

Energy Group AGM

Wednesday 15th October, 2008

16:45 – 17:15

Institute of Physics, 76 Portland Place, London W1B 1NT.

The formal notice and agenda have been sent separately. We urge you to attend as this will help ensure the vitality of the Group, the committee, and the activities we undertake.

Peter Gill has tabled discussions on the location of future meetings, representation of members' views to IOP, and energy and climate change

Nomination for committee members and Group officers are invited and should be made to the Acting Honorary Secretary, Jenny Love (energygroup.sec@googlemail.com) before **Friday 3rd October**.

This year elections will be held to fill the following vacancies: Chair, Honorary Secretary, Honorary Treasurer, and Ordinary members.

If you unable attend the AGM and have issues you would like to be raised at the meeting, please contact the Honorary Secretary.

Attendance is free and it will be followed by a talk, 'The Reliability of CO₂ Ice Core Studies' by Professor Z. Jaworowski, which will take place at the nearby Energy Institute at 18:00.

This newsletter is also available on the web and in larger print sizes.

The Energy Group website is <http://eg.iop.org>

The contents of this newsletter do not necessarily represent the views or policies of the Institute of Physics, except where explicitly stated.

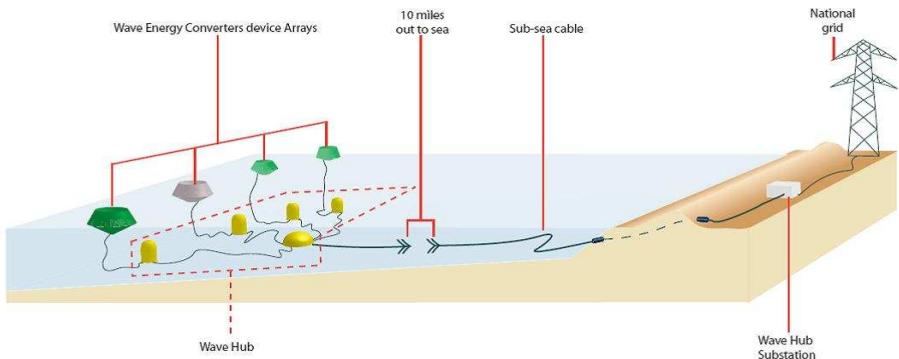
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Wave Hub

**Nick Harrington,
South West of England Regional Development Agency**

The Wave Hub forms the final step for wave energy conversion devices to prove their performance in strong sea conditions before they are likely to be taken on by industry into commercial scale projects around the UK and elsewhere. The project, led by the South West RDA, is aimed towards arrays of full scale machines after the designs have been conceived and early prototypes tested elsewhere. The first port of call for testing of prototype small-scale devices is the New and Renewable Energy Centre (NaREC) in Northumberland which has a wide portfolio of activity including early stage wave devices and strong engineering support for testing in an outdoor wave tank. For the next stage of development, the European Marine Energy Centre (EMEC) in Orkney provides a near-shore test site for prototype wave and tidal devices at full scale

The Wave Hub can be described as an 'electrical socket'. To be built off the north coast of Cornwall at a depth of 50–60 metres, it will provide a 'plug and play' site where companies developing machines to generate electricity from the waves can demonstrate and improve their design by deploying arrays of full-scale devices over several years. The 8km² area of sea has already been consented and will allow each of four developers 2km² within which to moor their devices. Each array of devices will be able to generate up to 5MW. Coming to Wave Hub allows developers the opportunity to deploy their devices in real sea conditions but without the time and expense of negotiating a separate site lease, their own assessment of environmental conditions and installing a power cable.



The concept of Wave Hub is simple: locate an area of sea with strong incoming waves, carry out an environmental assessment and obtain regulatory consents and then design and install the system ready for device developers to connect. The project is anything but simple. It will not be installed until 2010 and has been under development since 2003. The challenges, even this far, have demanded the expertise of civil, electrical and mechanical engineers, physicists, mathematicians, environmental scientists, lawyers, navigational experts and many others.

This preparatory work, funded by the South West RDA, has been undertaken in close consultation with device developers in order to understand their requirements for a project of this nature. It is essential to construct a 'socket' which is compatible with the machines planning to connect to it. Likewise, the power generated by each developer's device would need to transfer smoothly to the national grid and meet the specification of the grid operators. The four companies currently looking to take a berth at Wave Hub each have their own unique methods of operation, resulting in widely differing needs from a demonstration facility such as this. The sizes of the various devices also impact on the design criteria. One berth could have as many as 20 devices located within it, whereas the next may house only two or three larger machines which move in a different manner and have different mooring methods. Not only will the Wave Hub site provide a testing ground for the devices themselves, the amount and quality of data that could be gathered from the operation of the arrays will be invaluable for future design concepts and the renewable energy industry as a whole.

Not surprisingly, the amount of electricity a device can generate is closely related to the power of the waves at the point where it is moored. Unlike wind, waves arrive from different directions and some devices can, within limits, be tuned to optimise their output in stronger or weaker waves. At the same time, the devices need to survive the worst the sea can throw at them and an interesting area for future research is how to predict waves that could damage the devices and allow them to shut down but to minimise that downtime. The BERR website (www.renewables-atlas.info) contains charts of the energy likely to be available around different parts of the United Kingdom. This work is based on available wave measurements and weather data. Readings collected from a buoy on the Wave Hub site show a reasonable correlation. However, little is known about the likely effects of bathymetry, tidal streams and currents or predicting the energy output of machines in the shadow of other machines. Annual variability of the

resource is another factor¹. Part of the important research programme associated with the Wave Hub project involves numerous sampling points around the site to gain a far greater knowledge of these effects. This will, I am sure, help to provide the level of confidence in resource measurement likely to be required to finance large scale projects in future years.



Staying with the role of physicists, what effect will this project have on the movement of sediment and on erosion or accretion of the shoreline? And for that matter, will it affect the quality of waves reaching the shoreline? The last is not at all a frivolous question. Cornwall is Europe's premier destination for surfing for

good reason and many businesses depend on making or selling wetsuits and equipment, teaching and accommodating visitors. A coastal processes study formed part of the application for planning permission² and a further study was carried out by the University of Exeter³. Later, at the request of the British Surfing Association, yet another study was carried out by ASR⁴, reviewing the assumptions and modelling of the previous reports. These studies approached the analysis in different ways but all concluded that the impacts were likely to be negligible. Coastal engineering is a leading expertise of the University of Plymouth and their research team, in collaboration with the University of Exeter and the South West RDA, has established the Peninsula Research Institute for Marine Renewable Energy (www.primare.org) in South West England which is made up of a team of world-class researchers to address the wider considerations of all aspects of marine renewable energy.

