

Institute of Physics

LONDON AND SOUTH EASTERN BRANCH REMS SECTION

“At Home” POWER GENERATION

13 July 2006

This at home has been organised by Alan B Lidiard

This meeting will address the national problem of electric power generation within the context posed by several major and relatively urgent considerations, viz. ageing plant (mainly coal-fired and nuclear), security of fuel supply, and the desire to reduce emissions of greenhouse gases. The emphasis will be on what can be done in the short term with existing technology, not on possible long term solutions requiring big research and development programmes, appealing though these are to the research community and, for different reasons, to politicians. The issues will be addressed via **quantitative presentations and comparisons** in as objective a way as possible, as appropriate to a scientific, mainly physics, audience.

Programme.

- 10.30 Registration and Coffee.**
- 11.00. Opening address and Chairman** Dr.Sue Ion (President, B.N.E.S.)
- 11.10 Power Generation - the Big Picture**, by David Ward and Chris Hall. Speaker Mr. Chris Hall, Energy Sales and Trading Ltd
- 11.45 The Gap: Projections of Future Demands and Capacity** Speaker Mr. Steve Davies, JESS, Department of Trade and Industry
- 12.15 The Role of Conservation** Speaker Dr. Eoin Lees, Energy Consultant (formerly ETSU, Harwell)
- 12.50 General Discussion.**
- 1.00 Lunch at I.o.P. HQ.**
- 2.00 Chairman** (to be announced)
- 2.00 The Practicalities of Wind Generation and other Renewables** Dr Keith Tovey (University of East Anglia).
- 2.30 The Practicalities of New Nuclear Stations.** Speaker Dr. Nigel Buttery, Sizewell B.
- 3.15 Other Contributions to the Problem**
 - Photovoltaic Microgeneration**, speaker Dr. John Gallup (N.P.L. and Imperial College).
 - Pumped Storage**, speaker Dr Graham Hill (Open University and NPL).
 - Biomass Energy**, speaker Prof. Frank Raymond (Agricultural Advisor and C.P.R.E.).
- 4.15 Final Discussion and Summing up**, Dr. John Rae (NPL).
- Tea**

The meeting will be at the IOP HQ 76 Portland Place. The cost including lunch is £18.

Abstracts and Biographies for REMS Meeting on 13th July 2006

Chair
Dr Sue Ion

Sue Ion.

Sue Ion received her Ph.D. from Imperial College for research in materials science, before joining B.N.F.L., where she is currently Executive Director of Technology. She is well known for her work on the nuclear fuel cycle and in 1993 received the Hinton Medal of the Institution of Nuclear Engineers for her outstanding contributions to nuclear engineering. She is a Fellow of the Royal Academy of Engineering and a Fellow of other learned societies including the Institute of Physics. She is currently President of the British Nuclear Energy Society. She was awarded the OBE in 2002 for services to the nuclear industry. She advises a number of industrial and governmental bodies including the U.K. Council for Science and Technology.

Power Generation - the Big Picture

By Chris Hall

Abstract

The paper will attempt to give an overall introduction to the day's proceedings. It will present a brief history of power generation in the UK up to the present day. It will describe the current structure of the electrical power system, both physical and commercial, and explain the implications. It will outline the changes in the sources of energy for power generation, and the changes in prices in the recent past. Finally it will summarise the general characteristics, and the advantages or disadvantages, of the existing and potential sources of generation.

Chris Hall.

Chris Hall is a consultant, working for Energy Sales and Trading Limited (ESTL). ESTL's main business is to trade electricity in the wholesale market on behalf of the Magnox nuclear power stations that now belong to the UK Nuclear Decommissioning Authority. Chris has also been providing energy market advice to the team within British Nuclear Fuels (BNFL) that has been examining the steps needed to keep the UK's nuclear skills and expertise alive. Chris Hall is a physicist by training, and started his career in 1984 as a research physicist with the Central Electricity Generating Board. He takes a great interest in economic issues, especially where they impinge on energy and environmental policy, and energy market behaviour.

