

## **ENERGY MANAGEMENT GROUP NEWSLETTER**

### **Introduction**

Welcome to the summer 2005 edition of our newsletter, dominated by reviews of meetings held by the Group. We hope that you find these useful. As ever, if you wish to contribute any material to the newsletter or have any comments on its content please contact the group secretary, Yasmin Andrew (Yasmin.Andrew@jet.uk). The next edition of the newsletter will be published in the autumn and the deadline for contributions is mid-September.

### **Bursaries**

We should like to remind group members that they can apply for bursaries to contribute towards the cost of attending energy related seminars or conferences. To apply for a bursary please contact Yasmin Andrew (Yasmin.Andrew@jet.uk), detailing the event you wish to attend, costs for which you are seeking support and reason for application (e.g. priority may be given to those not in employment or for whom travel costs are a particular obstacle for certain events). The availability of bursaries is dependent on the group funds at that time.

### **Energy Management Group Events 2005**

**The following events are being organised for EMG members this year:**

#### **Energy - the big issues**

Date: 10:30-15:45 Tuesday, 25 October 2005 Venue: IoP HQ in London

Note that the AGM of the Energy Management Group of the Institute of Physics will take place during the lunch break. The first announcement for this meeting appears on the IoP website on the Energy Management Group's page.

Outline for the day

CBI energy outlook, Jon Bird (CE electric and the CBI)  
Sustainability from an oil company's perspective, James Smith (chairman of Shell UK)  
Risk and nuclear business opportunities, Professor John Gittus (Chaucer Holdings plc.)  
Sustainable consumption, Sir Brian Heap (Cambridge University)  
Prospects for Fusion, Sir Chris Llewellyn Smith (UKAEA)  
The coming global energy crisis: peak oil meets global warming, Jeremy Leggett (ceo Solarcentury)

In addition Group Members may be interested in the meeting: "Sustainable Energy Developments", organized by Taylor & Francis on 21 & 22 September, 2005 at the Café Royal, Regent Street, London. For more information see [www.tandfevents.com](http://www.tandfevents.com).

## **ENERGY NEWS**

Compiled by Terri Jackson

### **Warning of global economic crisis if the oil price doubles:**

Guardian report John Vidal 26 April 2005. Matthew Simmons, an advisor to President Bush and chairman of a Wall Street energy investment company has warned that Middle East countries may have far less oil than officially stated and that oil prices could double to \$100/barrel triggering economic collapse. He said at a recent Edinburgh conference that peak oil was rapidly approaching even as demand was increasing. Demand was pulling away from supply. The situation could be catastrophic if peak oil arrives quickly and unexpectedly. Peak oil is the moment when oil production will peak and then rapidly decline at a rate of 3% per year. There is much debate between geologists and academics as to when peak oil will arrive. The International Energy Agency has put its arrival as somewhere between 2013 and 2037. Chris Skebowski of the Energy Institute in London predicts that we have at best 32 months before the crisis hits. His estimate is that depletion of conventional global oil reserves is running at about 5% a year with Norway, Venezuela, the UK and Indonesia all declining production and China, Mexico, Malaysia and Brunei predicted to peak within three years. This view of the imminent arrival of peak oil is also shared by Colin Campbell former vice president of Finn and chief geologist of the oil giant Amoco.