They will be using data collected around the Wave Hub site and further towards the shore to determine the accuracies of the models used in

¹ Applied Wave Research, November 2006, "The wave power climate at the Wave Hub site". Available from the Documents link at www.wavehub.co.uk

² Halcrow Group Ltd, June 2006, "Consent Application – Appendix A: Coastal Processes". Available from the Documents link at www.wavehub.co.uk

³ Millar, D.L, Smith, H.C.M, and Reeve, D.E, 2007, "Modelling studies of the sensitivity of the shoreline wave climate to the proposed wave hub development off the north coast of Cornwall", *Int. J. Ocean Eng*, **34**, pp 884-901.

⁴ ASR Ltd, April 2007, "Review of Wave Hub Technical Studies: Impact on inshore surfing beaches". Available from the Documents link at www.wavehub.co.uk

these predictions. This work will provide valuable knowledge for determining coastline impacts for further projects around Cornwall, and elsewhere in the world.

So much is still to be learned about the operation of a site such as this off the coast of Cornwall, not least showing the effect it will have on the marine flora and fauna such as passing whales and dolphins, commercially important fishery species and organisms on the sea bed. Extensive studies involving the Universities of Exeter and Plymouth will show if the effects are benign, as they are expected to be.

Wave Hub will be the world's first of its type, and will reinforce the UK's leadership in the development of marine renewable energy. This could lead to expertise in design, monitoring, construction, operation and research which would be greatly in demand as the requirement for low carbon alternatives for energy grows. It is estimated that marine energy could supply up to 15%-20% of the current UK consumption, with a massive saving in emissions when compared to fossil fuels. The cost of production is currently high however, and the technology is not yet proven. It is expected that the Wave Hub will significantly speed up the availability of commercially proven technology.

Nick Harrington is the General Manager for the Wave Hub project. For more information, please see: www.wavehub.co.uk

Pivotal Points in the Power Programme – Can the Looming Power Gap be Filled?

Terri Jackson

With the retirement of many of the present nuclear stations and the closure of several coal-fired power stations due to the EU Large Combustion Plant Directive (LCPD), a considerable gap in electricity plant capacity will open up around the years 2012 to 2018. If this gap is not filled then without regular electricity supplies the UK economy will inevitably be affected. Nuclear and coal account for around 47% of electricity supply today.

A 2006 report from the international consulting group Logica CMG highlights the consequences for the economy if such a power gap is not filled. For example, if by 2012 the gap was 5%, which does not at first glance seem a lot, Logica estimate it would mean energy companies would have to shut down operations at peak use and the loss to businesses could be £7.9bn per year. If the gap was not filled by 2015, the impact on GDP could be £108 billion per year; £3700 a year for every working adult in the UK. This would mean disastrous consequences for the whole UK economy. By 2018, a DTI foresight programme has suggested that electric and plug-in hybrids could take 50% of the new car market. The increasing demand for home entertainment will further increase demand for electricity and will tend to undermine efforts to reduce CO₂ emissions.

So how might this power gap may be filled? As any new nuclear plants are unlikely to be ready before 2020 at the earliest, I see four main options:

1. build more gas-fired plants,
2. build more coal-fired plants,
3. build more renewables (essentially this means more wind capacity),
4. extend the life of the current nuclear plants.

Regarding **option 1**. Gas fired electricity plants are much more sensitive to fuel price than are either coal-fired or nuclear plants. Thus high priced imported gas into the UK will mean ever increasing electricity prices. In 2004, the UK became a net importer of gas; by 2015 it is estimated that the UK will be at least 40% dependent on gas-fired plants for electricity supply. Gas plants will be increasingly dependent on foreign supplies from Russia and Iran. The wisdom of depending on supplies from Russia must raise serious doubts bearing in mind that Russia has already turned off the gas to the Ukraine and Belarus. There are other problems with gas from Russia

as well as security of supply. Demand for gas in Russia itself is increasing and the investment climate for energy companies is becoming much more difficult as BP will testify. It is estimated that gas imports into the UK will be 90% of supply by 2020. There is no doubt that Russia is trying to tighten its grip on UK gas supplies with its proposed new 'South Stream' pipeline under the Black Sea, by-passing Turkey and in direct competition with the EU pipeline via Turkey. The new Norwegian pipeline will meet about 20% of UK supplies in the immediate future if it is working. Recent news that it may be out of action for a year is not encouraging.

Option 2, the building of more coal fired plants. The International Energy Authority has predicted that world electricity prices from coal will double by 2030. However this option may mean extra pollution as coal produces twice as much CO₂ emissions compared to gas. In the UK, coal now represents 37.5% of UK electricity while coal imports in 2006 represented 75% of the coal used. The EU's LCPD will be in force by 2016, so preventing the uncontrolled use of high sulphur coal. Also, the future price of coal imports is an unknown quantity.

The topical and controversial **option 3** is to increase renewables. In 2006, electricity from renewables was about 4.6% of total electricity supply. Half of this was from biofuel sources. The desire of the Government to increase electricity from renewables will essentially mean more wind farms both on- and off-shore. However, the cost and unpredictability of wind-based electricity will mean big problems as wind generation can only displace a modest amount of conventional plant and still maintain the same level of security of supply which the grid authorities are mandated to do. A significant capacity of conventional plant will still be required when wind output is low. The grid authorities have to be able to meet peak demand and wind on its own cannot provide a reliable source of power. It is the cost of conventional backup plant that represents the increased costs associated with the intermittency of wind power. There will also be transmission reinforcement costs and further distribution costs.