The Gap: Projections of Capacity and Demand **by S.R. Davies.**

Abstract

This lecture will deal with the following aspects of future electrical power demands and supply: (i) the role of Government in maintaining a secure energy supply, (ii) the outcome of the 2006 Energy Review - an update on the process, (iii) the current generation mix, (iv) future demand and the longevity of existing generating capacity, (v) factors affecting this longevity. Finally, we address the question are we likely to see a gap between future demand and supply?

Steve Davies.

Steve Davies is an Assistant Director in the DTI's Domestic Energy Directorate where he works on the security of the UK's gas and electricity supply. He has worked for the DTI for 19 years since graduating from the then Middlesex Polytechnic with a BA (Hons.) in Business Studies, specialising in industrial relations legislation. He has worked in the Energy Directorate since March 2005. His most recent DTI posts before moving to Energy were in the Consumer and Competition Directorate where he worked on modernisation of the Competition Act 1998, and before that on international trade policy where his main focus was on EU-US trade disputes.

The Role of Conservation: Time to Turn Down Energy Demand or Can Energy Saving Deliver?

by Dr Eoin Lees

Abstract

Demand for electricity continues to grow despite considerable improvements in its end use efficiency. Given the historical perspective, what are the opportunities to save energy and what are the realistic prospects for achieving such energy savings? The speaker will draw on his 21 years experience of energy efficiency, initially in the industrial fields but latterly in the challenging and growing residential sector. For this sector, the extent to which technological solutions will be sufficient to turn down the overall demand for household electricity will also be explored.

Eoin Lees.

A physicist by training, Eoin Lees has worked in sustainable energy for 21 years, particularly in the field of energy efficiency in households. Since 2003, he has been an independent consultant and worked with a wide range of clients including UK and overseas Governments, the EU, trade bodies and the private sector.

He was the founding Chief Executive of the Energy Saving Trust from 1993 to 2003 and built the organisation from 1 employee to 110 in that period. He also broadened its remit into greener road transport and into household and community renewable energy sources. Prior to that he was the Director of ETSU, which was then the UK Government's agency for research and promotion of energy efficiency, renewable energy sources, fuel cells and strategic energy studies.

He is founding chair of EDF Energy Trust, an independent charity to help customers of London Energy, Seeboard and SWEB who are in debt with their energy bills. He is a member of Ofgem's Environmental Advisory Group and a Board Member and vice-chair of the European Council for an Energy Efficient Economy.

The Practicalities of Wind Generation and other Renewables

By Dr Keith Tovey

Abstract

This presentation will explore some social and technical aspects of wind generation. Experience gained from interaction with opponents of wind generation and how an initially negative response was turned into a positive one will be discussed. Some modelling on intermittency and the consequential carbon emissions associated with backup will be considered. In recent months, research on the performance of a large, 34 kW photo-voltaic array integrated into a building has been completed, and some of the results and lessons learnt will be shared in the presentation .

Dr N. Keith Tovey

Keith Tovey read Mechanical Sciences at Corpus Christi College and followed this with a PhD in the Engineering Department at Cambridge. Initially his research interests included image analysis of soil microfabric and landslide hazards and he was seconded from the University of East Anglia to the Hong Kong Government where he dealt with no fewer than 199 landslides and was instrumental in establishing the Geotechnical Information Unit..

On return to the University of East Anglia in 1984, he became increasingly involved in energy related topics both in teaching and research and became a Reader in 1993. In 2003 he also took on the role of Energy Science Director of the CRed (Carbon Reduction), and in 2005, in addition, became the HSBC Director of Low Carbon Innovation at the University. He regularly advises Russian MPs and members of the Russian Energy Supply Industries on matters relating to the move towards a privatised electricity supply system. At present he is part of a team promoting the flagship project of a large carbon-neutral city in Dongtan, China.

The Practicalities of New Nuclear Stations

by Nigel E. Buttery

Abstract

The following topics will be covered.

(1) The reasons why the Sizewell B design meets current modern standards and so in theory could be replicated.

(2) The reasons why this is probably not feasible. Thus:

(a) although British Energy owns the design, the practicability of obtaining all the components is far from clear. A lot was invested in establishing UK manufacturing capability for Sizewell and the intended follow on plants, but much of this has been lost or superseded.

