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AGENDA

SELECT COMMITTEE - ENERGY SECURITY

Friday, 4th December, 2015, at 2.00 pm		Ask for:	**Denise Fitch/David Price**
Wantsum Room, Sessions House, County Hall, Maidstone		Telephone	**03000 416090/414182**

Tea/Coffee will be available 15 minutes before the start of the meeting in the meeting room

Membership

Mr J N Wedgbury (Chairman), Mr D L Brazier, Mr B E Clark, Mr A D Crowther, Mr C P D Hoare, Mr P J Homewood, Mrs E D Rowbotham, Mr C P Smith, Mrs C J Waters and Mr M E Whybrow

UNRESTRICTED ITEMS

(During these items the meeting is likely to be open to the public)

2.00 – 2.45pm	Professor Gordon MacKerron and Emily Cox (University of Sussex and University of Sussex & Oxford) (Pages 3 - 20)
3.00 – 3.45pm	Dr Wim Melis (University of Greenwich) (Pages 21 - 26)
4.00 – 4.45pm	Stephanie Karpetas (Sustainability Connections) (Pages 27 - 38)

EXEMPT ITEMS

(At the time of preparing the agenda there were no exempt items. During any such items which may arise the meeting is likely NOT to be open to the public)

Peter Sass
Head of Democratic Services
(01622) 694002

Thursday, 26 November 2015

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Energy Security Select Committee

Prof Gordon MacKerron

Professor of Science & Technology Policy & Co-Director of the Sussex Energy Group (University of Sussex)

Biography

Professor MacKerron is an economist specialising in energy and environmental economics, with degrees in economics from the Universities of Cambridge and Sussex. His academic career has specialized in the economics and policy issues of electricity and especially nuclear power, in which he has published and broadcast widely. He has frequently been Specialist Adviser or invited witness before House of Commons Select Committee inquiries on energy subjects. From June to December 2001 he was on secondment to the PIU, Cabinet Office, as Deputy Leader of the UK Government's Energy Review team. He has subsequently assisted the UK Department of Trade and Industry (DTI) in its consultation process leading up to a major Energy White Paper released in February 2003 and subsequently advised DTI on security of supply and low carbon technology strategies. Between 2003 and 2007 he was Chair of the Committee on Radioactive Waste Management, an independent body charged with recommending the best approach to long-term radioactive waste management to the UK Government. He was a member of the Royal Commission on Environmental Pollution from 2009 until its demise in 2011.

Emily Cox

PhD Research Assistant (University of Sussex & Oxford)

Biography

Emily is a Research Assistant and PhD student with the Sussex Energy Group at the University of Sussex. For her PhD she is researching energy security in the context of a low-carbon transition, developing a methodology which can be used to assess low-carbon transition pathways for their resilience, affordability and sustainability. The focus of this project is on the security of electricity systems in the UK. She recently worked for the Royal Academy of Engineering, undertaking research into the social and economic impacts of electricity shortfalls as part of a project requested by the Council for Science and Technology and DECC. She has also spent time working for E.ON Technologies at the Ratcliffe-on-Soar power station, researching energy security, district heating, distributed storage, and the UK Capacity Market.

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Energy Security Select Committee

Hearing 4

Friday 4th December 2015

Witness Guide for Members

Below are suggested themes and questions. They have been provided in advance to the witnesses to allow them to prepare for the types of issues that Members may be interested to explore. All Members are welcome to ask these questions or pose additional ones to the witnesses via the Committee Chairman.

Themes and Questions

Professor Gordon MacKerron (University of Sussex)
Emily Cox (University of Sussex & University of Oxford)

- Please introduce yourselves and provide an outline of the roles and responsibilities of your posts.
- Please discuss the key issues facing the UK around electricity supply and generation.
- In your view, what are the key benefits and challenges associated with nuclear energy in relation to energy security?
- Please discuss the key advantages and disadvantages of fossil fuels and low carbon energy generation in the UK in relation to energy efficiency and security.
- What is the current status of the security of electricity systems in the UK, and what, if anything, can be done to improve this?
- How can distributed storage and other innovations contribute towards greater energy security for local and national communities?
- What role can the public play in meeting energy security requirements and UK carbon targets?
- What, in your view, can Kent County Council do to promote energy security within the county?
- Are there any other issues that you would like to raise with the Committee?

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Nuclear Energy Statistics

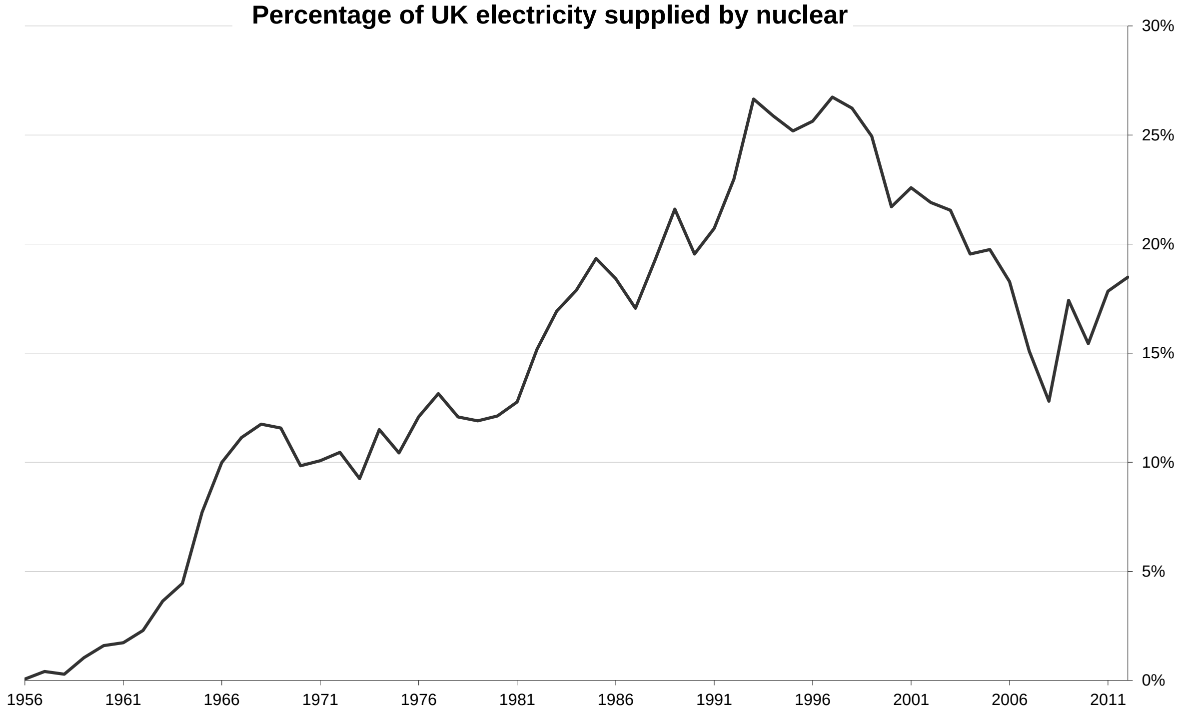
Standard Note: SN/SG/3631
Last updated: 9 September 2013
Author: Paul Bolton
Social & General Statistics