It has been pointed out by Centrica's director of power generation that the cost of the proposed London Array will be a staggering £80bn. It is so costly that Shell have withdrawn from the project entirely. The intermittency of wind power and the problems that stem from that was well illustrated in the massive European grid collapse which led to the blackout of 4th November 2006. The reason for this was the problem of accommodating the 18,000 wind turbines in the German grid to give a mere 6% of their electricity supply. This was noted by the European grid authority, the UCTE, in their report. Deutsche Energie Agentur in a report sponsored by the German Government records that while wind power

capacity would reach 48GW by 2020, it would be so intermittent and so unreliable that it would be equivalent to only 2GW of stable fossil fuel capacity! The average load factor for wind turbines is at most 30%, so wind capacity of 600MW will only give at most about 200MW of continuous electricity supply.

The **fourth option** of extending the life of some of the present nuclear stations is a very risky strategy fraught with problems. As the present stations age there is an increasing likelihood of breakdown. Boiler problems could arise and there may be a deterioration in the state of the graphite moderator. Hinkley Point B and Hunterston B have been operating well below their usual load factor due to boiler problems. The output from British Energy's nuclear stations has declined over the last six years and this trend is likely to continue. The message from this is that the proposed new nuclear stations should have been built years ago.

The Future – Electricity Rationing?

There is no doubt that a power gap in electricity supply is opening up over the next six to eight years with frightening prospects for the UK economy if it is not filled. The BERR Energy Markets Outlook 2007 expects that by 2015 some 18GW_e of capacity will have closed (24% of the present total). Almost all of any planned new capacity will be gas-fired. Nuclear Issues¹ (June 2008) asks the fundamental question “will this gas be available in 2015 and at what price?”. The BBC programme “You and Yours” on 20th June claimed that London is already suffering from a chronic electricity shortage and that a number of internet Data Centres are considering relocating to Amsterdam and Paris as apparently the Government has made it clear that the 2012 Olympic Games has priority as far as electricity supply is concerned. If this is the situation now, what will it be like in 4 to 8 years time? Electricity rationing to minimise the effects of blackouts now looks unavoidable with possible disastrous consequences for industry and households.

This article is an abridged version of a presentation made by Terri at the Institute of Physics Scotland Branch AGM as one of talks for “Physics and the Energy Gap”, held in Glasgow (May 2008). Terri is formerly Chair of the Energy Group.

¹ Nuclear Issues is the Newsletter of the organisation, Supporters of Nuclear Energy.

WREC-X

Simon Roberts reports on the first day of the 10th biennial congress of the World Renewable Energy Network held in Glasgow between 19th-25th July.

WREC¹ is a major forum for networking between consumers, governments, industry and academia, addressing issues of the source and nature of energy, the security of supply and the equity of distribution, the environmental impact of its supply and utilization. There is a strong emphasis on helping speakers and attendees from developing countries.

The opening session had speakers from Strathclyde University (the hosts), Islamic Educational Scientific and Cultural Organisation, UNESCO, EU, ICTOP (Trieste), BRE, AXA (insurer and sponsor). There was much in common between their scripts, often sounding like wish lists: affordable energy, climate change mitigation, supporting transition of the energy supply, securing the energy supply, industry competitiveness, and lifestyle. Dr Ali speaking about Abu Dhabi described a “green leap into the 21st century” including rehabilitation of lost habitats and species. The 7 Emirates have a 40-year programme to spend \$6bn on R&D with one early project of \$350m on a 500MW solar plant.

The star attraction was Scotland's First Minister, Alex Salmond. He gave a rousing speech extolling Scotland's unique wind resource of 25% of the EU's offshore wind capacity. Holyrood's aim is much more ambitious than Westminster's – 31% renewable electricity by 2011 and 50% by 2020. He announced approval for the largest on-shore wind farm in Europe – the 540MW Clyde Farm. Mr Salmond was then surrounded by an avid press corp, an unusual sight at an energy conference. Professor David Elliott (Open University) who studies energy policy, observed that Holyrood tend to do the opposite to Westminster. So where London's support marine power research has barely got off the ground (some say “has failed”), Edinburgh in contrast gave out £14m of grants straight off (their £20m Salter Prize).

Rainer Hindrichs-Rahlwes of the German Renewable Energy Foundation gave the inside story of why Germany has the most successful EU renewables programme. The basis is a feed-in law in which every producer has the right of connection and prices are guaranteed for 20 years. Each technology has its own degression, ranging from a low 1% annual reduction of tariff (premium) for established hydro to a rapid 10% annual reduction for grid-connected PV. Despite this appearing to be a huge subsidy programme, recent analysis by David Elliott has shown it delivers lower cost RE investment compared to the UK's renewable obligation

¹ <http://www.wrenuk.co.uk/>

certificates (ROCs). It avoids the uncertainty inherent in freely-traded ROCs that add a cost in investment plans for having to insure against a drop in the ROC price. The 3 “secrets” for the German approach are: broad consensus on secure investment, especially for new players; simple and reliable instruments; and strong public support. In Jan 09, a new law will oblige new buildings to have 50% of supply from biomass and 15% from solar.

I was looking forward to a couple of big names I had not seen present before. Hunter Lovins (with her former husband Amory and Paul Hawken) is famous for “Natural Capitalism” – a standard text for sustainable development. Lovins is easy to spot with her hallmark stetson, rather incongruous in a modern conference hall. Her message was that “reduced emissions mean increased profits” supported by a stream of statistics. But her fervour went too far. For example, while natural daylighting has been demonstrated in a few small-scale trials to increase retail sales, school exam success and recovery rates in hospital, it’s clearly naïve to extrapolate this to increasing profits generally. The audience became impatient as she ignored the chair’s signals for going over time.

Professor Martin Green of the University of New South Wales, Sydney, has a distinguished role in PV. His research team invented the laser-groove buried grid technology in BP Solar’s silicon cells (front contact masks less of the active area by being edge on). He showed the familiar graph of efficiency / cost for PV technologies for the first 3 generations. The first two have a maximum theoretical efficiency of 31%, but the Carnot limit for converting solar energy gives a tantalising 93% (6000K of the sun and 300K of the earth). His group are working on the 4th generation for which they have calculated 74% maximum efficiency. The new technology will consist of several junctions in tandem. He mentioned multiple exciton generation, hot carrier cells and quantum dots with tunneling. Green seeks to use only non-toxic (so excluding cadmium) and abundant materials.