### **Wind power experience in Germany and the UK:**

Sunday Times report 24 April 2005. With the planned phase out of nuclear power in Germany it is to be noted that although Germany has around 16 500 wind turbines, more even than the US, carbon dioxide emissions have been reduced by only 2.5%. The 2004 report from E.ON one of the largest producers of energy in Germany points out that as wind power is so unreliable, power companies can only avoid blackouts by keeping conventional power stations with at least 50% of the capacity of its wind farms on permanent standby. Wind power reaching the German grid in 2003 was only one sixth of the installed capacity. When the wind speed goes above a certain limit the sudden power surges can burn out circuits and put the whole grid at risk. Power supply problems will occur if the wind speed drops below 5m/s and also if it goes above 25m/s. Transmission limitations and annual load factor are crucial elements in determining just how much wind power can contribute to renewable energy in countries like Germany and the UK. The UK wind load factor was 24.1% for 2003 (Digest of UK Energy Statistics 2004.) While Scotland may be building 14 270 MW of wind capacity, the maximum export capacity to England and Wales at present is 2200MW due to transmission limitations, (see Michael Laughton Energy security seminar IMechE 13 April 2005). System power supply security constraints will limit renewable power from wind sources and most conventional plant will have to be retained. The huge extra cost of the wind turbines will inevitably lead to large electricity price rises to both domestic and industrial consumers.

### **Rising energy prices affecting Business:**

Financial Times business section 5 May 2005. Soaring energy prices are forcing businesses to trim production and to ditch long term contracts. Increases of more than 60% in the wholesale price of gas and over 50% in electricity prices has led to a rethink in many companies. If this is the situation today, one wonders what it will be like when the UK is importing 90% of its gas supply for electricity production. One explanation for this situation is that gas prices in the UK are linked to movements in expensive light oil while on the continent of Europe they are tied to cheaper heavy oil.

## COMMENT ON SPRING 2005 NEWSLETTER

From David Ward

I have just received the Energy Management Group newsletter. It is interesting as usual but it contains errors about the Kyoto protocol that are misleading. It says that the US have not signed, also India and China have not signed. The former statement is incorrect but not misleading (the US signed but didn't ratify the treaty so it doesn't apply to them). The latter is misleading however. China both signed the original treaty and approved it (the same as ratifying) so it does apply to them. India were not original signatories but have acceded to it (again equivalent to ratification).

The reason that China and India are different from the developed world is not that they have rejected Kyoto (they haven't) but that they are not "Annex I" countries, i.e. countries of the developed world who agreed to legally binding reductions in carbon dioxide emissions. Nonetheless they are signed up to the goals of reducing carbon dioxide emissions globally, and are committed to monitoring and improving their own performance. I assume that in the follow up to Kyoto, countries with increasing emissions will have an increasingly important role to play.

### Response to 'Talking Point for Wind Power'

*Dr Simon Watson*

*Director of Renewable Energy Teaching Programmes*

*Centre for Renewable Energy Systems Technology, Loughborough University*

There are many misconceptions about wind power and many people are unaware of or choose to ignore the large amount of research work that has been done over the last 25-30 years to study the potential impact of wind power on the grid. Much of this work has been carried out by hard-nosed engineers whose job it is to run electricity networks such as National Grid Transco in the UK, Eltra in Denmark and several of the US utilities. These people are by no means apologists for wind power. The so-called low 'load factor' for wind power is often used as an argument against this type of generation, when indeed no power station operates at 100% load factor. Nuclear power stations achieve load factors of up to 80% and many of the less efficient thermal power stations are operating at less than 50% load factor. Many gas turbines may only operate for a few hours every year. This is before distribution and transmission losses are included which in many (though not all) cases can be avoided by distribution network embedded generation such as wind power.

There is no obligation by law for electricity supply companies to have enough plant installed to enable them to meet peak demand. UK electricity supply companies do not even have to have any generation plant of their own. They are merely buying electricity from generators and selling to their customers. At any one time, they should ensure that they have bought enough electricity to meet the demand of their customers and can face unfavourable prices through the imbalance market if they have not (or indeed have an excess to sell). National Grid Transco as system operator must ensure that supply and demand balance at all times but have no say about what plant is installed. In the competitive wholesale market in the UK, the incentives are mainly financial, backed up regulatory codes.