The UK had the first civilian nuclear power station in the world and increased its nuclear output for most of the latter half of the twentieth century. The last nuclear power station to be built in the UK started operating in 1995. Since then output has fallen as some older power stations have been decommissioned. One consequence of being a pioneer of civil nuclear power is large ongoing financial liability for decommissioning old power stations and managing nuclear waste. The UK now has among the lowest share of generation from nuclear of all countries with nuclear power. Some aging nuclear power stations have had their operating life extended, but the majority are due to close over the next decade. No new nuclear capacity is due to come online until the end of this decade at the earliest. Developers have announced plans to build new nuclear power stations with a combined capacity of 16 GW or around half as much again as current capacity.

This note looks at trends in nuclear generation in the UK, compares this to other fuels and other countries. It also presents some data on past levels of public expenditure on nuclear power and estimates of the future costs of decommissioning and managing waste.

The Department of Energy & Climate Change's energy statistics pages give the latest information on generation of nuclear power. The Energy and Climate Change Select Committee published *Building New Nuclear: the challenges ahead* in February 2013. It includes a great deal of background on and discussion around the issue.

Percentage of UK electricity supplied by nuclear



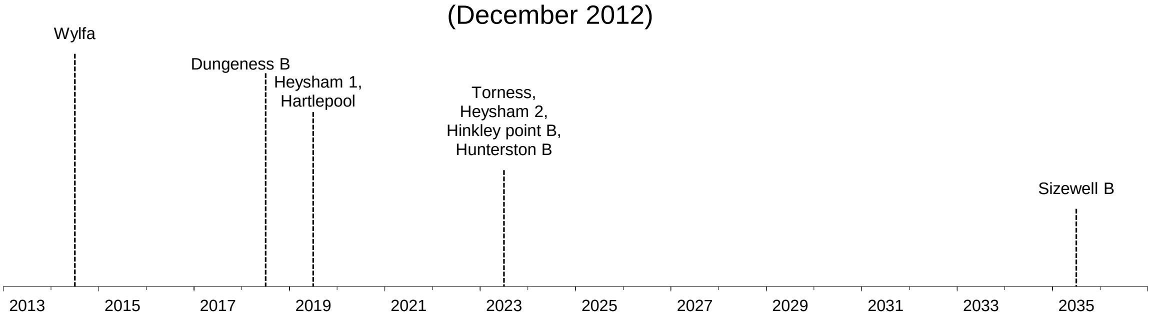
Contents

A. Trends in UK nuclear power generation

1. Electricity generation

Commercial generation of nuclear power started in the UK in 1956 when Calder Hall power station opened. The UK currently has 15 nuclear reactors in eight operational nuclear power stations. Wylfa is the oldest station dating back to 1971; Sizewell B the most recent (1995).[1] Oldbury, which was previously the oldest station, was shut down in February 2012. The timeline below shows the latest schedule of closure for these power stations. Since 2005 there have been extensions to the operational lives of Hinkley Point B, Hunterston B (first five years then in December 2012 a further seven years), Dungeness B (10 years), Heysham 1 and Hartlepool (5 years) Wylfa (4 years) and Oldbury (2 years to its closure in February 2012). Wylfa is the last of the older Magnox-type stations. The remaining eight were all owned by EDF after it was acquired British Energy in 2009. These stations have scheduled closure dates of 2016-2035, giving them operational lifetimes of around 30-47 years. When EDF announced the most recent life extensions to Hinkley Point B and Hunterston B it said that it expects 'average of seven-year life extensions across all its Advanced Gas-cooled Reactor stations and a 20-year extension for Sizewell B.'[2] This would take Sizewell B's operational lifetime to 60 years.

Timeline of scheduled closure of current UK nuclear power stations
(December 2012)



Sources: Table of past and present nuclear reactors, DECC
http://www.decc.gov.uk/assets/decc/11/meeting-energy-demand/nuclear/2027-past-and-present-uk-nuclear-reactors.pdf
EDF press notice 4 December 2012, *EDF Energy announces seven year life extension to Hinkley Point B and Hunterston B nuclear power stations*

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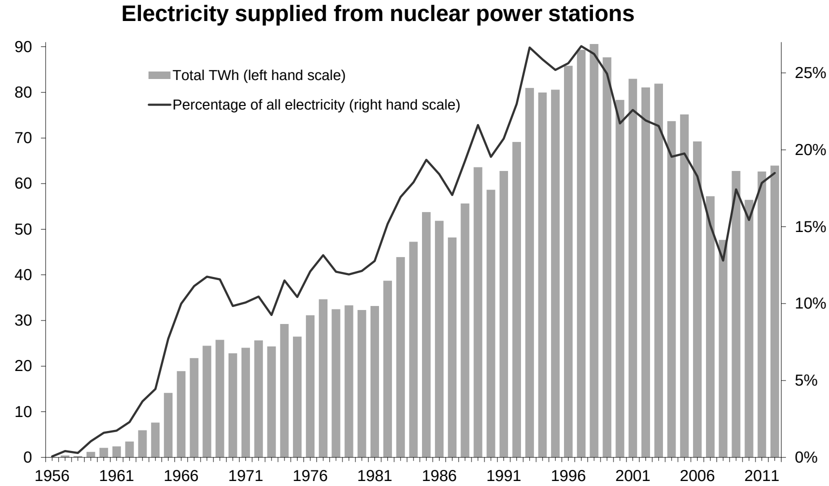
1 *Table of past and present UK nuclear reactors, DECC*

2 *EDF Energy announces seven year life extension to Hinkley Point B and Hunterston B nuclear power stations*

The appended Table 1 and the chart opposite show trends in the electricity supplied by nuclear power since 1956. This excludes the electricity used by the stations themselves. The amount of electricity generated from nuclear power increased rapidly in the late 1960s, from less than 8 terawatt hours[3] (TWh) in 1964 to almost 26 TWh in 1969. Expansion was much slower in the following decade but picked up again in the early 1980s. Output increased from 33 TWh in 1981 to 81 TWh in 1993; an increase of 144% in 12 years.

