

**SPRING NEWSLETTER 2005**

**EDITOR: TERRI JACKSON**

***Introduction:***

Welcome to the first edition of the Energy Management Group newsletter for 2005. At the outset may I welcome Dr Yasmin Andrew as the new group keen to receive any energy information, ideas etc from any group member.

The committee also wish to record their thanks to Patricia and to Dr Feroze Duggan and Miss Emi Apuila-Afitu for the excellent work they did while on the committee.

(Terri Jackson, newsletter editor).

***Group activities for the spring of 2005:***

The group have organised two meetings between now and Easter.

- 1. Climatic Change lecture by Piers Corbyn**, 2 February, 6.00 pm at the Institute of Physics Portland Place, London. Organiser: Peter Gill. (A report of this meeting is carried in this newsletter.)
- 2. Joint meeting with the IMechE Energy Environment and Sustainability Group on Security of Energy Supplies**, 13 April, 9.30am all day at the IMechE, 1 Birdcage Walk, Westminster. Chair of organising committee: Terri Jackson. Professor Peter King, a member of our committee, will be one of the speakers.

***Energy News Items:***

Power cut alarm over Ukraine crisis.

Daily Telegraph report. Edmund Conway 29-11-04. The political power change in this energy sensitive country has precipitated this article by Edmund Conway. About a third of Europe gas supplies come in from the Ukraine. Ukrainian gas pipelines carry over 210 billion cubic metres of natural gas from Russia and central Asia to Europe every year. By 2020 the UK will be importing a large percentage of its gas supplies with supplies from Russia through the Ukraine being one of the preferred routes. The UK electricity will be three-quarters dependent on imported gas by 2020. The possibility that at some date in the future and under particular circumstances the Russian gas could be affected is a definite risk. Russia has already turned off the gas to Turkey and to Belarus in the past. The present electoral victory of the pro western Victor Yushchenko is not the result that Russia wanted. Conway quotes both Patrick Heren of gas experts Heren Energy and Stewart Gray of Wood Mackenzie as saying that the cut off scenario is a future possibility. It needs also to be remembered that Russia is increasingly looking East to China in its energy strategy with China having negotiated a hydrocarbon pipeline from Russia and a stake in Yukos the Russian oil giant. (All of these

matters will be considered in the security of supply seminar which we are co-sponsoring with the IMechE on 13 April.)

### **Cost of Renewable Power link up.**

The cost of rewiring Britain to connect green energy projects such as wind farms to national and local electricity networks has risen to more than a £1bn according to Ofgem (see report in the Financial Times).

The cost of all this will be borne by customers. The British Wind Energy Association

has predicted that almost £7bn will be invested in new wind farms by 2010. Ofgem says that the extra spending by the grid operators, National Grid Transco, Scottish Power and Scottish and Southern would mostly be invested in Scotland where many of the new renewable schemes are planned and in reinforcing electricity interconnectors between England and Scotland. (report by Andrew Taylor, Utilities Correspondent, Financial Times and in Praseg News).

### **Buenos Aires Climatic Change conference press release.**

The tenth anniversary UN Conference on climatic change just preceded the legal introduction of the Koyoto Protocol on 16 February. J Waller Hunter the conference executive secretary said that it had succeeded in bringing adaption into the mainstream of the intergovernmental process. The conference adopted the Buenos Aires Programme of Work on Adaption and Response Measures.

### **Gas bills rocket.**

BG chief executive Frank Chapman has forecast considerably higher prices now that North Sea production is waning and Britain has to import liquid gas from as far away as Kazakhstan, Nigeria and Egypt. Heating bills for domestic premises have soared by 21percent in 18 months! (Daily Mail 16 Feb.)

### **Total calls for greater access to Opec reserves.**

Thierry Desmarest, chief executive of Total, the fourth largest oil company in the world, has called for more investment by Opec nations to restore the security margin between oil consumption and supplies. He said that the continuing strength of the oil price at a time when refiners were preparing for the end of high winter demand was confounding expectations and shows the market is very nervous. (Times report 21 Feb).