One of the misconceptions associated with wind power is that there must be a significant amount of back-up generation (generally fossil-fuelled) to cover for the large fluctuations of the wind. Study after study have shown that this is not so. Running a power system is all about managing risk. A modern integrated power system must already be able to meet large swings in consumer demand and possible outages of large power stations. National Grid Transco can forecast demand well, but knows that there is some uncertainty one-hour ahead. The uncertainty due to wind power generation one hour ahead when 1000MW are installed is almost negligible compared with the uncertainty on the demand. It should be remembered that if one of the cross-channel links goes down this is an instantaneous loss of 1000MW. The power output from a 1000MW of wind farms distributed throughout the UK would never instantaneously drop to zero. A recent study at Oxford University has shown that in the last 30 years there was never an hour

where the wind was not blowing somewhere in the UK. The key is to have distributed wind power generation onshore and offshore. National Grid Transco has shown that 20% of power generation from wind power would present no problem to the grid.

No-one is suggesting that we can meet the UK's entire electricity demand from wind power and clearly any form of power generation has its limitations. Wind power has a part to play in our future energy mix and should be given a fair hearing based on sound engineering principles and proper research.

## **REPORTS FROM ENERGY RELATED MEETINGS**

### **ENERGY SECURITY SEMINAR**

Held at the IMECHE, 1 Birdcage Walk, Westminster on 13 April 2005 and co-sponsored by the Energy Management Group, Institute of Physics. Report by Terri Jackson co-chair of the organising committee.

This seminar aroused so much interest in the business/energy world that no less than 120 delegates and six members of the press were in attendance to hear the first speaker Professor Peter King Professor of Petroleum Engineering at Imperial College and a member of the Institute of Physics Energy management group committee open the proceedings with a wide ranging talk on the global and UK oil and gas scene. This ranged from world energy consumption now and to 2025, through to world and UK oil and gas reserves and world and UK oil and gas consumption rates. The speaker noted that global consumption was outstripping global refinery capacity. Also that fewer large fields are being discovered. The speaker then went on to list the technical challenges facing the industry, including better understanding of pore scale physics, improved drilling especially in deeper waters, better understanding of flow, improved uncertainty modelling and better monitoring.

This first session of the seminar dealt with primary energy resources and the second speaker Graham Chapman, managing director of Energy Edge Ltd and standing in for Milton Catelin of the World Coal institute who was suddenly called away on business, went into considerable detail on coal resources. He considered worldwide coal reserves and demand in the Atlantic and Pacific basins, demand is outstripping supply in the former but in the latter supply is still ahead of demand. Germany and the UK have falling production rates with US mines closing over the next decade and China possibly leaving the export market. New sources will be Nigeria, Botswana and Venezuela. While underground production declines opencast production in the UK will increase. The interesting and fundamental question was posed as to the real availability and cost of imported coal in the long term.

The third speaker in this session was Dr Arthur Max head of the consulting group at RWE Nukem in Germany who considered the situation for uranium fuel supplies to the nuclear industry. This detailed analysis considered the number of nuclear stations world wide and the many new nuclear projects under construction. Worldwide demand for uranium was outstripping supply. Uranium supplies were in stable countries such as Canada and Australia and although the uranium spot market prices are now over three times what they were in 1993 in terms of US\$/lbu308 normally functioning metals markets and technology changes provide drivers to ensure that supply at costs affordable to consumers is continually replenished.

The next session dealt with energy conversion issues and the first speaker was Malcolm Watson of the Petroleum Industry Association. The PIA represents the UK refining and marketing interests of BP, Chevron Texaco, Conoco Phillips, Exxon Mobil, Shell, Total Petroplus, and Murco. The speaker noted that the UK is 4th in European refining capacity with 1800 000b/day next to Germany, Italy and France. Demand for road transport is growing with the efficiency of

new cars improving. at present the UK has 170 gCO<sub>2</sub>/km with a EU target of 140 gCO<sub>2</sub>/km. Road transport CO<sub>2</sub> emissions are up by 10% since 1990. It is likely that petrol and diesel will dominate up to 2030 with the future for liquid fuels being hybrids and biofuels, while for gaseous fuels LPG/CNG will give rise to fuel cells, hydrogen, renewables and sequestration.

