Anderson

Keith joined Scottish Power in 1999 and was appointed as UK Strategy & External Affairs Director in August 2003. As a member of the UK Executive Team, Keith is responsible for leading the strategic process within the UK Division and managing key interactions with stakeholders.

Mr Richard Mayson

Richard is Technology Director for Reactor Systems at BNFL, he is also a member of NW Energy Council. He has been Head of Safety and Environmental Risk Management for BNFL. Richard is interested in Advanced Passive Design Pressurised Water Reactors and developments such as Pebble Bed Modular Reactors.

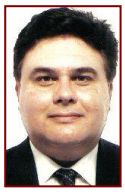
Professor Nick Jenkins

Nick is Professor of Electrical Energy and Power Systems at the University of Manchester and Director of the Joule Centre. His research interests include distributed generation, renewable energy, wind energy, photo-voltaics, power quality and the hydrogen economy.

Professor Keith Ross

Keith is Professor of Physics and Director of the Institute for Materials Research at the University of Salford. He leads the Hydrogen Energy activity in the Joule Energy Research Centre and is a Member of International Energy Agency Task 17: Hydrogen Storage.

Eur Ing George Aggidis



George is Senior Lecturer in Engineering at Lancaster University, Director of Lancaster University Renewable Energy Group and Director of Lancaster University Fluid Machinery Group. He has made wide-ranging contributions to research, design, and development in the field of fluid machinery and renewable energy, including patent for power generation water turbines. He is on the Board of the Joule Centre and also the Fluid Machinery Group of the Institution of Mechanical Engineers.

Mr Joe Flanagan

Joe joined the NWDA as Head of Energy in December 2003 coinciding with the formation of the NW Energy Council.

Professor Roger Kemp

Roger is a Professorial Fellow in the Engineering Department at Lancaster University. He spent almost 30 years in the rail industry. He retains his rail interests at the university as well as being a member of the sustainable energy group.

Will the lights go out?

Summary of conference proceedings

Introduction

The conference, held at Lancaster University on 14 December 2004, attracted more than 230 delegates, evenly divided between industry, academia and local groups.

In the course of a very full day, papers were presented by 10 invited speakers and there were diverse contributions both from members of an invited panel and from the floor.

This summary tries to capture the main points made during the day; it does not claim to be a full transcript of proceedings and contributions have been grouped by topic, rather than chronologically. Unless a statement is specifically attributed, there should be no presumption that it was supported by any individual.

The main themes

Throughout the conference four main themes emerged:

- Security of supply;
- Limiting climate change;
- Local environmental and amenity impact of energy industries;
- The way forward.

Everyone recognised that these themes are interlinked – an action that improves security of supply might well be detrimental to CO_2 emissions and low-emission generating technologies are sometimes intrusive neighbours.

The Energy White Paper

Many speakers referred to the Energy White Paper (EWP). The key objectives, as explained in March 2004 by the Government Minister, Stephen Timms, are:

- Putting ourselves on a path to cut UK carbon dioxide emissions by 60% by 2050;
- Ensuring that every home is adequately and affordably heated;
- Maintaining the reliability of energy supplies; and
- Promoting competitive markets in the UK and beyond.

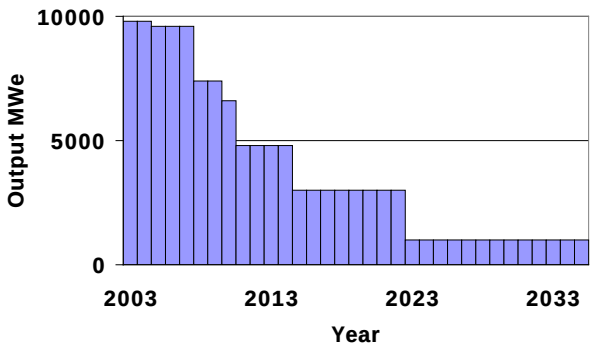
Some speakers welcomed the white paper – One described himself as a "fan". Others were less enthusiastic – Sir Martin Holdgate described it as "not a thought-through strategy, never mind an implementable plan".

Several speakers questioned the EWP's mixing the ability to pay with policies to reduce CO_2 emissions. Professor Alasdair Macbean argued that there is a strong case for raising the price of energy and using the income to subsidise those unable to afford to keep themselves warm. Julian Carter from Energy North-West argued for the need to decouple policies on fuel poverty from energy policy. On the other hand Karl Brookes from Energywatch strongly argued for maintaining low domestic energy prices to avoid fuel poverty and achieving savings in other ways.

Security of supply

Richard Mayson showed a graph of the predicted run-down of UK nuclear generation from more than 9000 MWe in 2003 to about 1000 MWe when only Sizewell B is operating after 2023.

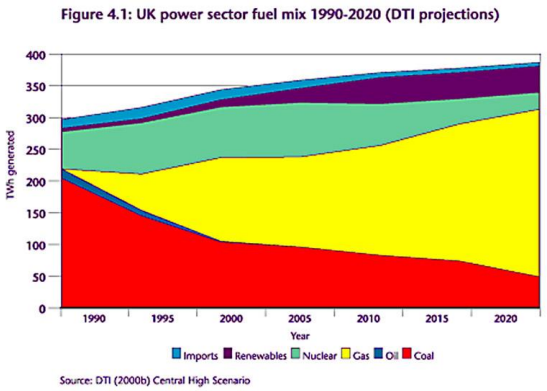
Fig 1: Rundown of UK nuclear plant



Keith Anderson said that the UK was reaching the end of a period of high spare capacity and that environmental measures were hastening the closure of old coal plant. He argued that the current price regime does not give an incentive to invest in new power stations and questioned whether replacement capacity would be available.