### **Koyoto.**

The Koyoto climate change protocol came into legal force on 16 February. The UK has a target of reducing its carbon dioxide emissions by 12.5% by 2012. The US is refusing to sign saying that it would have a serious effect on their economy, will increase unemployment and will increase energy costs. Both China and India have also not signed.

## **Energy Demand - Spiralling out of Control?**

The Energy Management Group (EMG) of the Institute of Physics arranged the seminar 'Energy Demand – Spiralling out of Control?' on the 17<sup>th</sup> November 2004. The event was organised to focus attention on the increasingly urgent energy demand situation both in the UK and across the world. The seminar started with an introduction by the group's Chair and was followed by talks from six invited speakers covering the key issues of current world energy demand. The seminar was well attended by around 50 people who took part in two lively questions and discussions sessions. To give a general overview of the meeting, very brief summaries of each of the talks are given below. All the presentations can be viewed on the EMG web-site.

### **Global Energy Demand and the Battle for Oil**

***Terri Jackson, EMG Chair***

The group Chair introduced the topic for the seminar with this general talk on global energy supply and demand. The presentation began with a description of global economic expansion as the driving factor behind the largest increase in oil demand in 16 years. China alone accounts for at least 40 % of the growth in global oil demand and their energy consumption is expected to more than double over the next twenty years. The important issue of current levels of oil demand and supply and its impact on oil prices was also discussed. The talk concluded with a discussion of the sensitivity of the UK domestic gas based energy strategy and its strong dependence on rising oil prices.

### **Energy supply and demand post 2050**

***Prof. Ian Fells, NaREC***

Prof. Ian Fells gave this talk on expectations of significant growth in the world's primary energy requirement post 2050. Contributing factors to spiralling energy demand include increasing population, developing countries' industrialisation and society's steady increase in affluence. The speaker also considered the effect of combustion of fossil fuels, which is already depleting oil and gas reserves in the North Sea, and the rising levels of CO<sub>2</sub> on climate change. It was concluded that it is imperative to find alternative sources of non-polluting energy to satisfy our ever increasing energy demand.

### **Gas and Electricity demand**

***Simon Griew, Transco***

Simon Griew gave a talk on the historical trends and future projections for gas and electricity demand in the UK. He showed how demand for electricity and gas in the UK have steadily grown in all sectors since 1990. The large increase in the gas market for example has been driven by gas-fired electricity generation and gas exports to Ireland and continental Europe. The speaker then went on to discuss how environmental concerns will play an increasingly important role in shaping the future of the energy industry. Factors such as carbon trading and limitations in atmosphere pollutants have made a real impact on developments. It was concluded that the closure of nuclear and

coal power plants by the end of the decade would result in a further increase in the gas and wind power shares of the energy generation market.

## **Energy demand related to GDP and prosperity**

***Chris Lambert***

The close link between economic output and energy demand was discussed by Chris Lambert. Energy demand was shown to be affected by two main driver sets: GDP drivers such as institutional capacity and technology and energy specific drivers like supply and price. So, if supplies remain adequate to meet demand by 2050, economic prosperity may be influenced by government efforts to limit fossil fuel use. In the next part of this presentation the ways in which advances in technology, such as carbon sequestration, may allow cost effective energy supplies and therefore demand levels to be maintained were considered. The strength of the link between economic growth and energy demand was shown to vary both regionally and developmentally. The speaker then focussed on the assumption that people can access energy in the first place. The developing world is severely disadvantaged in this respect and commitments to future climate policy frameworks may run counter to these countries' needs to capitalise on slowly improving access. It was stated that China is now considered key to global energy demand and climate impact potential.

## **How much energy for aviation?**

***Christine Bickerstaff***

Civil aviation has always been under enormous pressure to reduce fuel consumption and this was the first topic covered in this talk. Improvements in aircraft fuel efficiency must take the whole aircraft into account and not just the engine design. For example, a very large fraction of the aircraft weight on takeoff is fuel which limits both the payload and the distance that can be travelled. The speaker then moved onto the need to provide a viable economic product while satisfying global and local environmental restrictions. Although aircraft currently only contribute a small fraction towards global emissions, estimates of increasing future contributions are an added spur to improve aircraft efficiency. Finally it was concluded that despite a great deal of recent research into alternative fuels, the civil aviation company Airbus does not envisage that an effective and economic replacement for kerosene for civil aircraft propulsion will be in common use by 2030.