This was followed by a presentation on clean coal by Kenneth Ferguson President of the Combustion Engineering Association. He started by reminding us that coal now produces about one third of UK electricity, however there is no longer overcapacity. Coal is being squeezed out. Coal has double the carbon intensity of natural gas per unit of energy so CO<sub>2</sub> emissions is the key target. The speaker also advocated coal gasification as the technology is well known and pollutants are removed before combustion, with hydrogen being produced as a sidestream. Coal gasification has the edge over PF combustion with proven chemical industry technology available for CO<sub>2</sub> capture. Underground coal gasification in which there are no transport or storage costs for fuel and all sold waste is underground so no particulates emissions was also presented.

The third speaker in this energy conversion session was Dr Adrian Bull head of energy policy studies at BNFL. He started by referring to the 2005 OECD report on the costs of electricity generation in which for both a 5% rate of return and a 10% rate of return nuclear was the cheapest, also add to that the fact that nuclear has virtually no greenhouse gas emissions and the advantages are obvious when compared to fossil fuels. The RAE 2004 report also put nuclear on an equal footing with gas fired Combined Cycle Gas Turbine (CCGT) technology. He also discussed the effect of deregulation on possible investors in the nuclear industry. This leads to a short term focus for investors leading to a reduced capacity margin. Nuclear makes a positive contribution to overall diversity. It provides reliable base load generation and uranium comes from stable countries ensuring a reliable supply. He then considered various reactor designs such as the European Pressurised Reactor (Pressurised Water Reactor) developed by Framatome ANP which has a 60 year life and a 36% efficiency which is favoured by Finland and France. The AP1000 is competitive with CCGT gas plants and has fewer components with a 36 month construction time. The speaker finished by reminding the audience that recent mori polls and also the Channel 4 poll all indicated that a large majority of people in this country now supported nuclear power.

After lunch we had the third session which dealt with supply infrastructure and alternative energy sources. The first speaker in this session was professor Michael Laughton from Imperial College who went into considerable detail about renewables which at present, excluding large hydro and mixed waste, supplied about 1.3% of electricity generation. He estimated for renewables to have a 10% penetration of renewables will need an investment of 8 to 12 billion capital. He then considered biofuels and wind power. As for biofuels, Professor Laughton noted that for a typical 30-40 MWe power station an area of 100 km<sup>2</sup> of forest crops would be needed. As for wind power system, power supply security constraints will limit renewable generation, most conventional plant being needed for back up. With wind power there are a number of unknowns such as the average UK annual load factor which is at present for 2003 stated as 24.1% (Digest of Energy Statistics 2004). Unknowns with regard to power supply include short term wind behaviour and the need for conventional plant as back up so that the electricity suppliers are able to meet peak demand. Matching wind to demand is difficult with problems occurring if there is too little wind below 5 m/s and too much wind above 25 m/s. To transfer the proposed 14 000 MW of wind capacity being planned in Scotland will need billions of capital to upgrade the grid. The maximum export capacity to England and Wales is 2200 MW.

The next speaker in this section was Patrick Heren, Managing Director of Heren Energy Ltd. who considered UK gas imports and the security of a competitive gas market. While gas imports will rise from 5 bcm/year in 2004 to around 60/70 bcm/year in 2010, this will be more than matched by new construction import capacity of 122.3 bcm/year by 2011. A criticism of European gas merchants is that they use the spot market at Zeebrugge as a source of cheap gas which has the potential to undermine the long term contract arrangements with the Russians and the Dutch and

cut their margins. The speaker made the point that security of supply lies in the application of competition law to those very large interests that block the economic flow of energy.

The next speaker was Simon Griew the charging and forecasting manager of National Grid Transco who considered the gas and electricity distribution networks. He also highlighted the huge investments which will be necessary for renewables to be integrated into the electricity grid and the transfer of power via upgraded transmission between Scotland and England.