Sir Christopher Audland showed a graph of DTI predictions of the future energy mix.

Fig 2: The future energy mix



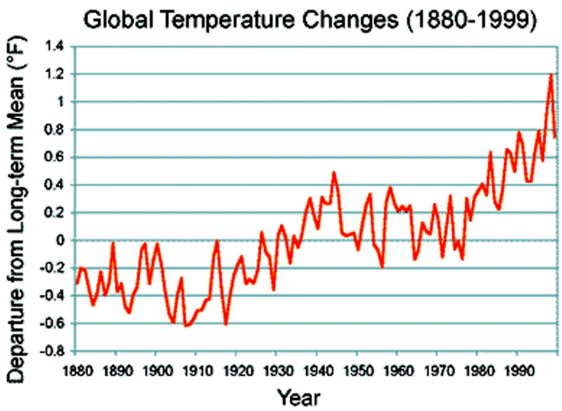
Many delegates expressed concern about an over-dependence on imported gas. Cristóbal Burgos-Alonso pointed out that external fuel dependence of the EU is forecast to rise from the current figure of 50% to 67% in 2030 and described this as "an unsustainable trend". Sir Christopher argued that "this enormous dependence on imported oil and gas is dangerous" and pointed out that most gas imports would come from countries which are currently unstable - Russia, Iran, the Caspian area, and Africa.

No speakers supported the Government policy, set out earlier in the year by Stephen Timms that "reliance on energy imports is entirely compatible with energy security and economic growth".

Climate change

Several speakers showed data indicating that climate change is happening and is, at least in part, due to emissions of CO_2 from energy industries. The following graph is from Richard Mayson's paper, but similar data was presented by others.

Fig 3: Global warming



Speakers quoted Professor Sir David King: "Climate change is the most severe problem we are facing today, more serious even than the threat of terrorism" and Robin Cook: "Future generations will be puzzled that we failed to grasp the urgency of climate change and may be furious at the environmental calamity we bequeathed to them". Cristóbal Burgos-Alonso spoke of "lasting, irreversible damage from energy production and use". Less than a week before the conference the Prime Minister reported in Parliament that the UK is unlikely to meet its targets for greenhouse gas reduction.

Reducing CO_2 emissions

There was a lively debate over whether it would be better to take the lead in reducing CO_2 emissions or go more slowly. Sir Martin Holdgate identified two separate questions:

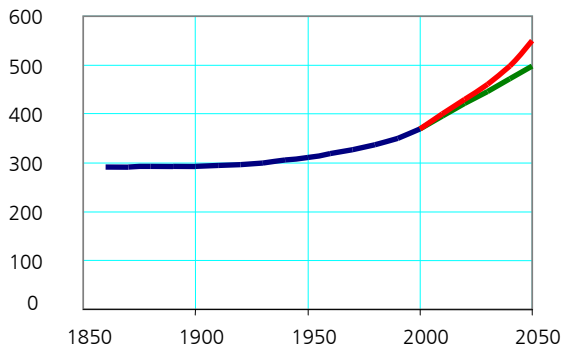
1. Will the ultimate global benefit from taking all the actions that can be taken now as quickly as possible outweigh the benefit that may come from devoting a decade or so to the evolution of more effective technology?
2. Does it make sense to be the pioneer, or will countries that adopt a somewhat more measured pace do better for themselves and the world in the longer term?

He argued that we are very likely to get the investment mix wrong if we push ahead uncritically now as rigid targets, imposed without a critical analysis of alternative means of achieving them (and at affordable cost), can prove socially damaging.

Other speakers took a different view. Cllr Chris Coates, of the Green Party, drew a comparison with the verve shown by Victorian entrepreneurs during the industrial revolution. They never debated whether it would be better to delay developing the steam engine until they could see whether other countries had good ideas to copy. He argued that we could not take the risk of not being leaders and that we should work towards a cross-party consensus on climate change.

Dr Brenda Boardman reminded the conference that the global warming we are seeing now is a result of a growth in CO_2 emissions since the industrial revolution. However, a graph of the increasing levels of atmospheric CO_2 shows how the build-up has only become evident in the past 50 years.

Fig 4: CO_2 levels (ppm)



If we are to maintain concentrations in the range 450 to 550 ppm, accepted as targets by the EU and the Royal Commission on Environmental Protection, we cannot afford to wait and may even be too late, due to the inherent lags in the system.