I was speaking in place of my colleague, Chris Luebke, and I presented a different view from the mainstream – despite the enthusiasm for low-carbon technologies, the majority contribution to energy supplies is from fossil fuels. However, their geology looks likely to dictate imminent declining supplies, “peak oil”, “peak gas”, etc. I made an uneasy prediction that national energy security will trump a low carbon agenda. Renewables investment will grow, but only alongside coal and whatever domestic supplies we have, “to keep the lights on”. I also presented ECCO modelling as a methodology to test national investment plans for physical and economic feasibility².

² Presented at the IOP on 9 October 2007. The slides and transcript are available in the 2007 section within the Events area of the Energy Group website, <http://eg.iop.org>

A Manifesto for a Low Carbon Future

Colin Axon reports on the symposium held on 6th September 2008 to mark Dr. Brenda Boardman's retirement from the University of Oxford.

Brenda Boardman¹ assembled a set of renowned energy researchers to recommend both practical and demanding policy actions for various UK Government Departments. This was a lively and stimulating event.

The Treasury

Dr. Cameron Hepburn² thinks that the EU Emissions Trading Scheme (EU-ETS) should be supported as a mechanism, but it requires reform and much tougher targets. Carbon has been trading at about €25 per tonne, which is too low a price. The main problem, as he sees, it is the first phase of ETS had only 1% of permits auctioned (99% given away free) and consequently the price of carbon crashed. The next phase is little better with only 7% being auctioned. Hepburn doesn't support the idea of windfall taxes.

Research and development incentives (tax breaks?) are the way to increase investment by companies. R&D rates in the UK have been declining since the 1970s and have reached "*absurdly low levels*". Cameron said that new coal-fired generating stations should only be given permission if carbon capture technology is fitted from the outset.

Looking beyond the UK, Hepburn thinks that the Clean Development Mechanism is a good way to encourage sustainable development; he wants all nations move to a cap and trade system.

Department for Business, Enterprise, and Regulatory Reform (BERR)

The separation of 'Innovation' from 'Business' and 'Enterprise', according to Catherine Mitchell³, is a barrier to lowering carbon emissions. Innovation policy has been given to the Department for Innovation, Universities, and Skills. In her view, BERR should have sustainability as a core responsibility. This would, Mitchell claims, lead to a more realistic energy policy where energy security, societal aims, and equity (locally and globally) were considered together. She was adamant that demand reduction is right

¹ Brenda remains Senior Research Fellow at the Environmental Change Institute, and is the former head of the Lower Carbon Futures research group. Her research continues on energy demand reduction across the UK economy, but particularly the built environment. Through all of her significant output, Brenda has considered the behavioural, technical, economic and political issues. She is particularly well-known for her expertise on fuel poverty.

² Deputy Director of the Smith School for Enterprise and the Environment, and Fellow of New College, University of Oxford.

³ Professor of Energy Policy, University of Exeter.

approach to ensure that we aren't reliant on imported supplies of fuel. Mitchell argued that presently, technology is not the problem – it's economic institutions, legislation, standards, skills, and behaviour. In her view the Renewables Obligation (RO) has failed, yet costs £1m p.a. to run. She thinks we need to move away from a small number of large companies.

Mitchell summarised a number of specific actions for BERR: keep the RO going for legacy purposes only, larger grants for small installations of renewables, implement a feed-in tariff, improve industry skills, create 'low carbon zones', and a complete change of industry regulation.

The Department for Transport (DfT)

Dr. Jillian Anable⁴ said half of the instruments available to the Government are voluntary, their target is only to stabilise emissions from transport, and the focus is only on technological efficiency gains. This problems, said Anable, include: long time-scales, increased costs, rebound effects, and ignoring whole lifecycle emissions. The key, is behavioural change – but not just shifting the mode of transport – it's what vehicles people buy, when, routes used, and driving style to name only four. Her manifesto (for road vehicles) was explicitly about *accessibility* not *mobility* and what she described as a 'whole package' approach – meaning an integrated transport and land use policy. She set out three areas for DfT attention.

Market transformation should be achieved through efficiency gains by tougher mandatory minimum industry standards, with big penalties for non-compliance. For consumers there should be progressive purchase taxes. Our concept of ownership needs to be examined, according to Anable. A national car club should be formed, as the much reduced costs of car use through the small-scale initiatives are not widely understood. Rises in the total cost of motoring remain below inflation, and despite the recent rise in oil price, driving is cheaper in 2008 than 1998.

When considering driving, Anable recommended retesting drivers every 10 years (to include 'eco-driving' skills). She supports road-user charging, but not for congestion. This, she suggested, would offer the chance to introduce a 'National Travel Card' (similar to a personal carbon allowance) and would assist with equity issues. She added that speed enforcement vital for cutting carbon emissions, and if necessary, should be achieved through the use of engine limiters. The use of smart technology is the third main element of her manifesto, including the new card.

⁴ Senior Lecturer, Centre for Transport Research, University of Aberdeen.

The Department for Communities and Local Government (DCLG)

Dr. Joanne Wade⁵ said that DCLG were the least engaged of any Department with respect to energy even though their remit covers social housing, planning, and local government. Wade wants to see mandatory minimum standards for existing buildings; she said that current regulations are too weak and that Councils don't even enforce those. Wade would like to see a ban on selling houses with the lowest levels of energy efficiency i.e. they should be improved before they can go onto the market. She cited Germany as an example of a Government which makes low interest loans available for such improvements.

Another major problem for Government legislation, said Wade, is that it is unclear what a 'zero carbon home' means. Is it the lifecycle of the final materials used or all materials, including waste created during construction? Does it include on-site or near-site renewables? Is it householder use? The UK construction industry has problems with low skills, capacity, and resistance to new practices. There are similar problems with planners. Added to this is the lack of understanding by Councillors.

Wade's summary was that DCLG needs to engage, deal with the existing housing stock, and seriously tackle the skills shortages.

The Department for Environment, Food and Rural Affairs (DEFRA)

The first part of Dr. Boardman's talk was a summary of the presentation she gave to the Energy Group in May⁶. She then went on to stress that DEFRA and DCLG need to work together. To tackle both what Joanne Wade was discussing and the fuel poverty agenda, Brenda suggested that the best approach was 'low carbon zones' with a street-by-street survey of homes to give an address specific database of energy efficiency.