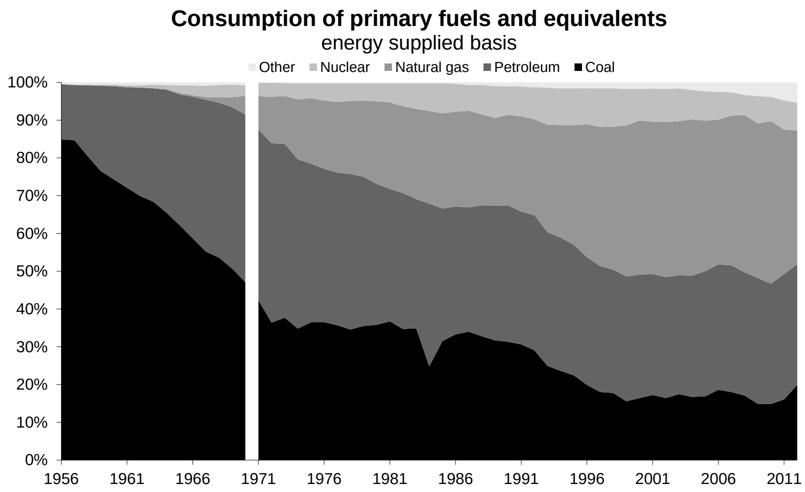


Output increased more slowly to a peak of over 90 TWh in 1998. The following years have seen the first sustained period of decline in nuclear power. Output in 2008 at 47.7 TWh was the lowest level since 1984. This decline was due in part to the closure of some stations, but also to ongoing high levels of unplanned outages (station shutdowns). Recent variations in output are mainly due to variations in the number and duration of these outages.

Nuclear power's share of electricity supplied has generally followed a similar trend to its own output. It passed the landmarks of 10% in 1967, 20% in 1989 and 25% in 1993. It fell back below 25% in 1999, below 20% from 2004 to a recent low of 12.8% in 2008. The 2012 rate of 18.5% was the highest since 2005

2. All energy use

The appended Table 2 and the chart opposite show the contribution of different types of fuel to all forms of energy use, not just electricity. This shows the importance of coal up to the 1960s and the increasing dominance of petroleum products and gas since then. Nuclear power produced an increasing proportion of the UK's energy needs up to a peak of just over 10% in 1997 and 1998. It has subsequently fallen to 5.3% in 2008; the lowest level since the early 1980s. These figures exclude all use within the fuel industries and conversion,



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3 Trillion or 10^{12} watt hours

transmission and distribution losses. There was a break in the series in 1970; however this had only a very minor impact. The 2012 rate for nuclear was 7.4%.

3. Evolution of nuclear power projections since 2000

The DTI published detailed energy projections in 2000.[4] These stated that:[5]

> Given present economic assumptions, modelling suggests that no new nuclear plants will be built over the projections period. Generation from nuclear plants decline post 2000 as plants gradually retire from the system.

The report gave detailed projections electricity from each source. According to these nuclear power was projected to decline to 66 TWh by 2010 (17-18% of the total) and to 27 TWh by 2020 (around 7% of the total). The report did admit that there was great uncertainty about the length of time that existing plant can operate.

The Prime Minister's Performance and Innovation Unit (PIU) published a report into energy in 2002 which looked at the policy choices the UK would have to face in the period to 2020 and beyond. This stressed the need to keep open the option of nuclear power because of its contribution to reducing carbon emissions and ensuring the diversity and security of energy supply. The report stated that costs of nuclear power are above those for fossil fuel generation. New technology could reduce these costs by 2020, but even then the range of costs would still be above those for electricity from natural gas, wind power or Combined Heat and Power plants.[6] Issues of cost are crucially important as in a liberalised electricity market decisions about new nuclear power stations are made on commercial grounds. Given the Government's targets to reduce carbon emissions the role of nuclear in electricity generation could be 'significant' if the costs of renewables do not fall as much as anticipated and/or concerns about waste and risks can be resolved. The report also noted that no new nuclear stations have ever been financed within a liberalised market anywhere in the world. [7]

The Energy White Paper (published in 2003) built on the work of the PIU report and citing many of the same reasons said that:[8]

> This white paper does not contain proposals for building new nuclear power stations. However, we do not rule out the possibility that at some point in the future new nuclear build might be necessary if we are to meet our carbon targets

The *Updated Energy Projections to 2020*[9] (from 2006) did not change the earlier projection assumption about new nuclear plants in the projection periods. There were only minor changes to nuclear projections from changes to productivity and the extension of operation at Dungeness B from 2010 to 2018.

The 2006 Energy Review estimated that up to 25 GW of new generating capacity would be needed over the next two decades to fill the gap left by closures of coal and nuclear stations

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4 *Energy Paper 68: Energy projections for the UK*, DTI
5 ibid. p.43
6 *The Energy Review*, Performance and Innovation Unit 2002, Annex 6
7 *ibid.* Chapters 5-7.
8 *Energy White Paper, Our energy future –creating a low carbon economy*, DTI
9 *UK energy and CO_2 emissions projections –updated projections to 2020*, DTI 2006

and to meet increasing demand. Analysis for the report showed that nuclear power could be economic given continued high gas prices and a positive carbon price under the EU Emission Trading Scheme. The proposals outlined in the Energy Review included:[10]

- The Government believes that nuclear has a role to play in the future UK generating mix alongside other low carbon generation options.
- Any new nuclear power station would be proposed, developed, constructed and operated by the private sector who would also meet decommissioning and their full share of long-term waste management costs.
- Government will engage with industry and other experts to develop arrangements for managing the costs of decommissioning and long term waste management based on the principles set out in this text.