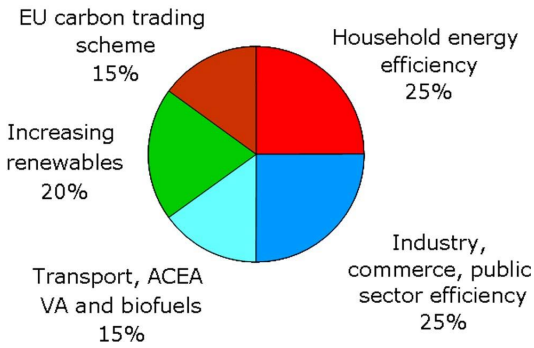
Several speakers mentioned the Kyoto protocol; while it was generally welcomed, it was recognised that it is, at best, a partial solution – it has not been accepted by the USA and does not cover energy growth in developing countries. In addition, it was noted that policing the emissions trading arrangements will be extremely difficult.

Christopher Cushing, from the Centre for International Cooperation and Security said that some speakers lacked the necessary sense of urgency. He argued that we did not have 30 years to debate the issue and action is required now. While the Prime Minister's concentration on the topic will be useful, we need a sustained effort over many years, not just 6 months.

Reducing energy use

Dr Boardman also showed a diagram of where the EWP anticipates savings will be made.

Fig 5: EWP savings



Half of all savings are anticipated from improvements in energy efficiency, with only 20% of the improvement coming from increasing the amount of renewable generation.

She suggested a system of personal carbon allowances (or tradable domestic quotas) as an alternative to taxation. Under such arrangements an equal allowance of carbon would be given to every adult. This would cover all use of gas, electricity and transport fuel and could be traded. The scheme would parallel the non-domestic emissions trading scheme, Climate Change Levy.

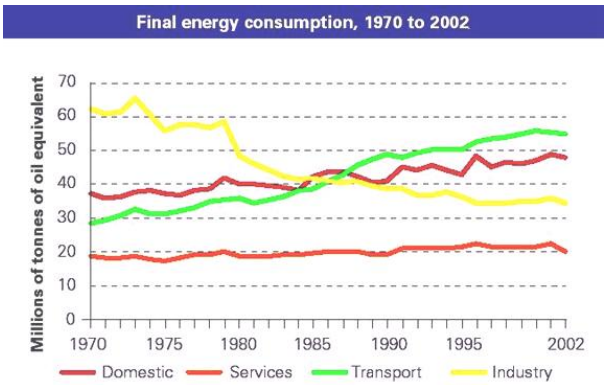
There was some scepticism about this proposal. Older delegates compared it with wartime ration books; other delegates considered it little more complicated than a credit card.

Other proposals for reducing domestic energy use centred on regulations to improve the efficiency of domestic appliances and of housing stock. Dr Boardman quoted the example of refrigerators. New appliances, on average, use less than half as much energy as those manufactured 15 years ago while providing a better performance. She argued that forcing up thermal standards of construction and a more active policy of demolishing inefficient buildings would significantly reduce energy use.

Not everyone agreed with this proposal: some delegates pointed out that the energy involved in the manufacture of building materials and in the construction industry made it counterproductive in energy terms to demolish otherwise sound property.

A graph from the DEFRA website impressed on delegates just how difficult it will be to reverse the trends of the last 30 years, cutting 30% from the energy used by transport and the domestic sector over the next 30 years.

Fig 6: UK energy consumption by sector



In the debate it became clear that the limitations of data on elasticity of demand for domestic energy made it difficult to form a rational judgement on the relative importance of fiscal and regulatory measures to cut energy use and, as referred to earlier, there was continued disagreement over the social effects of using the price mechanism to limit demand.

Several delegates expressed surprise at survey data presented by Dr Boardman showing that, while 80% of the population is worried about climate change and 70% accept it is due human activities, only 20% believe the use of gas and electricity in the home contributes to it and 60% say their family can not use less energy.

Non-carbon energy supplies

George Aggidis gave a comprehensive review of renewable energy sources. The most mature technology is hydro-electric power which has been exploited for more than a century. It is now the largest source of renewable energy with 2.03% of total generation. This is followed by bio-mass with 0.94%, wind 0.83%, photo-voltaics 0.051% and wave 0.006%.

Wind energy

The scope for further development of hydroelectric power is limited, as there are few suitable rivers unexploited. The next best developed technology is on-shore wind. The technology of wind turbines is improving and unit outputs of 2 MW or more are now possible (compared to 0.4 MW for most currently installed).

Fig 7: Wind turbine

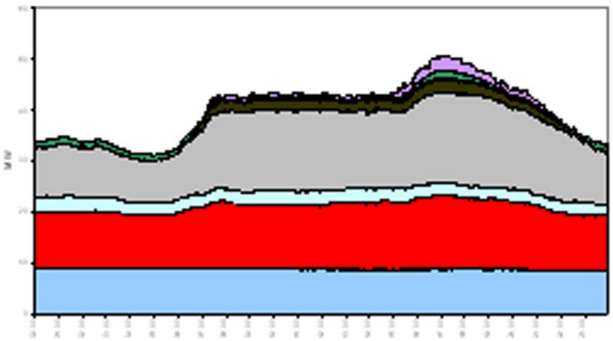
There was strenuous opposition from some delegates to the development of more and larger wind farms. Sir Martin Holdgate noted that to replace a single old-style CEGB 2GW power station like Ferrybridge would demand nearly eight hundred 2.5MW turbines, which if set 200m apart in one row would stretch for 158 km – and as they need to be on exposed sites the visual environmental footprint would be immense.

