

Volume 36 Number 1

March 2019

The Big Heat – geothermal energy - Professor Jon Gluyas, Durham Energy Institute

Disruptive Innovation – three professors from Energy Research Accelerator

The energy outlook - four separate views from:

Alan Whitehead MP, Alan Brown MP, The Rt Hon Sir Edward Davey MP, Ian Liddell-Grainger MP

ENERGY FOCUS



Energy – what happens next?

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The journal of



PGES
All-Party Parliamentary Group
for Energy Studies



The All-Party Parliamentary Group for Energy Studies

Established in 1980, the Parliamentary Group for Energy Studies remains the only All-Party Parliamentary Group representing the entire energy industry. PGEs aims to advise the Government of the day of the energy issues of the day. The Group's membership is comprised of over 100 parliamentarians, 100 associate bodies from the private, public and charity sectors and a range of individual members.

Published three times a year, Energy Focus records the Group's activities, tracks key energy and environmental developments through parliament, presents articles from leading industry contributors and provides insight into the views and interests of both parliamentarians and officials.

PGEs, Room 2.2, Speaker's House, House of Commons, London SW1A 0AA

www.pges.org.uk

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Editor: **Matthew Gordon**, matthew@pges.org.uk, 0797 445 1085

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Cover image original work, drawn by annietheillustrator.co.uk. Chairman's portrait drawn by Calum Hanchett. ©PGEs 2019, prints available.

ISSN 0265-1734 For non-members, annual subscription rate is £65.00, single copies £27.00
Members receive a complimentary copy as part of membership to the Group

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"remember, Governments create nothing and have nothing to give but what they have first taken away" Winston Spencer Churchill, Birmingham 1903

Printed in Great Britain by First Colour Ltd, 15 Newman St, London W1T 1PA

CHAIRMAN'S FOREWORD



Noise around the Brexit debate will, of course, continue to run throughout this session with increasing intensity up to the end of March – and possibly beyond. The Parliamentary calendar is already packed and the scale of the challenge of putting legislation in place is growing. Soon, surely, something has to give.

Throughout the whole process, the All-Party Parliamentary Group for Energy Studies (PGES) has tried to look ahead, predict the issues and cover them in topics for the Speaker Meetings, also guided by our Policy Priority list, on which it was noticeable that all were forward looking.

You will see inside this edition of Energy Focus, reports on the presentations made by four professors at our most recent Speaker Meetings on geothermal heat and disruptive innovations. Our future programme includes presentations on the voice of the customer, demand side response and energy in transport.

Approaching the end of last year, we decided that this edition should be published earlier than the Easter recess, so that we could continue to help parliamentarians see energy issues in the context of the final votes on Brexit. As a result, we have asked energy experts from the major parties in the House to submit articles which look beyond Brexit. These are in the subsequent pages.

When (or should I say, if) the dust settles on Brexit, PGES will lead with expertise on issues as they arise. Our Associate and Academic Membership is still growing in strength and diversity. Our Parliamentary Members, despite the pressures of political life, still attend meetings, although we would always welcome more!

Please make contact with me or the PGES Secretariat – we are continually looking for topics and articles of interest.

One thing of which we are confident is that energy will become ever more important, as we are all, consumers and generators alike, dependent on it and increasingly engaged in all the issues.

Ian Liddell-Grainger MP

Chairman, PGES

An All-Party Parliamentary Group

HOW TO SECURE THE UK ENERGY SUPPLY AND SAVE THE PLANET

Professor Jon Gluyas

Durham Energy Institute,
Durham University

j.g.gluyas@durham.ac.uk

JANUARY SPEAKER MEETING



The second claim in the title of this paper is an exaggeration but the offer to secure UK energy supply is not. Moreover, by delivering on the first claim we will be starting on a journey that will ultimately deliver a significant reduction in the UK's emissions of greenhouse gases and enable the nation to meet the next carbon budget. We will also send a strong signal to other nations that low-carbon based heating systems are as viable as those for power and for transport. Here, we explore options for delivery of low carbon heating that would also improve energy security by lessening our dependency on imported gas.

The UK energy consumption was about 150 million barrels of oil equivalent (or the energy equivalent of 5.25 billion gallons of oil) in 2017, of which about a quarter was used in transport and the remaining three quarters split more or less equally between power generation and heating. Power (electricity) is also used for heating, so in total around 50% of all energy used in the UK is for heating; our homes, our offices and other workplaces. Moreover, we generate about 77% of the heat we need by burning fossil fuels (almost entirely gas) either directly in our homes or indirectly via electricity, which is still largely generated from burning gas in power stations. In short around 30% of the UK's emissions of greenhouse gases is associated with keeping the nation warm.