The Energy Review also included a possible range of new nuclear generation in 2020 as part of estimates of potential carbon saving proposals. The range was 0-1.6 GW. However this was given for illustrative purposes only as "The scale of new nuclear capacity and the timing of its commissioning will depend on commercial investment decisions."[11] To put this in context total UK nuclear capacity was 11.0 GW at the end of December 2006.[12]

The projections that were published alongside the 2007 Energy White Paper made no real changes to earlier ones. Because the issue was subject to consultation 1GW of new nuclear capacity was included in the 2020 high fossil fuel price scenario only.[13] The White Paper itself stated the Government's preliminary view:[14]

> …that it is in the public interest to give the private sector the option of investing in new nuclear power stations as part of our strategy to tackle the challenges of climate change and security of energy supply.

The January 2008 White Paper on Nuclear Power[15] that gave the go ahead for new nuclear power stations accepted that '..new nuclear generation can make only a limited contribution before 2020.'[16] However, it also included an indicative timetable which showed the fastest practical route to the building of new nuclear power stations.[17] This showed power output from new plants starting in 2018.

The July 2009 the projections that were published alongside the UK Low Carbon Transition Plan included the assumption of a single new station of around 1.6 GW operational from 2020 and up to one new station per year thereafter.[18]

The June 2010 projections make only minor changes –the first new nuclear station is expected to come online in 2021 under the central forecast, or up to three years earlier if fossil prices are at their highest. Even under this scenario (the most favourable to nuclear) its total output

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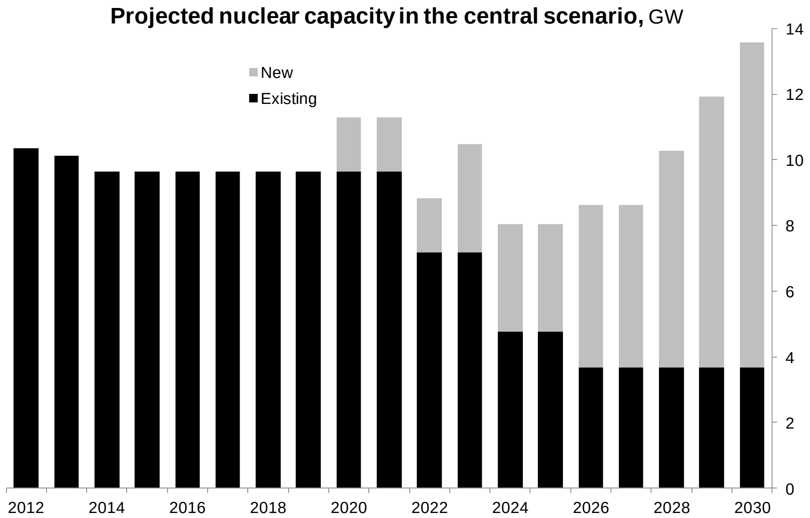
10 *The energy challenge. Energy review report 2006*, DTI. Chapter 5
11 ibid. Table 8.1
12 *Digest of UK energy statistics 2007, DTI*. Table 5.7
13 *Updated energy and carbon dioxide emissions, the Energy White Paper*, DTI May 2007
14 *Energy white paper: meeting the energy challenge*, DTI. Chapter 5
15 *Meeting the Energy Challenge. A White Paper on Nuclear Power*, BERR (Cm 7296)
16 ibid. para. 15
17 ibid. Chart 1
18 *UK Low Carbon Transition Plan Emission Projections*, DECC (July 2009)

in 2025 would only be around current levels and make up around 20% of total generation. The central price scenario has output at around half this level.[19]

The October 2011 projections put back the assumed date for first new operational nuclear station to 2022. Under the central scenario new capacity increases to 12 GW in 2030 and generation from nuclear drops to less 20% in 2020 before increasing to more than 20% by the end of that decade.[20] At the same time DECC published an 'Indicative timeline' for new nuclear build which shows a pathway for the first new nuclear stations to be operational in 2018.

The 2012 projections make some minor changes. The first new nuclear capacity is shown as coming on line in 2020 and the total new capacity reaches 10 GW in 2030. This is illustrated in the chart opposite. New capacity during the first half of the 2020s only really replaces the output of older stations that are due to close down and the first sustained increase in output is projected to be from 2026. In 2030 the central scenario has 103 TWh of nuclear generation; one quarter of the total.[21]

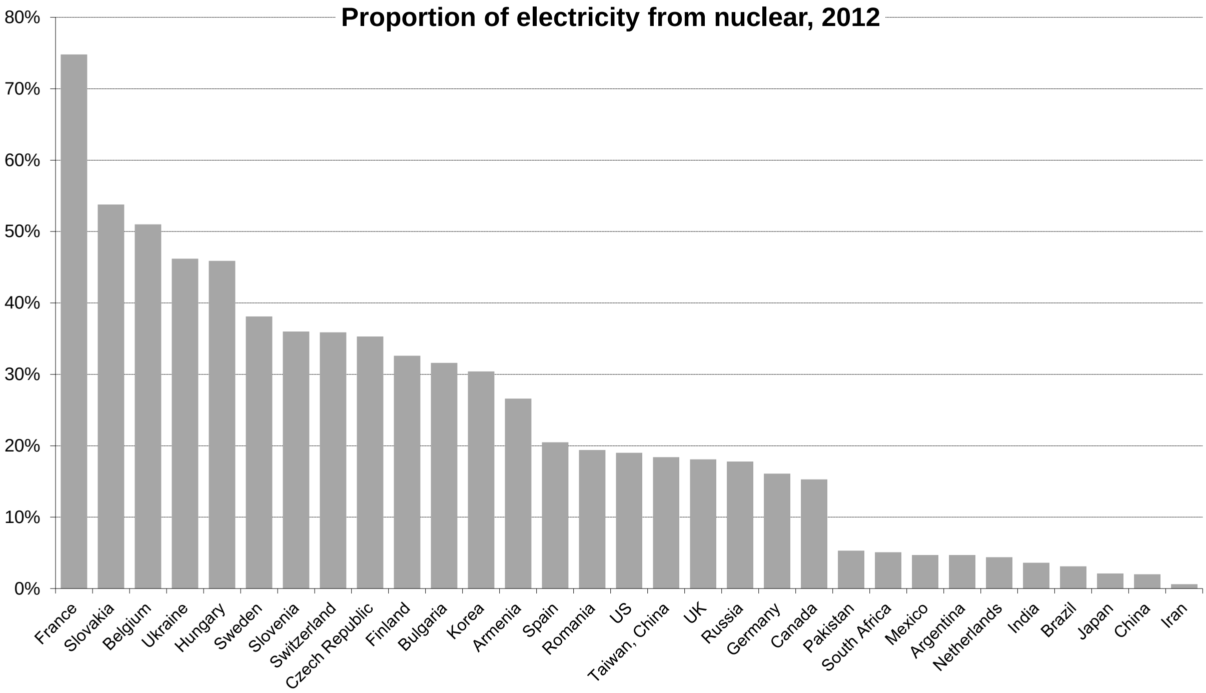


B. Nuclear energy around the world

There are currently 434 operational nuclear power plants in 30 different countries across the world. A further 69 are under construction. Their total output in 2012 was just over 2,300 TWh. Output in 2011 was 10.6% of global electricity generation.[22]

Table 3 at the end of this note and the chart below show the proportion of electricity from nuclear power in each country in 2012. Among those countries with nuclear power, the UK had among the smaller shares at 18.1%. Three countries produced more than half of their electricity from nuclear power, all of which are in Europe. France had the highest level at 75%; it was the second largest producer of nuclear power in absolute terms after the US.