Sir Christopher Audland suggested that not a single commercial wind-turbine would have been built in this country without some form of subsidy. He considered that the Government had rigged the market and that a wind-power installation can expect to receive nearly three times more from the Renewables Obligation System than from selling electricity. He argued that the development of land-based wind farms was directly against the principles of town and country planning as it, in effect, industrialised otherwise open country.

Elizabeth Mann, from the CPRE, Naomi Klenerman from CPRW and several delegates from FELLS argued that the wind farms damage the local environment and have a detrimental effect on tourist income.

Several speakers argued that the economics of wind energy was flawed as the power is only available for 30% of the time and so standby generation capacity has to be available. Professor Nick Jenkins disagreed with these conclusions. He showed graphs of typical winter daily demand (below) in which there is a load increase of more than 20% between 06:00 and 08:00 hrs and a similar increase between 15:00 and 18:00 hrs.

Fig 8: 24 hr electricity demand

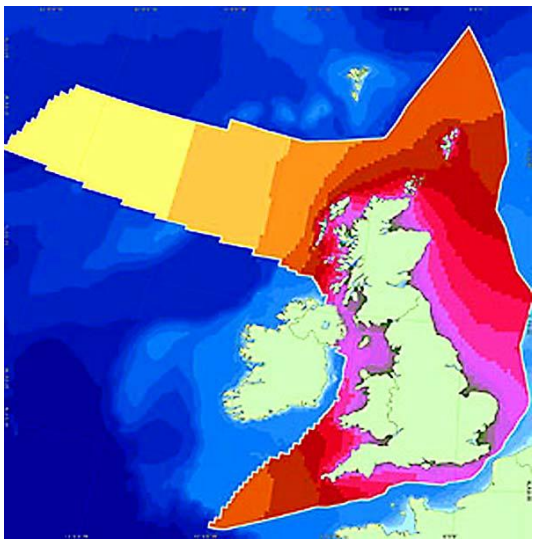


Professor Jenkins suggested that the grid has to have reserve capacity, for example open-cycle gas turbines, capable of dealing with these increases in load and the same generating capacity can also be used to cater for reductions in the output of renewables. Nuclear stations (shown as blue in the above diagram) and combined-cycle gas turbines (red) provide the base load and it would be uneconomic to use them for load levelling.

Wave energy

George Aggidis described work being undertaken at Lancaster University and elsewhere on exploiting wave energy. It is a large resource and, so far, is largely untapped.

Fig 9: Available wave energy



In the above diagram, produced by the DTI, the section of UK territorial waters shown as yellow have mean wave amplitudes of 4 metres. While there is plenty of available energy, harnessing it is challenging due to the inhospitable environment and the distance from the grid.

He mentioned the large number of projects under development, some designed for coastal use, others for deep water and using a variety of technologies:

SOWC: Limpet

NOWC: Osprey, Sperbuoy, Mighty Whale

Pneumatic devices: Sea Clam

Spillover devices: Tapchan, Wave Plane, Floating Wave Vessel

Float based devices: Danish Wave Power Device, Bristol Cylinder, Hosepump, Archimedes Wave Swing, IPS Buoy, Sloped IPS

Moving body devices: McCabe Wave Pump, Pelamis, Edinburgh (Salter) Duck, PS Frog, Frond

Several speakers referred to the Pelamis project that has just started sea trials.

Fig 10: Pelamis wave energy converter

Keith Anderson, talking about wave energy, said "It is still a long way off and needs long-term Government support".

Tidal energy

Tidal energy is more limited than wave energy and can be extracted either in natural bays and estuaries or from tidal flows in the open sea. George Aggidis presented DTI data on the best sites for tidal energy, shown below, where the mean spring peak exceeds 4.5 knots and the water depth is at least 20 to 30m.

Where the tidal flow does not meet these criteria, as is the case in many estuaries, the only efficient way of extracting energy is to construct a barrage and channel the water through turbines. While this can be economic in narrow, deep inlets, such as La Rance in Brittany, the economics are less favourable for wide, shallow estuaries, like many sites in the UK.

Fig 11: Possible tidal energy sites

Biomass and biofuels

Throughout the conference speakers mentioned the production of energy either from agricultural or domestic waste or from specially grown crops. While there were no reservations about burning methane (a greenhouse gas) from capped landfill sites or agricultural waste, there was more concern about the implications of specially grown fuels. Richard Mayson showed a slide of the huge tracts of land that would have to be devoted to fuel-crop production to match a modern power station.

Can renewables fill the gap?

Several speakers highlighted the difference between the 3% that renewables contribute to the present energy mix and the 20% implied by the Government targets quoted earlier in this paper. When one realises that the largest present contributor is hydro-electric generation, with only limited possibility for future exploitation, the required growth rate is even more challenging.

It was also evident that renewable energy installations are not always benign neighbours. Comments about wind farms have been mentioned earlier but tidal barrages, biomass farming, near-shore wave energy devices and hydro-electric dams all have significant effects on their local environment and amenity. While it was recognised that renewable energy can play a significant part in the future energy mix, no-one was arguing that they can take up the load presently supplied by nuclear and coal generation.