The next part of her manifesto was for a personal carbon allowance (PCA). This scheme would give individuals credits for gas, electricity, petrol, diesel, and flights. Low energy users would be able to sell their surplus. DEFRA have said that "*it is too early to support such a mechanism*", which Boardman described as "*Bizarre*" given that it hasn't even been trialled. Brenda ended by offering up an estimate for the costs of tackling energy efficiency and fuel poverty, with various incentives such as stamp duty rebate and tax reliefs. The total would be about £13bn p.a. which would decrease over time (as the housing stock was improved). She reminded us that the Government has spend £20bn on fuel poverty since 2000, but only 15% of that went to the intended targets.

⁵ Director of Impetus Consulting Ltd.

⁶ 'Fuel and Energy Poverty', a report by Helen Cotterill, IOP Energy Group Newsletter, Issue 28, July 2008.

Chair's Notes

For many years IOP Groups were funded according to a simple formula consisting of a fixed amount for each group plus an additional amount per member. Groups were allowed to carry over unspent monies from year to year. Now groups bid for funds; this new approach was sold to group Officers on the basis that benefits would accrue to active groups at the expense of less active or moribund groups. At the time of the change carry-over of monies from year to year was stopped. The Energy Group is one of the most active groups within IOP and consequently we expected to receive a grant close to our bid which was for £4,756. In fact we received only £3,400, a very similar sum for the year 2008 than we would have received under the old system. The reason that we can put on the kind of events that we do at all is of course that your Committee Members give all their time free of charge and rather less dependent on the budget. However your Committee always endeavours to work with the budget.

Our programme for this year consisted of six meetings in the period January to May, with a seventh and final meeting in October. In fact only six meetings in total had been originally planned including the October meeting, but through some misunderstandings we ran an extra meeting. Your Committee decided that we would make no charge for evening meetings, but we would charge for the two half-day nuclear energy meetings. All Energy Group events so far this year have been based at IOP HQ and as the group is charged for the hire of IOP rooms and for catering most of our grant funds and the profit achieved through running the nuclear meetings has been spent with IOP. In fact of the over £3000 spent on evening meetings so far 37% was spent on room hire and technician attendance, 20% on tea/coffee, 28% on nibbles and 15% on wine. For reasons that will become apparent your committee needs member input on whether the current venue of meetings at IOP HQ is appropriate for future meetings.

With the above background it was a surprise that in early July the Officers of the Energy Committee received an e-mail from the Hon. Sec. of the Group Coordination Committee (GCC) to the effect that we had massively overspent our budget for the entire year by end of May, that we should not commit any further funds and that we should meet with IOP staff to discuss the position. On analysis we discovered that the figures that the GCC Hon. Sec. had been provided did not take account of the profit from the nuclear meeting and consequently at the time of the receipt of the e-mail, and with only one meeting to go in our programme, we were still in the black. Since it was clear that by the end of the year we would be over budget, we met with IOP staff to discuss the position. Five members of the Group Committee attended and two members of IOP HQ staff. The time

costs of those involved by far exceeded any possible overspend of the group budget which your Chair pointed out and included in a three page paper explaining our recent circumstances, exactly what had occurred including the misunderstandings, errors etc. against a background of incomplete and very late financial information from IOP. The outcome of that meeting was that the Group Committee should strive to break-even by the end of the year. Clearly under existing planned arrangements this would be impossible without eliminating the room and refreshment charges and obtaining income from other sources to fund the speaker's travelling and hotel expenses. We therefore approached the London Branch of the Energy Institute (EI), the IOP's Environmental Group and another potential sponsor. Fortunately EI was able to co-sponsor the meeting and we are able to hold the 'Reliability of CO₂ Ice Core Studies' Meeting at EI on 15th October (17:30 for 18:00 hrs) - details at the end of the Newsletter.

Major IOP Policy Changes

Three major changes of IOP policy have taken place recently. Firstly the Annual Representatives Meeting (ARM) was postponed this year and then cancelled for good. This removes the main way that the member representatives from Branches and Groups can interact with Council. At the most recent Group and Divisions Officers Forum (GDOF) meeting we were told that instead such representation would be arranged in the period 11:00–13:00 hours before every Council Meeting. It is not clear whether this is going to be incorporated in a revised IOP Constitution. Such a change is essential for members to maintain real influence in the operation of the IOP.

The second change is that "e-groups" are being established on the IOP web site. These will include free of charge e-versions of all existing groups as well as provision for new groups. The problem for existing IOP group committees will include responding to blogs as distinct to responding to e-mails to individual committee members. I pointed out at the recent GDOF meeting that consequently those only joining e-groups would get the majority of benefits of membership of existing IOP Groups free of charge. The Committee have recently been informed that Council has decided that from September this year membership of each and every IOP Group is free of charge. The problem for Group Committees bidding for budgets for the coming year is not knowing the membership levels for which the funding will be required. No doubt this will quickly settle down.

Issues for the Energy Group Annual General Meeting

The Agenda for the AGM to be held at IOP on the afternoon of 15th October will be issued shortly. Apart from the usual items we wish to receive views of

members on three issues. Two of these have already been mentioned namely the location of meetings particularly in respect of budget considerations and secondly the changes in IOP policy especially the demise of the ARM. The final issue concerns the anthropogenic climate change hypothesis. Members will be well aware that Governments particularly those of EU Countries have made anthropogenic climate change a fundamental energy policy issue. This being the case under the past Chair and under my Chairmanship we have allowed debate on anthropogenic climate change and the representation of different sides of the argument. Indeed the discussion of energy and climate change is written into the subject listing part of the Constitution of the Energy Group. However there are those who do not want to allow discussion of the possibility of the causes of current climate change to be anything other than anthropogenic in origin and in any case believe that we should leave any discussion of climate change to the Environmental Group. I believe however that this is unhealthy for science in general and physics in particular and wish to seek the views of the Members on the matter at the AGM for the guidance of the new Committee.

Finally, we urgently need members to consider putting themselves forward to the Committee. I step down as Chair having done my three year stint (the maximum period allowed). Whilst I understand that there may be a number of candidates for Chair we do still need both a new Hon. Treasurer and Hon. Secretary. Our Treasurer, Dr Marc Beurskens, has had to step down through pressure of work, and the vacant Hon. Sec. position derives from the requirement that Officers can only be drawn from Corporate Members of the IOP. As three Committee members have fulfilled their present terms and Prof. Michael Laughton has resigned, there are also a number of ordinary committee places available.