[19] *Updated energy and emission projections*, DECC (June 2010)
[20] *Updated energy and emission projections*, DECC (October 2011)
[21] *Updated energy and emission projections 2012*, DECC (October 2012)
[22] IAEA Power Reactors Information System (PRIS) www.iaea.org/pris



Source: *IAEA Power Reactors Information System (PRIS)*

All but five of these countries increased their output of electricity from nuclear power between 1990 and 2012. Among larger producers, those with the greatest increase were Korea (186%), the US (34%) and France (37%). Nuclear output in Japan fell by 44% in 2011 in the aftermath of the March 2011 Fukushima-Daiichi accident and by a further 89% in 2012.

The IAEA's latest projections of nuclear capacity give a range of estimates for nuclear's future share of electricity generation. Their expected range in 2030 is 9.9% to 13.5% compared to a range of 10.4% to 13.5% made in 2012 and 12.3% projected in 2011. Nuclear capacity is projected to increase by 17-94% over the same period. This range is lower than in previous publications and has been affected by the Fukushima accident. These projections are based on data provided by individual countries on their own nuclear capacity, plus assumptions about economic growth, development, energy prices and energy mixes.[23]

C. Public expenditure

Ongoing expenditure by DECC and its predecessor departments relating to nuclear power in the UK primarily consisted of grants to the United Kingdom Atomic Energy Authority (UKAEA) to cover their nuclear liabilities, decommission facilities and fund research into nuclear fusion. This expenditure totalled £8.7 billion (in 2011-12 prices) over the period 1980-2005.[24] These liabilities and ongoing funding have since been transferred to the Nuclear Decommissioning Agency. It received government grant totalling £7.7 billion for its work on decommissioning over the years 2005-11.[25] It is expected to receive funding totalling £8.6 billion from DECC

23 *Energy, electricity and nuclear power estimates for the period up to 2050*, 2013 edition, IAEA

24 HC Debs 24 January 2002 c329-330W and 17 March 2004 c328-330W and 27 March 2007 c1466-7W. Prices adjusted using the GDP deflator at 22 December 2011

25 *Annual Report & Accounts 2008/09*, NDA; *NDA business plan 2010-11*, NDA

over the four years covered by the Comprehensive Spending Review (2011-15).[26] DECC also provided £280 million for British Energy and other nuclear legacy spending in 2011-12.[27]

Although not strictly government subsidies, Nuclear Electric, and latterly British Energy received substantial support from the Fossil Fuel Levy between 1990 and 1996. This support was to ensure that the newly formed Nuclear Electric would be able to meet the costs of its long-term liabilities. From 1990 consumers paid the levy as a percentage of their electricity bills. The regional electricity companies effectively passed this on to the generator. The total cash value of this support was £5.4 billion[28] or £8.5 billion in 2011-12 prices[29]. Measures included in the Energy Bill 2012, particularly 'contracts for difference', are expected to support nuclear operators and encourage new nuclear. Again this is support paid by customers through energy bills rather than direct public funding. The Library Research Paper on this bill gives much more background.

The nuclear sector also receives ongoing public funding for research into nuclear fission and nuclear fusion. The majority is for fusion research which is currently £25 million a year.[30]

1. Costs of the nuclear legacy

The 2002 white paper *Managing the Nuclear Legacy. A strategy for action*[31] estimated the undiscounted civil nuclear liabilities at £48 billion. This was made up of 47% nuclear waste management, 43% decommissioning and 10% ongoing management and maintenance costs. The majority of the total (£40.5 billion) was for liabilities that were managed by British Nuclear Fuels plc[32] (BNFL), principally Sellafield; the rest was managed by UKAEA. The lifetime of these liabilities goes well into the next century.[33] The white paper included estimated profiles of the costs. Annual expenditure was expected to be over £1 billion in the first 10 years with expenditure declining over the first half of this century. There is still uncertainty about the level of these liabilities and the white paper stated that they are likely to increase still further in the short term.[34]

The Energy Act 2004 established a new public body, the Nuclear Decommissioning Authority (NDA) to manage and fund the Government's civil nuclear legacy, which was previously the responsibility of BNFL and UKAEA. The NDA became operational in April 2005 and has taken over all these liabilities and associated assets. In the case of BNFL this included the funds it had set aside to contribute towards its decommissioning costs. The Secretary of State said at the time that the effect of these transactions would be financially neutral.[35] In August 2005 the NDA published its draft strategy for consultation. This gave their latest estimates of the undiscounted costs of operations, decommissioning and clean-up as £56 billion. They also

26 *Nuclear Decommissioning Authority. Business Plan. 2011-2014*, NDA
27 *Indicative 11/12 budget allocation*, DECC
28 HC Deb 17 March 2004 c328-330w
29 Adjusted using the GDP deflator at 22 December 2011
30 HC Deb 7 September 2011 c722-3W
31 *The Nuclear Legacy. A strategy for action,* DTI 2002. Cm 5552
32 This excludes liabilities covered by commercial; contracts which covered 12% of BNFL's liabilities.
33 ibid. figures 1-3
34 Cm 5552 para.1.14
35 HC Deb 28 November 2001 c990-95

stated that such costs could be 'considerably' higher due to the costs of dealing with higher hazard legacy facilities and the possible reclassification of certain nuclear materials as waste.[36]

The strategy based on 2005/06 Life Cycle Baselines, gave the undiscounted total costs of meeting their remit as £62.7 billion[37] (35.4 billion discounted at 2.2%). However, this did not include certain costs outside this baseline (but already identified) which they expect to add a further £7.5 billion to the undiscounted costs.[38] This would take the total costs to £70 billion; £14 billion of which is for operations and £56 billion decommissioning and clean-up.[39]