Nuclear energy

Sir Christopher Audland claimed that, so far as nuclear generation is concerned, the EWP is totally negative. The EWP recognises that nuclear could be an important source of carbon free electricity, but he argued that it was wrong in claiming that the current economics of nuclear power make it unattractive and that nuclear waste represents a major problem.

He described the phrase in the EWP that "at some point in the future new nuclear build might be necessary" as pre-electoral prevarication. Planning processes mean it takes up to 10 years between the decision to build a new nuclear power station and it coming on stream and, in his view, the Government should have been considering how to cope with the run-down of nuclear energy from the time it came to power in 1997.

He claimed that "the argument about the current economics of nuclear power is rubbish. When the EWP was published, the Government's New Electricity Trading Arrangements had driven wholesale prices for electricity to unsustainably low levels. Now, they have doubled. The Royal Academy of Engineering, last March, published a serious study showing that - if subsidies are disregarded - nuclear power is in fact very economic".

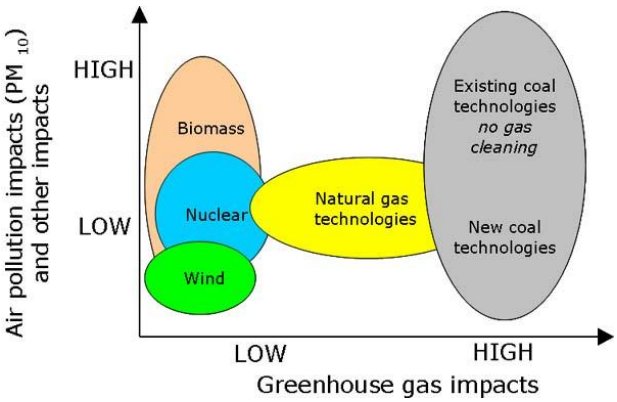
He also claimed that the argument about nuclear waste is wrong. "High level waste has been safely stored, on the surface, for half a century. The

technology of vitrification is fully operational: once vitrified, the material can be placed in deep repositories. Besides, if the Government were to replace the entire British nuclear capacity so far built, then, over the 40-50 year lifetime of the new plants, only 10% would be added to the amount of nuclear waste already in store."

Richard Mayson supported the argument that nuclear power should be an essential ingredient of a future energy policy. He noted that it provides 16% of world's electricity and provides 23% of the UK's electricity. Internationally there are 440 nuclear reactors operating and they have built up more than 11,000 reactor-years of operating experience. 4 new plants were connected in 2004 and 25 new plants under construction. In Europe Finland ordered a 1600 MWe PWR (EPR) in December 2003 and France is to build an EPR demonstrator and has a policy to maintain the nuclear contribution to its energy mix.

He argued that the air pollution and greenhouse gas impacts of nuclear power are at the benign end of the energy spectrum, as shown below.

Fig 12: Impacts of energy technologies



Not all delegates agreed with these views. Cllr Anne Chapman, from the Green Party, said that the risks of nuclear power and, in particular, the risks of nuclear waste storage were unacceptable. She agreed with the need to reduce greenhouse gases but argued that this should be done by more emphasis on low-tech ways of saving energy and less on technological solutions to produce so-called "clean" energy.

Energy storage

Several speakers mentioned the need for greater energy storage – particularly if the future supply mix will be predominantly nuclear (which becomes uneconomic unless used at a high load factor) and renewables (which tend to be variable).

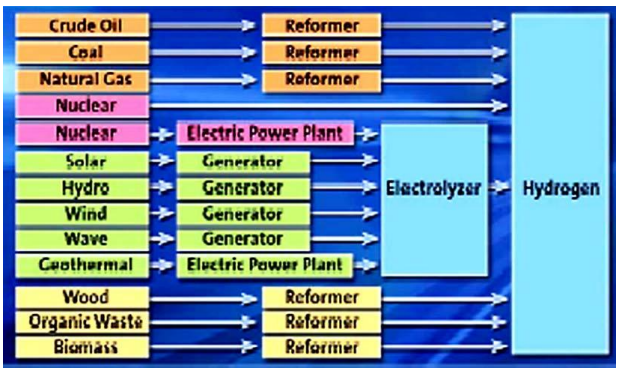
Hydrogen

Professor Keith Ross gave a presentation on the uses of hydrogen in future energy scenarios. He stressed that hydrogen is an energy vector (i.e. a means of transferring energy and storing it), not a source of energy in its own right. He identified 4 main means of producing hydrogen:

- ◊ From wind, waves, tide, solar via electricity
- ◊ From biomass – direct or from CH_4
- ◊ From nuclear – via electricity or thermo-chemical processes
- ◊ From fossil fuels – with CO_2 sequestration.