## **Grappling with the energy demands of surface transport, the wheels of the economy**

***Simon Roberts, Arup***

This presentation focussed our society's strong dependence on road transportation and the associated energy management issues. Three main areas governing energy consumption in road transport were examined: technology, fuels and behaviour. The speaker described in detail the fascinating technology of the new generation of hybrid cars and the Hypercar. In the next section of the talk oil production forecasts were discussed and alternative fuel options such as ethanol, hydrogen and solar electric were considered. The talk concluded with an examination of society's road

transport behaviour, in terms of food miles and speeding and possible modifications to reduce energy consumption.

## **Energy use in buildings - how reduction in their carbon impact can be achieved**

*Peter Warburton, Arup*

With buildings accounting for around 40 % of all energy consumed within the EU the question of how to reduce their carbon impact was addressed in this talk. The speaker outlined the possibilities of reducing the demands necessary to achieve a healthy and comfortable environment. This includes a reduction in the demands of mechanical wind energy directly in the buildings. In the second part of the talk the energy performance of buildings and the energy certification for buildings was considered.

## **Concepts for Fusion Power Plants**

On Monday 24 January 2005, Neill Taylor from UKAEA Culham gave an evening lecture to the British Nuclear Energy Society (BNES) Central England Branch. There was a healthily sceptical audience of about 25, primarily with a background in the nuclear fission industry.

Neill started his talk by introducing the basics of fusion, the power of the stars, and how it is possible to utilise fusion for mankind's energy needs. He then moved on to the progress made over the last 10 years or so, during which time fusion power levels have increased above 16MW and power outputs approximately equal to power inputs attained. That progress, coupled with the experience from earlier experiments has given the confidence to design a power-station scale machine, a worldwide venture called ITER, designed to produce 500MW of fusion power and presently at the site decision stage. Design concepts for real power plants are now quite advanced and there exist different near-term options for the key technologies, particularly the coolant, as well as different options (as yet untested) for novel materials. These concepts show that it should be possible to produce safe, economically viable power plants with low environmental impact.

In this summary I will elaborate on some of the key items presented.

### **Confinement**

Just another way of saying thermal insulation, the key to scientific success in fusion is to reach the high temperatures needed (100M Celsius) without consuming too much power. The most advanced way of doing this is to use magnetic fields to hold the fusion fuel away from the surrounding material surfaces and prevent it giving up its heat. This has allowed the routine achievement of the temperatures needed for fusion to succeed and culminated in the production of 16MW of fusion power in JET (the main World experiment, sited in the UK).

For net power production, the insulation must be strong enough that the fusion power is greater than the heating power needed. This has gradually

progressed so that the present generation of devices can produce about the same fusion power as heating power and the results from successive generations of machines have made clear the size of machine needed to produce large power gain. This has given the confidence needed to design a power-station scale device, known as ITER, being pursued as an international venture.

## **ITER**

ITER is a joint venture between EU, Japan, Russia, USA, China and South Korea. It is designed to produce 500MW of fusion power, 10 times more than the heating power, and is to be sited in France or Japan. The site decision is ongoing and is currently stalled by the strong desire of both France and Japan to host the project. The construction cost is around €4B with the largest cost items being the superconducting magnets used to insulate the fuel against heat loss. Prototypes of all the major ITER components are already built and tested.

With the ITER design now essentially fixed, attention has turned to more careful consideration of what a real fusion power plant (rather than an experimental fusion power device) would look like.

## **Power Plant Studies**

These studies have been pursued over the last 4 years in Europe, looking at a range of possibilities, from near term, water cooled steel plants through to more advanced, helium cooled plants utilising composite materials. Because the major part of a fusion power plant would in fact consist of conventional systems like buildings, turbines etc. attention has been focussed on the main, fusion specific technologies, known as the blanket and the divertor. The superconducting magnets are essentially known technology, with any necessary developments already tested for ITER.