The final session of the seminar was on the corporate view, social responsibility and risk involved. The first speaker was Jon Bird director of external affairs, CE Electric and chair of the CBI security of energy supply working group. He gave the CBI view of the present UK energy situation and said there was the perception of a credibility gap between the government position on energy and that of CBI members. He said the CBI supported the government and the EU efforts to promote liberalisation of energy markets. He also posed the question "will the market encourage investment?" Concern has been expressed by members of the CBI about gas imports and the loss of coal and nuclear. The second speaker in this session was James Smith the chairman of Shell UK who made it clear that the energy transition could only be effectively managed by taking account of technology, regulation and consumer preferences. The final speaker was professor John Gittus a world expert on risk. He analysed the likelihood of interruptions to UK supplies of LNG, piped gas and nuclear power in 2020 due to accidents, fire, flood, terrorists and political intervention, (the Russian state gas company Gazprom has already turned off the gas to Turkey and to Belarus). The risk was the lowest for nuclear power. The speaker also mentioned the disastrous effect on GDP of such interruptions. The 1974 oil imports interruptions led to a 7% drop in GDP for Japan which Japan has never recovered from to this day. Our reliance on imported gas could lead to energy shortfalls that could reduce GDP by over 7% with a probability of 2%. Nuclear plant is forecast to be more than 10 times safer than gas pipelines or LNG.

## Moving beyond global warming 'theory'

This presentation to our group by Piers Corbyn on 2<sup>nd</sup> February this year generated much debate; here are two sets of views.

### ***An introduction to the IPCC***

By Simon Roberts ([simon.roberts@arup.com](mailto:simon.roberts@arup.com)) and Jake Hacker (Arup)

Global warming and climate change are particularly complex issues with possibly profound consequences for the earth and life (in general). Seriousness of the *consequences* demands an investigation while *complexity* means the form of the investigation is probably unique in the history of scientific endeavour.

Many specialists, and specialisms have a part to play in furthering our understanding of climate change because this is not a single-issue problem. The Intergovernmental Panel on Climate Change (IPCC, <http://www.ipcc.ch/>) was set up by the World Meteorological Organization and the United Nations in 1988 to review scientific information on climate change. The panel's most recent report in 2001, the Third Assessment Report (TAR), represents nearly three years of work by approximately 450 Lead Authors and more than 800 Contributing Authors. During the expert and government reviews, comments from approximately 1000 government and expert reviewers were received, which were carefully analysed and assimilated to revise the drafts with guidance provided by Review Editors.

Global warming is the subject of much emotive and often misleading debate in the media and from lobbyists on both the "environmentalist" and fossil fuel industry 'sides'. It is also the subject of much detailed peer reviewed science which for the most part is objective and thorough.

The aim of the IPCC process is to communicate that science to policy makers not to take any moral or political stance.

The 3-volume TAR is thorough but daunting document, perhaps awaiting one of those publications that package up difficult and lengthy subjects into more digestible chunks; a "Dummies guide to the IPCC". Many of the climate change facts and future predictions we read about come from information reviewed by the IPCC.

We at Arup are working with other organizations, such as the University of Reading, to understand the climate change science and consider its implications for our work as design and engineering consultants. The summary below seeks to explain some of the conclusions from the IPCC together with how these relate to Mr Corbyn's ideas (that solar particles and sun-earth magnetic links control climate change).

### **On the greenhouse gases:**

One area of the IPCC assessment in which there is really quite a high degree of confidence, is the finding that the present increase in atmospheric CO<sub>2</sub> is due to anthropogenic sources (mainly fossil fuel burning, but also deforestation and cement manufacture) - and that's 100% due to, not just predominantly due to! We know this with a high level of certainty for the last two decades, from measurements of changes of the atmospheric O<sub>2</sub>/CO<sub>2</sub> ratio that show the effects of fossil fuel burning on depletion of atmospheric oxygen. For the whole industrial period, we have direct measurements of CO<sub>2</sub> uptake by the oceans and good estimates of the amount of fossil fuels that have been used. These measurements place strong constraints on the possible direction of fluxes in the carbon cycle. Some of this evidence is described in the TAR and some further supporting evidence has come to light since. While it is certainly true that in the past naturally process caused CO<sub>2</sub> to be released and absorbed into stores, at the moment the natural stores are acting as a sink for fossil fuel and other anthropogenic CO<sub>2</sub>. This is not a matter of "belief" but as close to scientific fact as one can probably get.