The following diagram shows some of these hydrogen pathways:

Fig 13: Routes for producing hydrogen



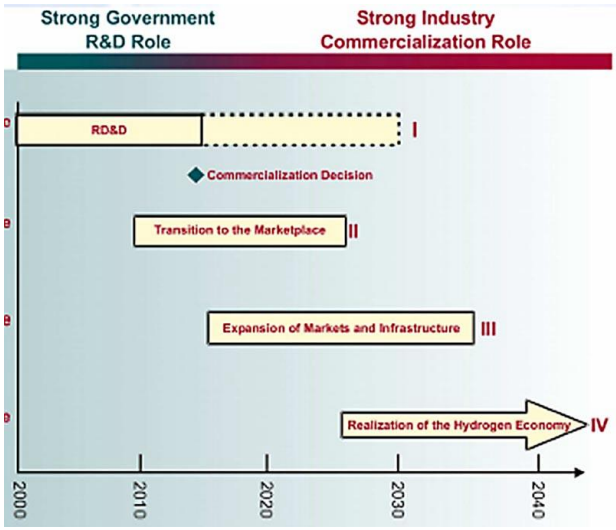
The overall efficiency of some of these pathways could be very low. As an example, he quoted the production from nuclear power via electrolysis (the 5th row on the above diagram): the efficiency of a nuclear power station might be 35%, the electrolysis process is typically 50%, the liquefaction process 70% and losses due to storage, transport and the fuel cell might be equivalent to an efficiency of 80%. Finally the efficiency of the drive train could be 85% giving an overall efficiency from heat production to mechanical energy of less than 5%.

Fig 14: Prototype hydrogen filling station

Professor Ross saw four phases of the introduction of a hydrogen economy. The first, where we will be at least until 2010, is the R&D phase, which is the necessary technical work to demonstrate project feasibility. The second phase will be the start of market penetration and commercialisation, with hydrogen being used increasingly in static power and specific mobile applications where it is particularly suitable. The third phase will concentrate on infrastructure investment and the fourth phase will be characterised by a fully developed market and infrastructure.

At least for the first two phases, lasting almost 20 years, there will be a need for a heavy investment by Government, as shown below:

Fig 15: Phases of development of "the hydrogen economy"



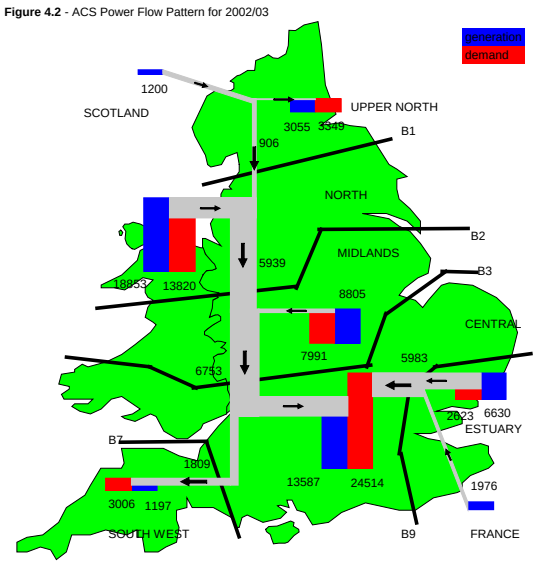
Significantly, the overall timescale from the first technical demonstrators (like the prototype car shown above) to the full commercialisation of the technology will be more than 30 years.

He identified two groups of barriers – the first are technological, including achieving competitive hydrogen production costs and obtaining energy efficiency and storage capacity competitive in energy terms with liquid fuel. The second group of barriers are economic and institutional; these include safety and regulatory hurdles, agreement on international interface standards and so on.

Regional implications

Professor Nick Jenkins presented data showing energy flows within the UK (see map below). These indicate that the NW region is a major exporter of energy.

Fig 16: Energy flows in the UK



Joe Flanagan filled in some of the details – the energy industry in the NW employs some 50,000 people, of whom 20,000 are in the nuclear industry.

In terms of energy usage, DEFRA are looking for 50% of the savings to come from the industry sector and many company managers consider that they are being asked to make a far greater contribution than are domestic consumers.

The way forward

Despite disagreements between delegates on a number of issues and a lively debate, there was general agreement on the way forward:

The need to reduce CO_2 emissions

No-one questioned the need to reduce CO_2 emissions in the UK. Although speakers had different views on the balance between savings due to the introduction of "carbon free" power generation and a reduction in energy use, there was general recognition that something must be done. The level of the necessary reduction – whether 40% or 60% – was not debated but no speaker questioned that it should be significant.

There was a greater divergence of views on the speed at which such a reduction should be made. On balance, more speakers supported the UK taking a leadership role than supported waiting for global consensus. It was generally recognised that the lags in the environmental system ensured that the results of actions would not be seen for many years after they were taken. It was also recognised that the development and commercialisation of new technologies – whether wave power or hydrogen energy storage – are measured in decades, rather than years.

The role of the EU

The EU Green Paper "Towards a European strategy for the security of energy supply" approved by the Commission in 2000 has set the agenda for discussion of many of the topics discussed during the conference.

Many improvements in energy consumption in the domestic sector rely on detailed regulation from the EU (energy labelling, minimum efficiency standards for white goods, etc.)

However delegates also recognised that EU policies on competition and the opening-up of markets could lead to significantly increased energy consumption – particularly in the transport sector. Councillor Anne Chapman argued for a review of EU policies in this area to ensure they did not contribute to a growth in energy consumption. Transport was a theme taken up by several speakers who considered that the Government was not prepared to take the necessary action to control the fastest growing component of UK energy consumption.

The market mechanism

The Government policy, expressed by Stephen Timms is that "Progress will require better technologies, better products and better processes. To achieve them, we will need to encourage innovation, investment and long-term planning. And we are convinced that the best way to achieve that is through the operation of open and competitive markets."