Designs of blankets (which absorb most of the heat and neutrons from the fusion reactions) and divertors (which act like the exhaust system of a car) have been developed and improved. The resulting safety and environmental properties, and the costs of the plants, have been investigated, as have methods of maintenance. The results of the studies are that inherently safe power plants with low environmental impact can have an acceptable maintenance scheme and be economically viable. The economic viability relies on producing a reliable plant with high availability and this in turn requires materials which can withstand the hostile fusion environment for years of operation.

## **Materials**

The materials for the power plant concepts have been specified and already exist, however it has not yet been possible to test the materials in a real fusion environment. Tests in fission plants have shown that, in so far as the tests are representative, materials can withstand the levels of damage that they will experience during the planned lifetime of the components inside a fusion power plant. However, there are additional effects in a fusion environment that can only be tested under conditions closer to a fusion power plant. To this end

it is proposed that in parallel to ITER, there will be a materials test facility, based around particle accelerators, which generates a fusion-like environment (but no net energy) to expose the candidate materials to the same hostile environment that they will encounter in a fusion power plant.

### **Overall properties of fusion**

Before finishing the talk, Neill reviewed the overall safety, environment, resource and economic properties of fusion.

- The power plant studies show the plants to be passively safe with no possible accident requiring evacuation of the local population.
- The environmental impact is low, mainly because of the lack of atmospheric emissions, particularly greenhouse gases, but also because the choice of materials is made such that radioactivity that does occur in the plant decays away rapidly, leaving no radioactive waste burden for future generations.
- There are essentially unlimited resources for fusion - this relies to a large extent on the very low fuel requirements (10 million times less than in a coal plant for instance).
- Now that there is wide experience in building fusion devices, not least in designing and costing ITER, the costs of a fusion power plant have become much clearer, and show that fusion could well be economically viable in a future energy market, without major breakthroughs. Magnets are the largest cost item, and these are expected to reduce substantially in cost as the technology matures, so improving the situation further.

The talk generated many questions and much discussion afterwards. The main theme seemed to be support for the need to develop fusion and interest in the recent progress that has been made, combined with a scepticism that a reliable plant with high availability can be built. This appears to be the main task facing fusion, the successful construction of a robust, reliable, power plant.

### **David Ward**

#### **Evening lecture organised by the Group at IOP HQ, London**

It's the Sun! (and the Earth's magnetic field to blame for global warming)

Report by Peter Gill ([gill.pf@virgin.net](mailto:gill.pf@virgin.net))

Our speaker, Piers Corbyn, runs a successful independent professional weather forecasting service, Weather Action Limited. His views are radically different to those of the conventional global warming camp. He has given a number of recent papers on global warming and weather phenomena. These include one to the Cera Global Oil Summit held in February last year in Houston, Texas and another to the International Seminar on Climate Change at the Russian Academy of Sciences, Moscow in July 2004.

Piers Corbyn's offered his 'Solar Weather Theory' aspects of which he summarised as follows:

1. Particles from the Sun and Sun-Earth magnetic Links control the Earth's weather and climate on all time scales from days to hundreds of thousands of years.
2. The effects of particles from the sun are dramatically modulated by shifts in the Earth's magnetic field – particularly transpolar shifts of the magnetic poles and excursions of the magnetic poles to near the equator.
3. Rapid motion of the magnetic north pole towards the geographic North Pole gives extra world warming, and subsequent moving away gives cooling. This is both a magnetic-particle effect and an effect involving Just before 1600 AD the magnetic pole approached the North Pole, and then moved away rapidly. This was the Maunder minimum period of solar activity, the Gulf Stream shifted south and the Little Ice Age came.
4. In the next 5 or 10 years warming is likely to be maintained as a transpolar shift occurs. This will be followed by the magnetic pole moving away from the geographic pole, a decrease in solar activity, a southward shift in the Gulf Stream and considerable world cooling by 2040 AD.
5. Gulf Stream shifts, the El Nino and the quasi-biennial oscillation of stratospheric winds are all controlled by particle & magnetic effects from the Sun and will all be predictable decades or centuries ahead.