Correction

The statement about the Applied Physics and Technology Division in the Chair's Notes in Newsletter Number 28 should have read as follows:

“At the suggestion of ex-Chair Terri Jackson your Committee agreed that the Group should apply to become part of the Applied Physics and Technology Division (APTD) of the Institute. Terri will represent us on the Divisional Committee with me acting as back-up until an alternative additional representative is agreed by the new Committee following the AGM.”

*Peter F Gill
crestport.services@googlemail.com*

Energy News

We present a round-up of recent energy and energy-related news which may not always have caught the eye of the mainstream media.

Hitachi and GE to Market Mid-size Reactors

Hitachi-GE is reported to have started marketing midsize nuclear reactors and hope to land the first orders soon after 2010. It plans to supply 400-600 MW_e boiling water reactors and 600-900 MW_e advanced boiling water reactors (ABWRs) to be priced at \$2-3bn. These will be marketed to countries such as Vietnam, Indonesia and Thailand with relatively small grid systems. Hitachi-GE in Japan has finished system design for 600 and 900 MW_e versions of the 1350 MW_e ABWR design. Construction of the ABWR-600 is expected to take 34 months – much less than the full-sized units.

*World Nuclear News,
1/7/08*

Hydrogen Balancing Act

Australia's WHL Energy have submitted a planning application for an H₂ balancing store for a wind farm in Ayrshire. The excess power, generated at times of lower demand, will be used to electrolyse water and to store H₂ under pressure. At times of low wind speeds, the stored H₂ will be combusted through internal combustion gensets. This would be the UK's first commercial facility.

*WHL Energy Ltd,
10/7/08*

French Tidal Stream Pilot

Electricité de France (EDF) are to build a pilot tidal turbine system off the Brittany coast at Paimpol, Côtes d'Armor. EDF claim that these currents are among the strongest in Europe. The 3-6 turbines will have an output of 4-6 MW and will enable the technology to be tested under real conditions. EDF's aim is to assess profitability and draw up an administrative and legal framework that will lead to further development.

*Renewable Energy Focus,
5/8/08*

Food Waste to Energy

Waitrose is to trial generating power from incinerating waste food, initially from five of its stores. If successful, the scheme could be rolled out to more stores.

*Waitrose,
19/8/08*

Thumbs-up for EU Energy Policy

The IEA has reported on an in-depth analysis of EU policy and strongly endorses the broad outlines of the Commission's energy proposals tabled during the last year. It specifically praises the coherent approach and the Commission's market liberalisation package for electricity and gas. The review encourages the Commission to pursue ownership unbundling of networks from supply and generation. It also makes recommendations concerning the need to increase research funding and establish a more coherent external energy policy with a stronger role for the EU institutions.

*European Commission,
4/9/08*

Shelling Out for Biofuels

Shell are funding six new academic research programmes over 2-5 years to investigate raw materials and biofuels production processes. They are with: MIT; the University of Campinas, Sao Paulo, Brazil; the Institute of Microbiology, Chinese Academy of Sciences, Beijing; the Qingdao Institute of Bioenergy and Bioprocess Technology; the Centre of Excellence for Biocatalysis, Biotransformations and Biocatalytic Manufacture. Manchester University; and the School of BioSciences, Exeter University.

*Royal Dutch Shell,
17/9/08*

UK Energy Statistics

We present the coal use figures for the second quarter of 2008.

| | Kilo tonnes | Change on Q2 2007 |
|-----------------|-------------|-------------------|
| Coal production | 4,597 | +4.4% |
| Coal imports | 9,817 | -3.5% |
| Coal Demand | 13,313 | +6.6% |
| Power stations | 10,221 | +2.7% |
| Coke ovens | 1,538 | +2.7% |
| Final consumers | 615 | +11.0% |

*Department for Business, Enterprise, and Regulatory Reform,
25/9/08*

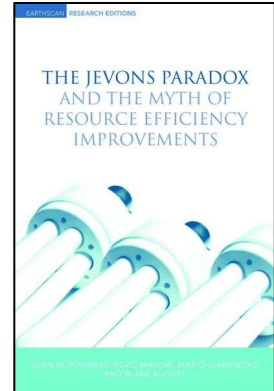
Book Reviews

The Jevons Paradox and the Myth of Resource Efficiency Improvements by John M. Polimeni, Kozo Mayumi, Mario Giampietro, and Blake Alcott

Published December 2007, 200 pages, ISBN-13 978-1-84-4074624, £65.00 (hardback), Earthscan, www.earthscan.co.uk

William Stanley Jevons was a 19th-century British economist and logician who played a key role in developing neoclassical economics. ‘Jevons’ Paradox’ is the idea that improvements in energy efficiency will lead to an increase rather than a decrease in energy consumption at the level of the economy as a whole – an argument that Jevons first developed in his 1865 book ‘The Coal Question’:

“...it wholly a confusion of ideas to suppose that the economical use of fuel is equivalent to a diminished consumption. The very contrary is the truth.....Every improvement of the (steam) engine when effected will only accelerate anew the consumption of coal.”



(Jevons, 1865).

Jevons cites the example of the Scottish iron industry, in which:

“...the reduction of the consumption of coal, per ton of iron, to less than one third of its former amount, has been followed....by a tenfold increase in total consumption, not to speak of the indirect effect of cheap iron in accelerating other coal consuming branches of industry.”

(Jevons, 1865).

The ghost of Jevons haunts modern-day climate policy. If Jevons’ Paradox is correct, encouraging energy efficiency as a means of reducing carbon emissions could be futile – rather like a dog chasing its tail. Conventional assumptions would be turned on their head the dominant strategies for achieving sustainability would be undermined. Perhaps because of its uncomfortable implications, Jevons’ Paradox tends to be ignored by

analysts, policy makers, business and the general public alike. For example, neither the Stern Review of the economics of climate change or the IPCC Fourth Assessment Report paid any attention to the idea. This is not because the Paradox has been demonstrated to be false: indeed, despite continuing improvements in various measures of energy efficiency, energy consumption continues to grow in all countries. What is at issue is whether this has occurred *despite* these improvements in energy efficiency or *because* of them – or whether it is possible to establish a causal relationship at all.