None of the speakers or the delegates taking part in the discussions supported this view. A large majority would have supported Dieter Helm who is quoted as saying "Our market is very well designed to force the prices down. It is not designed for the purpose of replacing most of the power stations in the UK."

Speaker after speaker stressed that long-term decisions are needed. Many promising renewable and energy storage technologies have development and commercialisation timescales measured in decades. Against the background of volatile energy prices, more influenced by geopolitics than market forces, and short-term profitability demands from the Stock Exchange, companies cannot be the driving force for this type of development.

A similar problem exists with the Government's attitude to the nuclear industry. The decision on whether or not to renew the UK's nuclear generating capacity cannot be taken by the private sector and delegates were clear that, given the long lead times involved, firm decisions are needed – decisions that can only be taken by Government.

David Clarke summed up the situation saying "The energy industry needs the Government to take unpalatable decisions".

Sir Martin Holdgate made similar comments on reducing energy use: "Energy conservation offers the greatest scope of all for cost-effective measures – but Governments down the years have failed to provide the blend of information, economic incentive and regulation needed to pull it through."

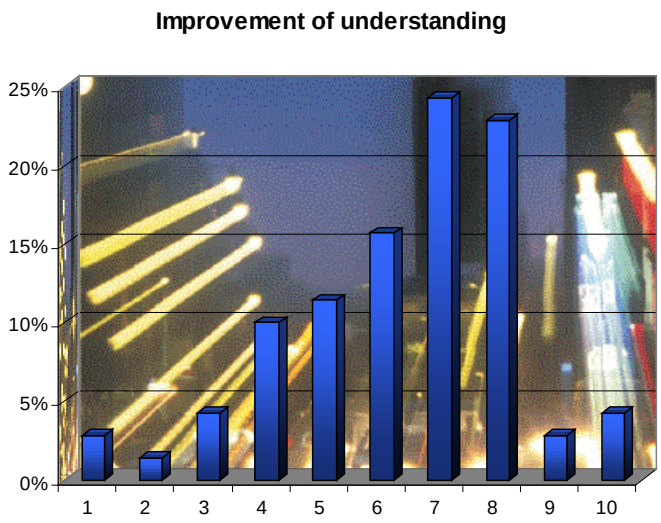
All speakers agreed that "hands-on" involvement from Government is required to meet the challenges. This became almost a *leitmotif* of the conference. We recognise that actions are needed across a wide front; the scale of these actions is greater than any individual company or organisation can contemplate and some will require individual sacrifices for the common good. If this isn't a legitimate objective of Government, what other organisation could take the initiative?

Questionnaire feedback

A questionnaire was given to each delegate in their delegate pack, this had two sections, the first assessing the delegates' views on UK Energy policy and the second section pertaining directly to the conference. 70 completed questionnaires were returned, this represents almost 30% of delegates.

UK Energy Policy

The delegates were asked to rate the extent to which the Conference improved their understanding of the Government's current Energy Policy, from 1 (not at all) to 10 (enormously). The responses to this question appear to suggest that the conference has brought about a high level of improvement in the understanding of the Government's current Energy Policy amongst the delegates. The mean score was 6.4. It should be noted that, as there has been no data gathered pertaining to the prior levels of understanding of the delegates, these results may be skewed. Delegates with a high level of prior knowledge will only be able to report lower levels of improvement.



Delegates were then asked to rank the goals of the current Energy Policy (Rank 1 to 4 with 1 as the highest priority). The delegates differentiated two more important goals of Energy Policy "**Cutting CO_2 emissions**" and "**Security of supply**" which were clearly ranked as more important than "Promoting competitive markets" and "Adequate and affordable heating". The differences within these pairs were not significant.

Topic	1st	2nd	3rd	4th	mean
a. Cutting CO_2 emissions	39%	33%	17%	10%	1.99
b. Security of supply	38%	28%	16%	19%	2.16
c. Promoting competitive markets	18%	13%	30%	39%	2.90
d. Adequate and affordable heating	9%	30%	40%	21%	2.73

In the final part of this section, delegates were asked if there were any other priorities they felt that the Government are ignoring, 66% of respondents answered this question and five topics each featured in between 15% and 20% of the responses:

1. Demand reduction and energy efficiency / conservation.
2. Promotion and R&D for new technologies and renewables.
3. Security of energy supply.
4. Development of nuclear energy.
5. Transport.

Conference Organisation

Delegates were asked how important and useful they rated the discussion sessions and open debate, over two thirds of the respondents regarded the discussion sessions as either very or extremely important.