The speaker presented an impressive array of data in support of the above, some of it as yet unpublished. He has agreed that his presentation may be posted on the IOP EMG web site. However the full presentation may have to await the publication of the new data elsewhere first. Should this prove to be the case then an abridged version should be found on our site at:

<http://groups.iop.org/EG/index.html>

### **Another View on Climate Change.**

#### **Simon Roberts and Jake Hacker(ARUP).**

Context of solar variability within the IPCC process. Mr Corbyn's ideas are about the role of solar variability on our atmosphere. It is important to say that the consensus view of the vast majority of the world's climate scientists, based on physical principles that are now understood in depth, is that the increase in the average temperature of the atmosphere over the last 50 years can be attributed to effects of rising carbon dioxide concentrations on the radiation budget of the atmosphere. And the consensus is that this carbon dioxide has been emitted into the atmosphere through human activity. This consensus has been reached by the Intergovernmental Panel on Climate Change (IPCC, [www.ipcc.ch](http://www.ipcc.ch)), whose reports are unique in the history of science in bringing together diverse scientists and synthesising their results into a coherent scientific view. Temperature variations on shorter timescales, up to decades, can probably be attributed to natural variability in our climate system, including effects of solar variability, an area of active scientific research at present. It is important to recognise that the IPCC has striven to incorporate all contributions to climate change where the physics is understood.

**Simon Roberts and Jake Hacker (Arup Research & Development Group)**

## **Talking Point for Wind Power**

When I read the scientific press concerning wind power one often reads about so many megawatts of installed capacity which will be able to heat so many thousand homes. It is amazing there is hardly ever a mention of load factor. Load factor is probably the most important consideration as far as wind power is concerned and represents the time for which the wind turbines will be available for power generation. The maximum load factor for on shore wind power is around 25 to 30% with at most 33%. That means that if for example there is 9000MW of installed wind capacity it will only give 3000MW of continuous power and it is continuous power that matters as far as industry and domestic electricity supply is concerned. I find it amazing that the so called intellectual press such as the broadsheets when they talk about installed wind power capacity never mention load factor.

In addition one has to remember that by law the electricity supply companies must have enough plant installed to enable them to meet peak demand. So if wind power with a maximum load factor of 33% is counted toward total installed capacity there must be enough standby capacity to make up for when the wind is not blowing. (Two years ago there were 50 days in England and Wales when the wind did not blow). Available stand by capacity which could be substantial depending on the amount of wind power installed can only come from one of two sources either fossil fuel based plant or nuclear plant. If it is to be fossil fuel based plant then that will inevitably lead to an increase in carbon dioxide emissions to the atmosphere. (Terri Jackson).

## **Koyoto**

The Koyoto climate change protocol came into legal force on 16 February. The UK has a target of reducing its carbon dioxide emissions by 12.5% by 2012. The US is refusing to sign saying that it would have a serious effect on their economy, will increase unemployment and will increase energy costs. Both China and India have also not signed.

## **NUCLEAR NEWS:**

### **Nuclear opinion poll.**

A recent Mori poll on the attitude of the public towards nuclear power has shown that since 2001 there has been a marked shift towards nuclear power. In 2001 there was a wide gap with 49% of respondents saying that they found nuclear power unfavourable and only 19 % saying they found it favourable. The figures for this recent poll show that the percentage of respondents against nuclear power has dropped to only 27% with 24% supporting nuclear. In parliament this pro nuclear trend is also reflected in recent surveys with large support among Conservative MPs and a more even split in Labour ranks.

### **Russia-Iran Deal.**

On going to press we have learned that news agencies have reported that Russia and Iran have signed a deal for Russia to supply uranium fuel for Iran`s first nuclear reactor.