Decarbonisation of power generation in the UK has been hugely successful and our capacity for

generation from wind and solar combined now outstrips that from fossil fuels. The UK also has a plan for decarbonising transport, although in doing so we will put a significantly greater burden on the power grid.

However, decarbonisation of heat has hardly begun and aspirations to replace gas heaters with electric ones will add to both the stress on the power grid and emissions of greenhouse gases from power stations because power stations are only 30-50% efficient.

Natural gas forms the largest part of the domestic heating bill in the UK at 66% and it is still a substantial part of the power generation system at 40% (2017). Until 2004 the UK was a net exporter of natural gas and as a nation we had been self sufficient for 200 years, first with town gas and subsequently natural gas from the North Sea. Today the UK can only meet about 40% of its gas requirement from domestic production; approximately equivalent to that required for power generation. The remainder is imported. From Norway we receive a further 40% through a single pipeline. Qatar supplies about 15% as LNG by tanker and the remaining 5% is shipped through the interconnectors from lowland Europe. Domestic production apart, that supply is vulnerable to technical and political issues. Because we have no significant gas storage (both Germany and France have 3 months stored supply), we leave ourselves open to acute supply issues. Each year, cold winter

- **50% of all the energy we use in the UK is for heating**
- 77% of all the heat generated in the UK comes from burning fossil fuels
- 30% of all the UK's greenhouse gas emissions are associated with heating
- The UK has a cryptic gas supply issue caused by vulnerable imports and a lack of gas storage
- **Geothermal energy could heat UK homes and industry for a minimum of 100 years**
(and properly managed the source will last indefinitely)
- Geothermal heat is generally discharged as waste from petroleum operations and flooded mines
- Hot water from flooded abandoned coal mines could supply heat to former mining districts in the UK
- **Use of geothermal energy in the UK would allow the nation to:**
 - **cut its greenhouse gas emissions by 30%**
 - **simultaneously become self-sufficient for heat**
- **Government strategy does not include geothermal heat in its decarbonisation plans**

days reduce us to having a 1% cover of supply over demand, leaving industry in receipt of restricted supply warnings (when they would be told to restrict energy use, thus having an impact on industrial production).

We can solve both our gas security problem and cut our greenhouse gas emissions by switching from gas for heating to direct use of geothermal, waste and ground/water/air source heat. Our calculations show that the absolute minimum resource of geothermal alone could deliver 100 years of profligate use. Managed properly direct use of heat could keep the people of the UK and Northern Ireland warm indefinitely.

To date, the UK has only one producing geothermal system linked to a heat network, the Southampton District Energy Scheme with an array of public and private customers in central Southampton. Fifty miles south-west of Southampton is the Wytch Farm oilfield that at peak production delivered copious quantities of waste water and 40 times as much heat as the Southampton borehole. No use was ever made of this heat. Southampton and Wytch Farm are but two geothermal water extraction points in the vast Wessex Basin. Indeed almost all of the UK's major population centers lie close to, or on, sedimentary basins from which heat can be extracted. Other nations are significantly more advanced in the use of geothermal heat. Both China and the USA have about 18 GW of installed geothermal heat and in Europe, Sweden has about 5 GW installed.

In a curious twist of history there is a short-cut to developing widespread geothermal heating in the UK. Much of our housing stock was constructed on

coalfields. In County Durham alone 25,000 homes directly overlie abandoned coal mines. We built our cities where we mined our coal. Today the mines are no longer, but the structures created by miners in the past still exist, galleries and roadways are now flooded by rising groundwaters. These groundwaters carry heat. To maintain safe water levels the Coal Authority already pumps water from several old mines and in doing so produces around 80 MW of as yet unused heat. That such easily accessible mine-water heat can be used at scale is demonstrated by the city of Heerlen in the Netherlands. The entire center of the city, 200,000 m² of floor space, is heated by near zero carbon mine-water heat. Development of the mine-water system in Heerlen has fostered inward investment and the area, once depressed, has been rejuvenated.

The development at Heerlen could be replicated in the UK, in Newcastle, in County Durham, in Manchester, Nottingham, Derby, Glasgow, Wigan, the West Midlands, in south-eastern Kent and more. To date the UK has one mine-water system at Lanchester Wines' warehouse in Gateshead and there are two early stage demonstration projects in Bridgend and Glasgow.

Replacement of gas by geothermal heat in our cities would lead to a massive reduction in carbon emissions and simultaneously improve the UK's energy security. The UK would once again become self sufficient in natural gas for power production and self sufficient in heat from geothermal systems.

Government strategy does not include thermal heating in its Carbon Reductions programmes - this needs to change. It is a vast underground, unconsidered and untapped asset.