The 2007/08 annual report updated these cost estimates. The undiscounted cost increased to £74.9 billion. The NDA's liability was £63.5 billion and was lower because it excludes costs of commercial operations which generate income. The discounted liability (again 2.2% a year) was estimated at £40.7 billion. On top of this is the liability for the Geological Disposal Facility (GDF) for the management of radioactive waste. The NDA's share of the undiscounted cost of the GDF was estimated at £10.1 billion; or £3.4 billion discounted. This took the NDA's total liability to £73.4 billion undiscounted and £44.1 billion discounted. Estimated annual expenditure is expected to be in the region of £2.5 billion per year to the middle of the next decade before falling below £1 billion from around 2030 onwards and continuing at some level for more than a century thereafter.[40]

The NDA's estimated liabilities including the GDF have been increased in subsequent annual reports. Changes in this estimate are based on a number of factors including the working undertaken in year, changes to cost estimates and any changes to discount rates. Estimated liabilities stood at £58.9 billion (discounted) in the 2012/13 report.[41] This is what the NDA deems the most likely outcome. It also gives a potential range of these costs from £54.6-£63.8 billion. Total NDA expenditure from Government grant and its own income is expected to be around £3 billion per year to the end of the spending review periods (2014/15). They expect expenditure on the liabilities to fall by around half (in cash terms) over the next two decades or so.[42]

The NDA is not responsible for the liabilities connected with the EDF (formerly British Energy) power stations. These are provided for by the Nuclear Generation Decommissioning Fund. This was set up in 1996 is now the Nuclear Liabilities Fund (NLF). Although this fund/these liabilities are outside the public sector, it has received public funds in the past and could do so in the future. The fund was initially set up by Government as part of the privatisation of British Energy. It received an initial endowment at its inception of £228 million of public funding and regular payments from British Energy afterwards.

The fund and the liabilities it covered were changed when British Energy was restructured in 2005. It was also renamed the NLF. These changes involved the Government taking on British Energy's historic spent fuel liabilities as part of the restructuring plan. The Government also agreed to underwrite British Energy's decommissioning fund by making up any difference

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36 *NDA Draft Strategy*, section 7.1, Nuclear Decommissioning Authority
37 This falls to £48.4 billion if commercial revenue and other income are netted off
38 *NDA strategy March 2006*
39 NDA news release 30 March 2006 *Approved strategy for clean-up of UK's nuclear sites published*
40 *Annual Report & Accounts 2007/08*, NDA
41 *Annual Report & Accounts 2012/13*, NDA
42 Ibid.

between the company's payments into the fund and the fund's requirements.[43] Restructuring also involved a new schedule of payments to the NLF from British Energy. Details of this, the impact of the sale of British Energy to EDF and the current value of the NLF can be found at: http://www.nlf.uk.net/history.html

[43] HC 26 2004/05 pp10-11

D. Reference tables

Table 1

Electricity supplied by nuclear power in the UK

	TWh	Percentage of all electricity supplied
1956	0.1	0.1%
1957	0.4	0.4%
1958	0.3	0.3%
1959	1.2	1.0%
1960	2.1	1.6%
1961	2.4	1.7%
1962	3.5	2.3%
1963	5.9	3.6%
1964	7.6	4.4%
1965	14.1	7.7%
1966	18.9	10.0%
1967	21.8	11.1%
1968	24.5	11.8%
1969	25.8	11.6%
1970	22.8	9.8%
1971	24.0	10.1%
1972	25.6	10.5%
1973	24.3	9.3%
1974	29.2	11.5%
1975	26.5	10.4%
1976	31.2	12.1%
1977	34.7	13.1%
1978	32.5	12.1%
1979	33.3	11.9%
1980	32.3	12.1%
1981	33.2	12.8%
1982	38.7	15.2%
1983	43.9	16.9%
1984	47.3	17.9%
1985	53.8	19.3%
1986	51.8	18.4%
1987	48.2	17.1%
1988	55.6	19.3%
1989	63.6	21.6%
1990	58.7	19.5%
1991	62.8	20.7%
1992	69.1	23.0%
1993	81.0	26.7%
1994	80.0	25.9%
1995	80.6	25.2%
1996	85.8	25.6%
1997	89.3	26.7%
1998	90.6	26.2%
1999	87.7	24.9%
2000	78.3	21.7%
2001	83.0	22.6%
2002	81.1	21.9%
2003	81.9	21.6%
2004	73.7	19.5%
2005	75.2	19.8%
2006	69.2	18.3%
2007	57.2	15.1%
2008	47.7	12.8%
2009	62.8	17.4%
2010	56.4	15.4%
2011	62.7	17.8%
2012	63.9	18.5%

Note: Excludes electricity used in works

Sources: *Digest of energy statistics, various years, Ministry of Technology*
Digest of UK Energy Statistics, long-term table 5.1.3, www.decc.gov.uk
Energy Trends, DECC. Table ET5.1