Some of the changes in other greenhouse gases are 100% anthropogenic (e.g. CFCs) while others are only partly anthropogenic (e.g. CH<sub>4</sub>), pointing to natural feedbacks with the changing climate; however the anthropogenic sources are by far the largest contribution.

The above says nothing about climate - is just an assessment of changes in atmospheric composition.

### **On climate:**

We know with some certainty that the radiative forcing on the Earth from the observed changes in greenhouse gases is consistent with the observed changes in global mean temperature, on the basis of well understood physics. (As has been said, "If we've got the greenhouse gas forcing wrong, then quantum theory is wrong!")

Mr Corbyn appears to assert that greenhouse gases do not affect climate, but rather, vice versa. This is at odds with the understanding of how the Earth's surface temperature is maintained at a level that is higher (around 33 °C higher) than it would be in the absence of an atmosphere that absorbs long wave radiation.

It is correct to say that in the Earth's past, greenhouse gas concentrations have shown a slower modulation than short-term variations in climate; nevertheless they are strongly correlated with longer-term climate changes and are implicated in producing those changes.

In the past, the timescales of processes that can change greenhouse gas concentrations have been slower than other processes affecting short and medium-term climate variability.

What is highly unusual (possibly unique) about our present period of Earth history is that there is a mechanism - human beings - that can influence atmospheric composition on relatively short timescales.

**On the solar forcing issue:**

The IPCC assessment acknowledges that solar forcing has increased over the 20th century and that solar forcing is likely to have played a role in climate changes prior to the industrial era, and this is discussed in the IPCC reports.

However, there is a very high uncertainty regarding the size and timing of changes in solar irradiance (e.g. see pp.380-385 of the TAR and discussion at <http://earthobservatory.nasa.gov/Study/VariableSun/variable.html>).

As far as can be gleaned from the estimates made:

- Solar variability is likely to have played an important role in the increases in global temperature in the early part of the 20th century,
- in the latter part of the century, the changes are too small to account for the observed warming, without there being amplification processes in operation.

There are some candidates for the latter - of which Mr Corbyn presents one - but these are at present only poorly understood. Furthermore, natural forcings (solar and volcanic) are believed to have been negative (cooling) in the last few decades and hence it is unlikely that natural forcings can account for the strong increase in global temperature since the 1980s, even if unknown amplification mechanisms for solar forcing are operating. It is interesting to note that some of Mr Corbyn's graphs also appear to also show little correlation since around 1980.

**In Conclusion:**

Most 'open minded' climate scientists would probably take the view that "the jury is still out" on the subject of what exact role solar variability plays in the Earth's climate. It probably plays some role but there are also known processes of variability here on Earth (e.g. atmospheric and ocean circulations, cryosphere, biogeochemical cycles, etc.) which Mr Corbyn appears to have disregarded in his discussions

There is a well understood and well observed effect - the change in the greenhouse gases - that can explain the current period of climate change. Hence, even if there were some solar forcing effect present and/or other process that are currently being overlooked, this does not negate the fact that we should expect anthropogenic greenhouse gases to be having a significant impact on global climate.

## **Climatic Change and Political Correctness**

A personal view from Peter Gill (gill.pf@virgin.net)

Avid readers of our Newsletter will have noticed my write-up of Piers Corbyn's lecture delivered at IoP in February of this year providing an alternative explanation of climatic change through the interaction of solar particles with the Earth's magnetosphere. Such readers will have also noticed the short article by two employees of ARUP. They addressed none of the issues or evidence that Piers Corbyn raised or gave in his presentation.

In April IoP distributed its sponsored paper 'Climate Change Prediction, A challenging scientific problem'. The paper, which is in booklet form, was written by ex Hadley Centre Director, Professor Alan J Thorpe. I would recommend that anyone who has an interest in this topic but who has not received a copy write to the IoP's Policy Officer, Tajinder Panesor for a free copy.