Given both the importance of the topic and the analytical and policy vacuum that surrounds it, a book devoted to Jevons Paradox is both timely and welcome. However, despite containing a great deal of valuable material, the inaccessibility of key parts of this book means that it is unlikely to have the impact it deserves.

There are three main sections, namely: a historical overview of Jevons Paradox, a discussion of the paradox in the light of complex systems theory and a statistical ‘test’ of the paradox using national data from a number of countries. These are supported by a concise introduction and conclusion and an insightful foreword by Joseph Tainter. While the historical and empirical sections provide a valuable addition to the academic literature, the lengthy diversion into complex systems theory is an unnecessary distraction.

The historical overview by Blake Alcott is wide-ranging, elegant and informative. Alcott shows how much of the modern debate over so-called ‘rebound effects’ from energy efficiency improvements was prefigured in the work of classical economists such as Thomas Malthus and John Stuart Mill. Most obviously, since improvements in labour productivity are acknowledged to increase employment in the long-term, why shouldn’t improvements in energy productivity correspondingly increase energy consumption? Alcott provides a masterful synthesis of a wealth of historical material and effectively links this to contemporary debates on the rebound effect. Helpfully, he organises the chapter around key concepts and arguments, such as the appropriate definition of efficiency and productivity; the contribution of efficiency to increased affluence and population growth; and the impact of efficiency improvements on commodity prices. The result is both an invaluable resource for researchers and a strong argument in favour of Jevons Paradox.

The empirical chapter by John Polimeni provides a useful complement to Alcott’s literature review. Using time-series data for a number of countries, Polimeni estimates regression equations for energy consumption as a function of variables relevant to population, affluence and

energy intensity - as measured by the ratio of primary energy consumption to GDP. He finds that the coefficients for energy intensity are significant, positive and often larger in percentage terms than those for the other variables-implying that improvements in aggregate measures of energy efficiency are strongly correlated with increases in national energy consumption. However, Polimeni pays insufficient attention to the methodological difficulties of such an approach, including the (un)suitability of energy-GDP ratios as an independent variable for an estimate of rebound effects and the difficulties of inferring causality from such a framework. As with other studies on energy-GDP relationships, this work can at best provide only suggestive evidence in favour of Jevons Paradox.

In contrast to the above, Mario Giampietro and Koza Mayumi's chapter on the evolution of complex adaptive systems is both heavy-going and uninformative. Promising a '...general theoretical framework by which a comprehensive understanding of the paradox can be acquired...', the chapter tries to integrate ideas from thermodynamics, epistemology and complex systems theory, including such gems as : 'autopoiesis entails impredicativity' and ' the epistemological conundrum associated with the evolution of holarchies - the concept of complex time'. While this may appeal to those fully acquainted with the relevant theory, the result from most readers is likely to be obscure rather than clarify, with the key issues getting lost in the maze of abstraction. This is most apparent in the concluding 'practical lessons for the analyst', which include: '...put the observer's role back in the system'; '...mediate between non-equivalent perspectives which require the use of different narratives'; and '...check the congruence of the resulting non-equivalent representations across scale and dimensions'. This is unlikely to make much sense to academics studying energy policy, let alone most policymakers.

Overall, this book will appeal primarily to academics and postgraduate students in the energy field and is unlikely to gain much attention from policy makers. This is unfortunate, since raising awareness of this issue is of vital importance for the future success of climate policy.

*Steve Sorrell,
Science Policy Research Unit,
University of Sussex.*

Energy...Beyond Oil**Edited by Fraser Armstrong and Katherine Blundell**

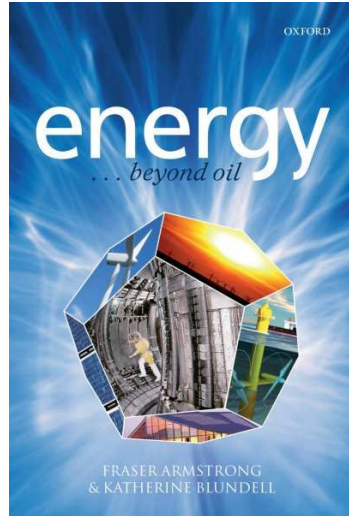
Published November 2007, 240 pages, ISBN-13: 978-0-19-920996-5, £25.00 (hardback), Oxford University Press, www.oup.co.uk.

Overall this is an authoritative text that is accessible to academics, professionals and the general public. The first two chapters are essential reading for anyone who wishes to gain an insight in to the current global energy crisis and the ongoing impact of global energy usage on climate change. The considerable evidence for this is based upon clearly presented and well balanced scientific data and reasoning. Armstrong and Blundell provide the reader with an unbiased opportunity to hear from a wide range of experts and draw their own conclusions.

As we move beyond oil, and other fossil fuels, to provide alternative sources of energy, lessen our reliance on dwindling fossil fuel resources and reduce CO₂ emissions, it is essential that all viable alternative sources of energy are considered whether nuclear, wind, wave, photo-voltaic, or geo-thermal. In addition, we must consider alternative energy carriers such as hydrogen, whilst also reducing our energy consumption by reducing waste and improving efficiencies. All of these issues are covered in sufficient detail through chapters 3-12. Each topic is clearly explained by internationally renowned and leading experts in each related field of engineering or science.

As the text went to press in 2007 it also indicates how fast both the national and international situations can change. The UK for instance is now facing an even more serious energy crisis as North Sea gas reserves are being depleted at a faster rate than predicted even a year ago. In addition, other countries, such as the US, are now building and connecting more large-scale wind farms per year than anywhere else in the world.

In summation, the final chapter concerning energy politics, sustainable energy policy, and socio-technological transitions is possibly the most important; if society is not fully engaged and hence strong national and



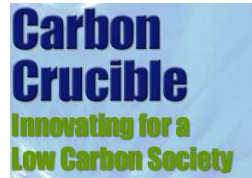
international energy policies adopted and adhered to, then the greatest fear, particularly in the UK, is that too little will be done too late.