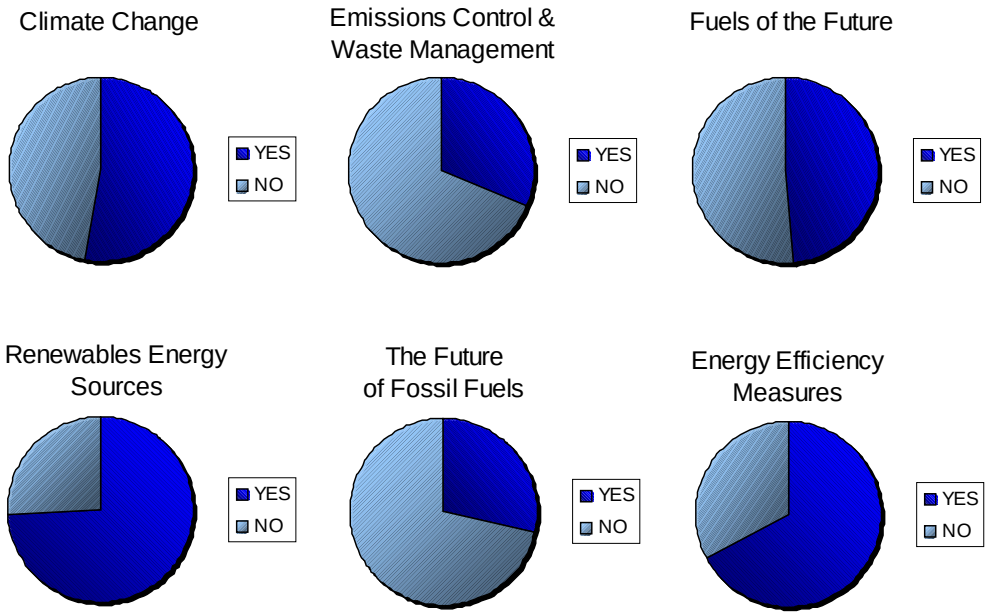
Extremely	13%
Very	55%
Moderately	31%
Marginally	1%

92% of respondents reported that the conference had either reasonably or fully met their expectations. Of those who had expressed dissatisfaction, improvements suggested included a better focus on renewables, less "pro-nuclear bias" and addressing the social issues.

Fully	41%
Reasonably	51%
Partially	6%
Poorly	2%

When asked if the conference had changed any previously held views, just over half of respondents answered. One particular area was highlighted more than any other, 10% of respondents stated that the conference had changed their views on the importance of nuclear power. Other responses generally reflected the varied backgrounds of the audience with delegates expressing that the conference has changed their views on a range of topics including renewables, security of supply and the importance of gas. While some delegates expressed that the conference had increased their general knowledge and awareness of the issues, a similar number remarked that it had only reinforced there own views.

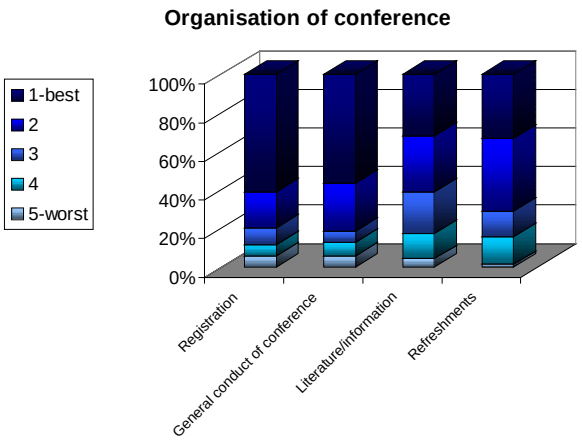
A list of topics were presented and delegates were asked if they would be interested in a further conference in any of these areas? 94% of respondents expressed interest in attending a further conference in one of the areas suggested. Almost three-quarters of respondents would be interested in a conference on "**Renewable Energy Sources - Deliverables and Drawbacks**" and two-thirds on "**Energy Efficiency Measures Can they work?**". Around half would be interested in "Climate Change: Mechanisms and Solutions" or "Fuels of the Future - nuclear fission & fusion, hydrogen, methane hydrate: Problems & Potential" conferences. The final two suggestions "Approaches to Emissions Control & Waste Management" and "The Future of Fossil Fuels" each had support from just under a third of respondents. From responses to earlier questions and in the final comment open section it could be that there would be a high level of interest in a transport conference had this been offered as an option.



Expressions of interest in further conferences

Delegates were asked to rate the overall organisation of the conference with regard to: Ease of registration, General conduct of the conference on the day, Quality & utility of the pre-conference literature/information and Quality of Refreshments (rated 1 to 5, with 1 the best and 5 as the worst).

The registration and general conduct of the conference where rated very highly with over half of respondents giving them the highest rating (1) and 80% ranking these features as 1 or 2. The standard of the refreshments was rated next best with one third of respondents giving the top ranking and 72% giving a 1 or 2. The poorest ratings were reserved for the conference literature/information, although 61% ranked this with a 1 or 2, 17% gave the lowest rankings of 4 or 5, this may reflect the minority of delegates who expressed the opinion that the delegate pack should have included copies of the speakers' presentations, though these have been made available on the conference website.



The final question provided delegates with the opportunity to comment on any aspect of the day, in general feedback was positive and though a small number felt that the conference had tried to address too broad a remit or was too pro-nuclear many more referred to the high quality of the speakers, the diverse audience and interesting, informative and stimulating presentations.

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Mrs Jayne Aggidis

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Siemens

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The NWDA believes that a clear Energy Policy is crucial to economic development and has created the Northwest Energy Council to oversee energy strategy in the region. The Energy Council consists of high level private and public sector representatives each with a wealth of experience in the field. The Chairman of the Energy Council is John Roberts, Chief Executive of United Utilities and other members are drawn from the key energy companies in the region, academia and Government.

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