Table 2

Inland consumption of primary fuels and equivalents for energy use

Percentage shares -energy supplied basis

	Coal	Petroleum	Natural gas	Nuclear electricity	Other[(a)]
1956	84.9	14.6	0.0	0.0	0.5
1957	84.7	14.6	0.0	0.1	0.6
1958	80.5	18.7	0.1	0.1	0.6
1959	76.5	22.6	0.1	0.2	0.6
1960	74.3	24.7	0.1	0.3	0.6
1961	72.1	26.6	0.1	0.4	0.8
1962	69.9	28.7	0.1	0.5	0.8
1963	68.4	30.0	0.1	0.9	0.6
1964	65.5	32.6	0.1	1.1	0.7
1965	62.2	34.6	0.4	2.0	0.8
1966	58.7	37.5	0.4	2.6	0.8
1967	55.2	40.2	0.7	3.0	0.9
1968	53.6	41.0	1.4	3.3	0.7
1969	50.7	42.7	2.7	3.3	0.6
1970	47.1	44.4	4.9	2.8	0.8
1971	42.3	45.2	8.8	3.6	0.1
1972	36.4	47.5	12.3	3.7	0.1
1973	37.7	46.0	12.7	3.4	0.2
1974	34.8	44.8	15.9	4.3	0.2
1975	36.5	42.0	17.3	4.0	0.2
1976	36.5	40.6	18.1	4.6	0.2
1977	35.7	40.4	18.7	5.0	0.2
1978	34.6	41.2	19.4	4.7	0.2
1979	35.5	39.5	20.2	4.6	0.2
1980	35.8	37.3	21.9	4.8	0.2
1981	36.7	35.0	22.9	5.1	0.2
1982	34.7	36.0	23.0	6.1	0.2
1983	34.9	34.2	23.9	6.8	0.2
1984	24.8	43.1	24.5	7.4	0.2
1985	31.5	35.1	25.2	8.0	0.2
1986	33.3	33.9	25.1	7.4	0.4
1987	34.0	32.9	25.6	6.8	0.7
1988	32.8	34.7	24.1	7.8	0.7
1989	31.7	35.7	23.2	8.4	1.0
1990	31.3	36.1	24.0	7.6	1.0
1991	30.6	35.1	25.2	7.9	1.1
1992	29.1	35.8	25.4	8.5	1.3
1993	24.9	35.4	28.5	9.8	1.4
1994	23.6	35.3	29.8	9.7	1.6
1995	22.4	34.5	31.7	9.7	1.6
1996	19.9	33.8	35.2	9.6	1.5
1997	18.0	33.3	36.8	10.2	1.6
1998	17.8	32.7	37.8	10.2	1.6
1999	15.6	33.0	40.0	9.7	1.7
2000	16.4	32.7	40.8	8.4	1.7
2001	17.2	32.0	40.3	8.8	1.6
2002	16.4	32.0	41.1	8.8	1.7
2003	17.5	31.5	40.8	8.6	1.6
2004	16.7	32.1	41.4	7.8	2.0
2005	16.9	33.1	39.9	7.8	2.4
2006	18.6	33.2	38.3	7.3	2.5
2007	18.0	33.6	39.6	6.2	2.6
2008	17.1	32.6	41.7	5.3	3.3
2009	14.9	33.3	40.9	7.2	3.6
2010	14.9	31.8	43.0	6.4	3.8
2011	16.1	33.2	38.3	7.7	4.8
2012	19.9	31.9	35.4	7.4	5.4

(a) Includes hydro, renewables and net electricity imports

Notes: These figures exclude energy used in works and conversion, transmission and distribution losses
There is a break in the series in 1970, data from before and after this time are not directly comparable

Sources: Digest of energy statistics, various years, Ministry of Technology
Digest of UK Energy statistics, long-term table1.1.1, www.decc.gov.uk

Table 3

Summary of international nuclear power statistics

	Reactors in operation in December 2012	Electricity supplied in 2012		Change in nuclear electricity produced 1990 to 2012
		TWh	% of all electricity produced	
Argentina	2	5.9	4.7%	-11%
Armenia	1	2.1	26.6%	..
Belgium	7	38.5	51.0%	-5%
Brazil	2	15.2	3.1%	+622%
Bulgaria	2	14.9	31.6%	+10%
Canada	20	89.1	15.3%	+29%
China	17	92.7	2.0%	-
Taiwan, China	6	38.7	18.4%	+23%
Czech Republic	6	28.6	35.3%	..
Finland	4	22.1	32.6%	+22%
France	58	407.4	74.8%	+37%
Germany	9	94.1	16.1%	-32%
Hungary	4	14.8	45.9%	+14%
India	20	29.7	3.6%	+482%
Iran	1	1.3	0.6%	..
Japan	50	17.2	2.1%	-91%
Korea	23	143.5	30.4%	+186%
Mexico	2	8.4	4.7%	+190%
Netherlands	1	3.7	4.4%	+12%
Pakistan	3	5.3	5.3%	+1218%
Romania	2	10.6	19.4%	-
Russia	33	166.3	17.8%	..
South Africa	2	12.4	5.1%	+48%
Slovakia	4	14.4	53.8%	..
Slovenia	1	5.2	36.0%	..
Spain	8	58.7	20.5%	+13%
Sweden	10	61.5	38.1%	-6%
Switzerland	5	24.4	35.9%	+10%
UK	18	64.0	18.1%	+9%
Ukraine	15	84.9	46.2%	..
US	104	770.7	19.0%	+34%
Total	**440**	**2,346.2**	**..**	**n/a**

Notes:

- No nuclear power in 1990

.. Country not in existence or listed separately in 1990

Source: Nuclear power reactors in the world, 2013 and earlier, IAEA
IAEA Power Reactor Information System (PRIS) pris.iaea.org

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Energy Security Select Committee

Dr Wim Melis

Senior Lecturer – Faculty of Engineering and Science (University of Greenwich)

Biography

Dr Wim Melis received his first degree in Belgium in Industrial Engineering in Electronics Design (MSc). He then moved to Imperial College, London where he obtained an MSc in Analogue and Digital Integrated Circuit Design (2001), before continuing on to obtain a PhD (2005) in Electronic Engineering – Computing Systems.

Since joining the University of Greenwich, Dr Melis has expanded his area of expertise to include more generic engineering challenges. He looks at a variety of different technologies in the area of sustainable energy generation and management, with a particular focus on improving the efficiency of these technologies, which includes the integration and use of energy storage solutions.

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Energy Security Select Committee

Hearing 4

Friday 4th December 2015

Witness Guide for Members

Below are suggested themes and questions. They have been provided in advance to the witnesses to allow them to prepare for the types of issues that Members may be interested to explore. All Members are welcome to ask these questions or pose additional ones to the witnesses via the Committee Chairman.