One of the strengths of this book is that the editors haven't set an agenda, and so I would recommend this book as a comprehensive general introductory text for Masters level students on programmes such as sustainable energy, renewable energy, or electrical power systems and management. It may also be suitable for those on courses considering the environmental impact of energy demand and use.

*Dr. Gary Taylor,
Lecturer and Director of the MSc in Sustainable Electrical Power
Brunel Institute of Power Systems,
Brunel University, UK.*

The Carbon Crucible – an Opportunity for Energy Researchers in the UK

The Carbon Crucible is a new professional and personal leadership programme for 30 energy researchers from a mixture of academia, industry and the public sector. The programme will inspire you to think differently about, and work together on, the low carbon energy challenge. As an experienced post-doc, recent academic appointee or team/project leader with research responsibilities, you would gain new skills and contacts and develop transformative ideas to create a sustainable, low-carbon future. Your research could be in any area that will affect the energy agenda, from engineering to social sciences.



Participants are required to attend workshops 1-3; the 4th is optional. Each lasts 3 days and will explore the wider social, technological, economical and political context of a low carbon society. They'll be a mixture of lectures, seminars, skills sessions, tours and informal discussions and visits. In the 4th weekend you'll be encouraged to work on your ideas and bid, as consortia, to a small funding pot. The broad themes are:

1. The bigger picture: gaining an understanding of the public policy aspects of the energy challenge (7th – 9th December, London).
2. The low carbon challenge: opportunities for interdisciplinary collaborations (2nd – 4th February, Edinburgh).
3. Skills for innovating for a low carbon society (16 -18 March, Totnes).
4. Participant Collaborations (27th – 28th April, tbc).

We will cover all residential costs, including accommodation and catering. Travel costs and other reasonable costs such as childcare will be provided where required. In most cases we would expect industry participants to have their expenses covered by their companies.

Apply using the short online form at www.ukerc.ac.uk and attach your CV (including publications) by 13th Oct 2008. Successful applicants will be notified on 1st November. For more information or to discuss your eligibility, contact Jennifer Otoadese: jennifer.otoadese@ouce.ox.ac.uk.

The Carbon Crucible is a collaboration between the UKERC Meeting Place and NESTA, in association with the Research Councils' Energy Programme and the Technology Strategy Board.

Forthcoming Events

Our programme for 2008 / 09 evolving and will be issued as a separate sheet. It will be updated regularly and we hope will prove useful. Detailed synopses of events will appear with the Newsletter and a monthly email update. Our events are free of charge unless specified and light refreshments will be provided. For catering purposes, registration is necessary.

Energy Group AGM

Date: Wednesday 15th October, 2008
Time: 16:45
Venue: Institute of Physics, 76 Portland Place, London W1B 1NT.

The AGM will be followed by "The Reliability of CO₂ Ice Core Studies" at the Energy Institute.

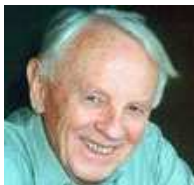
The Reliability of CO₂ Ice Core Studies

Professor Zbigniew Jaworowski

This is a joint meeting with the London and Home Counties Branch of the Energy Institute. We gratefully acknowledge the support of Multi-Science Publishing Co. Ltd (www.multi-science.co.uk) for this event.

Date: Wednesday 15th October, 2008
Time: 17:30 for 18:00
Venue: The Energy Institute, 61 New Cavendish Street, London W1G 7AR. (off Portland Place, a short walk from the IOP)
Registration: energygroup.events@googlemail.com
(If appropriate, please give your IOP or EI Membership no.)

The man-made climate warming hypothesis is based on the assumption that, mainly through burning fossil fuels, the pre-industrial level of CO₂ of about 290ppmv has increased by about 30%. However, Professor Jaworowski claims that this assumption is at odds with direct measurements of CO₂ over the past 200 years. Furthermore, recent estimates of pre-industrial levels of CO₂ have been largely based on analyses of polar ice cores which do not fulfil the essential closed-system criteria required for reliable reconstruction of the pre-industrial and ancient atmosphere. Professor Jaworowski will discuss the problems of ice core analyses, including differential solubility of gases and the formation and decomposition of various clathrates as pressures increase with depth or are released by removal of ice cores.



Zbigniew Jaworowski, M.D., Ph.D., D.Sci, is a professor at the Central Laboratory for Radiological Protection In Warsaw. A multidisciplinary scientist, he has studied pollution of the global atmosphere and population with radio-nuclides and heavy metals. He is a representative of Poland in the United Nations Scientific Committee on the Effects of Atomic Radiation, and served as its Chairman in 1980-81. In 1986 he was a member of the Polish Governmental Commission for mitigation of the effects of Chernobyl catastrophe. He has been a member or Chair of about 20 advisory groups of the IAEA and UNEP. Zbigniew has authored about 300 scientific papers, and organized 10 scientific expeditions on 17 glaciers in both hemispheres.

Sustainable Energy: new solutions from physics and engineering

A one-day conference of the Institute of Physics Division of Applied Physics and Technology. Charges apply (with the usual concessions), lunch and refreshments are included, and the early-bird deadline is 14th October.

Date: Wednesday 29th October, 2008
Time: 09:45 – 18:00
Venue: Institute of Physics, 76 Portland Place, London W1B 1NT.
Registration: www.iop.org/Conferences/

This meeting highlights new scientific and engineering ventures which are beginning to provide new energy sources and reductions in carbon emission. Sustainable energy is one of the main areas identified by research councils for support and the meeting will give an opportunity for academics and industrialists to seek new collaborations for fundamental and applied research in this area. The speakers will give non-specialist level overview of their work and outline areas where further work is urgently required. Scheduled talks:

- Ole Thomson (Denmark): wind turbine blades,
- John Kilner (Imperial): solid oxide fuel cell materials,
- Steven Cowley (Culham): fusion,
- John Ridealgh (Pilkington): energy efficient glazing,
- Stuart Irvine (NEWI): new materials for photovoltaics,
- Jamie Taylor (Edinburgh): hydraulics for wind and wave systems,
- Paul Davidson (BRE): energy efficient buildings,
- Vladimir Vishnyakov (MMU): proton exchange fuel cells,
- Mark Gee (NPL): low friction coatings.

Energy Group Contacts

We welcome comments and suggestions for events and items for the Newsletter.

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