### **New build for Poland, South Korea, and Pakistan.**

While the Blair government in the UK dithers as to what to do with nuclear new build other countries forge ahead with their nuclear plans. In Poland the government has decided to build its first nuclear power station by 2021 in order to ensure security of supply and to meet its greenhouse gas emissions target. South Korea plans to build two new units Shin-Kori1 and 2 in Pusan. They are based on the Westinghouse System 80 technology design. BNFL`s Westinghouse subsidiary has contracts to

supply components. South Korea now has 20 reactor units in operation following the grid connection of Ulchin 6, a 960 MW pressurised water reactor. Pakistan is planning a nuclear expansion to reduce its dependence on imported oil and gas. At present it has only two nuclear reactors generating about 1% of its electricity.

### **Parliamentary nuclear group visit to Brussels.**

In November the all party nuclear group on nuclear energy spent two days in Brussels. The 14 strong group met with industry representatives, politicians and officials. The new energy Commissioner Andris Piebalgs highlighted that security of supply would increasingly become a serious issue for the EU over the coming years. On nuclear power he said that nuclear power would continue to be part of the energy mix. There was considerable debate as to whether the market alone could give security of supply (readers of this newsletter might like to debate whether they think the market in the UK will deliver security of supply). At their meeting in Brussels all sides were agreed that it was vital that the nuclear sector was maintained for both security of supply and for environmental reasons. (Industry Link, Nuclear Industry Association).

### **Some useful energy web sites:**

**Renewable energy sources:** [www.agores.org](http://www.agores.org)

**Caddet international information on renewables:**  
[www.caddet.co.uk](http://www.caddet.co.uk)

**Combined heat and power association:** [www.chpa.co.uk](http://www.chpa.co.uk)

**DTI energy:** [www.dti.gov.uk/energy](http://www.dti.gov.uk/energy)

**Nuclear Industry Association:** [www.niauk.org](http://www.niauk.org)

**Inst Mech Engineers:** [www.imeche.org.uk](http://www.imeche.org.uk)

**Energy Institute:** [www.energyinst.org.uk](http://www.energyinst.org.uk)

**International energy agency:** [www.iea.org](http://www.iea.org)

**International Solar energy society:** [www.ises.org](http://www.ises.org)

**World energy Council:** [www.worldenergy.org](http://www.worldenergy.org)

**World Nuclear Association:** [www.world-nuclear.org](http://www.world-nuclear.org)

**British wind Association:** [www.bwea.com](http://www.bwea.com)

**Parliamentary Group on Renewable and sustainable energy:**  
[www.praseg.org.uk](http://www.praseg.org.uk)

### **Energy Management Group committee:**

<b>Chair:</b>	<b>Terri Jackson</b>	<a href="mailto:jacksont@utvinternet.com">jacksont@utvinternet.com</a>
<b>Hon Sec/Treasurer:</b>	<b>Yasmin Andrew</b>	<a href="mailto:Yasmin.Andrew@jet.uk">Yasmin.Andrew@jet.uk</a>
<b>Webmaster:</b>	<b>Simon Roberts</b>	<a href="mailto:simon.roberts@arup.com">simon.roberts@arup.com</a>
<b>Ordinary Members:</b>	<b>Peter Gill</b>	<a href="mailto:gill.pf@virgin.net">gill.pf@virgin.net</a>
	<b>Peter King</b>	<a href="mailto:peter.king@ic.acl.uk">peter.king@ic.acl.uk</a>
	<b>Richard Bloodworth</b>	<a href="mailto:richard.bloodworth@ntlworld.com">richard.bloodworth@ntlworld.com</a>
	<b>Alan Morton</b>	<a href="mailto:alan.morton@nesta.org.uk">alan.morton@nesta.org.uk</a>
<b>Group Industrial Representative:</b>	<b>Terri Jackson</b>	
<b>Group Education Representative:</b>	<b>Richard Bloodworth</b>	

### **Contacts:**

The group may be contacted through the Hon Sec, Dr Yasmin Andrew, or through Carolyn Sands, IOP group support officer at [carolyn.sands@iop.org](mailto:carolyn.sands@iop.org). Information about the group is also available on the group web site at [www.iop.org/IOP/Groups/EG/](http://www.iop.org/IOP/Groups/EG/). The next issue of the group newsletter will be published in June. Any contributions should be submitted to either the Chair or the Secretary or Professor Peter King the next newsletter editor, by 10 June.