Alternatively you can download it as a PDF from the Institute's website at <http://policy.iop.org/Policy/HE/index.html>.

There is much in Professor Thorpe's paper with which few would take issue and broadly speaking it is a useful introduction to the subject in general and climatic modelling in particular. However it is somewhat marred in my view by its political rather than scientific correctness in certain areas. The flyleaf contains the following statement endorsed by IoP: "It is hoped that this paper will increase believability in these models (*climatic models*) and be persuasive that anthropogenic (*human*) activity is likely to be causing global warming. It aims to convince policy-makers, the general public and the scientific community that the threats posed by global climate change are real."

In his introduction Professor Thorpe argues that not all views on climate change are equally defensible on scientific grounds and cites in particular a statement by Melanie Phillips from the Daily Mail of 12<sup>th</sup> January 2004 as follows: "The claim of man-made global warming represents the descent of science from the pursuit of truth into politicised propaganda. The fact that it is endorsed by the top scientist in the British government shows how deep this rot has gone."

In discussing "What is climate? Evidence of Change" Professor Thorpe makes reference to the Vostok ice core record covering the past 400,000 years. He reproduces a glacial cycles diagram (J.R. Petit et al, Nature, **399**, 429-36, 1999). This shows the variation of inferred mean air temperatures, carbon dioxide and methane contents over four glacial cycles. The strong correlation between these variables is obvious to the eye. Professor Thorpe comments that this relatively short period (about 0.01% of the lifetime of the Earth's atmosphere), whilst important for understanding the causes of climatic change, is not of much interest to the development of human societies. Instead Professor Thorpe lays more stress on recent history stating "There is an accepted global change over the last 100 years of nearly 0.8°C in the global average near surface temperature thus laying the foundations for his later explanation of the effect in terms of emissions of greenhouse gases from fossil fuels."

Returning to the Petit data I would have thought it of interest to the reader to have explanations of both the rises in temperature from glacial periods to warm periods and vice versa. Professor Thorpe is silent on these issues. There were of course not many human beings on the planet for almost the whole of the 400,000-year period and they were in any case not burning fossil fuels. So if one is explaining the rise or fall in global mean temperatures by rises and falls in carbon dioxide and methane levels one has to consider both the production and absorption of these gases by natural processes. One would also have to debunk the alternative explanation that the rises in levels of these gases are a consequence rather than a cause of global warming as a result of some other mechanism. Interestingly the maximum levels of both gases reached approximately 325,000 years ago were similar to current levels. About 25,000 years later they had dropped well below current levels. It would have been appropriate for Professor Thorpe to comment on this issue as clearly there is a compensating mechanism that prevents runaway concentrations operating roughly every 100,000 years. By the way we are now a little overdue for another drop into a major ice age with or without the intervention of mankind!

In the next section "The physics of climate" provides a simplified explanation of the greenhouse effect and states that pre-industrial concentrations of carbon dioxide were about 280 ppm whilst the current level is around 370 ppm attributing the difference to human emissions from for example the burning of fossil fuels. In common with many authors on climate change Professor Thorpe fails to discuss the natural mechanisms of emissions and absorption of greenhouse gases or indeed their levels. Without this information I suspect that the average reader will find it difficult to gain a proper perspective. In fact each year, circa 220 billion tonnes of carbon dioxide are emitted by natural processes. Mankind's additional contribution is currently around 10 billion tonnes and is maybe the same order as the variability in the natural processes. Most of this carbon dioxide is reabsorbed, roughly 50/50 by the oceans and by vegetation on land. Indeed it would be possible to argue that had we not been busy clearing forests over the last thousand

years or so and particularly over the last few hundred years perhaps rather more carbon dioxide would be naturally sequestered.