(b) the CEGB had a large in-house Architect-Engineering capability. For new nuclear build, operators would be looking for standardised plants supported by architect engineering services. Some of the economies would be expected to come from the application of advanced project management and construction techniques developed in parallel with the development of the designs.

(c) in the past UK safety requirements tended to be more onerous than those elsewhere so overseas designs required a lot of modification to be acceptable in the UK. (Sizewell B being an example of this process.) However since TMI and Chernobyl international standards for new plants have changed and are now probably close enough to make the replication of standard advanced designs like EPR an attractive possibility.

(3) Some of the options, e.g. evolutionary advanced designs using extensions of existing technology and the more radical passive designs.

(4) The issues associated with new build in terms of economics, licensing and construction risks and waste disposal.

Nigel Buttery.

Having obtained his D. Phil. in Theoretical Physics from Oxford, he joined the C.E.G.B. Berkeley Nuclear Laboratories in 1974 where he worked on Fast Reactor Safety and Light Water Reactor Severe Accident Studies. He has since worked on safety, technical and licensing aspects of other reactor designs, but mainly Pressurised Water Reactors. He is currently Safety and Performance Manager at the Sizewell B Power Station.

Photovoltaic Microgeneration

By Dr John Gallup

Abstract

This talk will describe his experience of installing and using a grid-connected microgeneration domestic photovoltaic system. It will outline the type of solar cells used, their intrinsic efficiency and the actual daily and seasonal variation attained in generated power. This is compared with seasonal consumption levels. Some tentative conclusions relating to the photovoltaic contribution to the wider UK power generation picture will also emerge.

John Gallop.

He is as an experimental physicist, mainly in the area of superconducting electronics. More recently he has also been working in the field of nanoscience, focussing on carbon nanotubes, NEMS and Raman microscopy. After 35 years full-time at NPL he now divides his research activity between NPL and Imperial College.

Pumped Storage of Energy

by Graham J. Hill

Abstract

Wind power is notoriously unpredictable; it might therefore be advantageous to have means of storing the energy produced. This talk looks at the UK's largest pumped storage scheme [Dinorwig] and considers its present role in peak-opping and frequency maintenance. A new US pumped storage [the LEAPS venture in California] is outlined to demonstrate that the concept has relevance in a privatised system. The problems of integration of wind power into the grid are then considered and the potential role of pumped storage, if wind power is to produce more than 15-20% of our electricity, is discussed.

Graham Hill.

Graham J Hill is an Associate Lecturer with the Open University : Faculty of Technology. His talk today is based on his work for the course '*T207: The Engineer as Problem Solver*' which has stimulated an interest in Pumped Storage. Graham spent most of his career with ERA Technology in Leatherhead working on Electronic Materials. He is also a Consultant in the RF & Microwave group at the NPL.

**Biomass energy.
by Frank Raymond****Abstract**

Biomass energy - energy from growing crops and trees - is being promoted as a means of reducing carbon oxide emissions, because when the crop is burnt in a power station the amount of carbon dioxide produced is similar to the amount taken up from the atmosphere through photosynthesis while the crop was growing. Biomass energy is expected to make a sizeable contribution to meeting Government targets for producing electricity from renewable sources. The implications of these expectations will be examined quantitatively in relation to the demands upon agricultural land in the U.K. and the effects upon the landscape and the security of our food supplies.

Frank Raymond.

Frank Raymond was for many years at the Grassland Research Institute at Hurley where he became Head of the Department of Biochemistry and Animal Nutrition and Deputy Director of the Institute. In 1972, following the Rothschild report, he was involved with the re-organisation of the planning and management of agricultural research and from 1980 to 1982 he was Chief Scientist at M.A.F.F. He has since been much involved in the agriculture/environment debate.

**Final Discussion
Lead by John Rae****John Rae.**

John Rae spent his early career as a theoretical physicist working on plasma physics, statistical mechanics, the theory of fluids and various environmental matters at universities at home and abroad and at A.E.R.E Harwell. He has since held the posts of Chief Scientist at the Department of Energy, Director of N.P.L. and Chief Executive of A.W.E. Aldermaston. He is now a non-executive director of N.P.L.