One of the main stated aims of the paper is to convince everyone that the threats posed by global climate change are real. Frankly I would have thought that just showing the Vostok ice core data would be enough to convince most people on that score. The other stated aim is that it is anthropogenic activity that is likely to be causing global warming. Whether you are convinced on this score depends on your confidence on the present climatic models. Whatever the case the fundamental question is whether we can do anything about changing the climate by changes in mankind's behaviours. Professor Thorpe cautions against the search for the one and only cause of climate change but in the same breath states that the increased carbon dioxide levels are due to mankind's emissions and it is the latter that largely determine the global temperature increase. Politicians need simple explanations and have latched onto carbon dioxide in particular as the culprit. Conveniently this can be taxed and other taxes can be kept high for similar reasons. Whether this will enable us to re-engineer the atmosphere remains to be seen. Of course the reality is that climate change would happen whether or not we give some help. The question that follows from this is how to protect human society from such changes? It is interesting that little prominence is given to mitigation plans and actions rather than to attempt to seek to re-engineer the atmosphere.

If mankind's activities are indeed the reason for the recent increase in average global temperatures then the main factor is the size of our population. When the world population was much smaller our activities even at current levels per head would have had little measurable effect. Conversely as we have no political will to reduce our population then we will continue to adversely affect the planet in greater numbers albeit at slightly lower levels per head. I suspect that mother nature will not ultimately allow this to happen and will use her arsenal of bacteria, viruses, impacts from extra terrestrial bodies and climate change to control or eliminate our numbers.

## **International boost for women in physics**

Joanne Baker (Oxford University Physics and UK delegate)

Increasing the number of female physicists was the focus of the Second International Union of Pure and Applied Physics (IUPAP) meeting on Women in Physics, held in Rio de Janeiro, Brazil, from 23-25 May 2005.

The Institute of Physics (IoP) organised a UK delegation of eleven members. Dr. Julie Corbett (representing the Institute of Physics) and Terri Jackson came from Northern Ireland. The UK team was the third largest after Brazil and the USA.

One hundred and forty five delegates from forty-two countries assessed the progress that has been made in recruiting, retaining and promoting women physicists worldwide. The consensus was that awareness of equality issues was greater, but that firm action now needs to be taken to boost the number of women throughout the physics sector.

Through a series of topical workshops, the conference prepared six resolutions. They direct IUPAP to implement gender-neutral hiring, selection and assessment procedures, promote networking and raise the profile of its female members. IUPAP will vote to ratify the recommendations at its General Assembly in October.

As a first step, IUPAP President, Yves Petroff, pledged to include women on all IUPAP committees and to require women are included as organisers of and invited speakers at IUPAP sponsored conferences.

Delegates sought examples of best practice to take to their home countries. These included

setting up searchable databases of women physicists and using site visits to improve the institutional climate. A new survey from the American Institute of Physics highlighted the period between high school and college graduation as being where the greatest dropout of women occurs.

Ann Marks – Chair of the IoP Women in Physics Group – spoke of how the UK has made recent progress through major Government and IoP initiatives, but the impact of these is still awaited. The UK delegation report is pending.

## **Contacts**

This newsletter is produced by the Energy Management Group of the Institute of Physics, a professional group comprising members with interests in all aspects of energy use, energy policy, power generation and energy technologies. Further information can be obtained from the following:

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Group honorary secretary: Yasmin Andrew ([Yasmin.Andrew@jet.uk](mailto:Yasmin.Andrew@jet.uk))

The rest of the committee are:

Webmaster: Simon Roberts CPhys MInstP

Group education representative: Richard Bloodworth

Ordinary members: Peter Gill , Peter King CPhys FInstP , Alan Morton

Contributions to the newsletter from group members are always welcome. In particular if you would like your company or research institute to feature in the snapshot section, please draft a short description and send it by e-mail for inclusion. The deadline for contributions to the autumn newsletter will be mid-September 2005 and all contributions should be sent to the Group Honorary Secretary at the e-mail address above.

For further information on the Energy Management Group see our website at [www.iop.org/groups/emg](http://www.iop.org/groups/emg)