Themes and Questions

Dr Wim Melis - Senior Lecturer – Faculty of Engineering and Science (University of Greenwich)

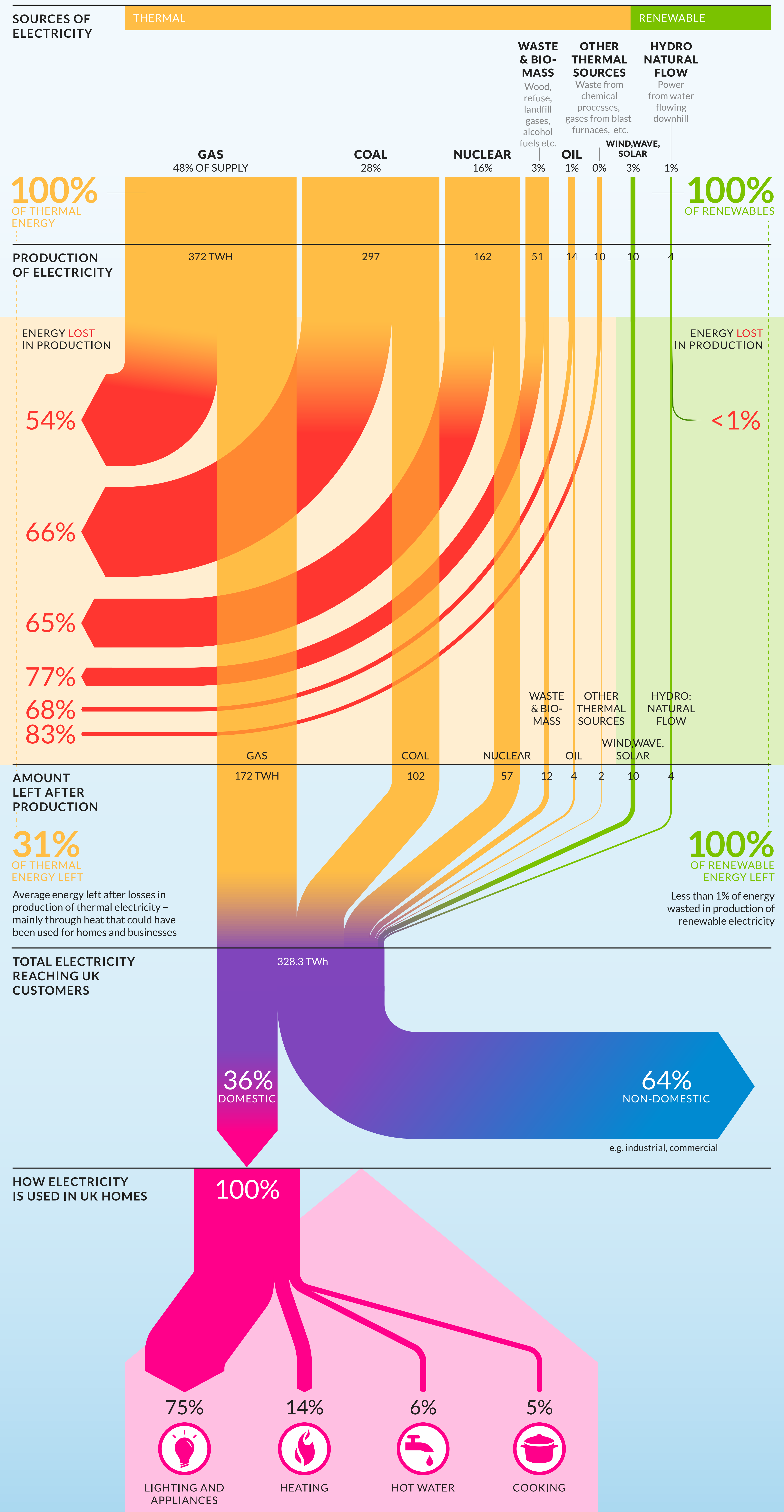
- Please introduce yourself and provide an outline of the roles and responsibilities of your post.
- Please discuss the key advantages and disadvantages of fossil fuel energy generation in the UK in relation to energy efficiency and security.
- What are your views on the benefits and challenges of decentralized energy generation?
- To what extent, in your view, is information and awareness around energy efficiency and security widespread within the UK?
- What are the advantages and disadvantages of introducing smart meters with regard to energy security?
- Please discuss the opportunities and challenges associated with energy storage.
- Please discuss the impact of transportation on future energy generation and security within the UK.
- What are, in your opinion, the main issues facing the UK in relation to energy demand and supply?
- Please outline the main issues around energy security and its relationship to the economy and environment.

- What, in your view, can Kent County Council do promote energy security within the county?

- Are there any other issues that you would like to raise with the Committee?

UP IN SMOKE

How is electricity produced in the UK?
How much energy is lost along the way and what can you do about it?



POTENTIAL ANNUAL SAVINGS	LIGHTING AND APPLIANCES	HEATING	HOT WATER	COOKING
	Change lightbulbs to CFLs and LEDs £55 (12%)	Change storage heater to slimline/fan model £110 (24%)	Wash clothes at 30 instead of 40 degrees £12 (3%)	Only fill kettle with what you need £7 (1%)
	Upgrade desktop computer to energy-saving laptop £47 (10%)		Replace old washing machine with A+++ model £15 (3%)	
	Replace old fridge freezer with energy efficient model £40 (9%)			
	Unplug electronic equipment £35 (8%)			
	Replace old tumble dryer with energy efficient model £21 (5%)			

SOURCES

Department of Energy and Climate Change, DUKES 2011

Energy Saving Trust 2012

DISCLAIMER

Figures rounded to nearest 1%. Totals may not always sum due to rounding.

34 TWh of electricity is lost after production, due mostly to transmission losses and electricity usage by the energy industry such as petroleum refineries and hydro pumped storage.

Usage breakdown refers to all UK homes whereas home energy savings are maximum per household and should not be considered cumulatively.

Savings calculated by Energy Saving Trust based on three-bedroom semi-detached gas heated house with average electricity price of 14.39p/kWh; correct as of September 2011, valid for 2011–12.

Bill percentages calculated by Friends of the Earth, based on DECC's average 2011 UK annual domestic electricity bill of £453 assuming electricity consumption of 3,300kWh/annum.

One Terawatt-hour (TWh) of electricity is approximately enough to power the London Underground for a year.

friends of the earth
see things differently

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Energy Security Select Committee

Stephanie Karpetas

Founder of Sustainability Connections & Director of Community Energy South

Biography

Stephanie has previously worked as Environment Training Manager at British Airways plc and has ten years of experience in Kent of working with SMEs, charities, social enterprises, local authorities, business support organisations and EU projects. She has conducted over 100 SME (small/medium enterprise) environmental audits, established a 300-strong green retrofit cluster for Ashford Borough Council, and has delivered two ESF (European Social Fund) projects training unemployed women to be Local Energy Champions. Stephanie is a co-founder and Director of Action Women! Community CIC, and a fellow of the RSA (Royal Society for the encouragement of Arts, Manufactures and Commerce).

About Sustainability Connections

Sustainability Connections draws together local expertise and capacity on sustainable renovation, energy efficiency, community owned renewable energy and alternative financing. Their immediate goal is to see local people having control and ownership of energy. They want fair energy tariffs, energy efficient buildings and community owned renewable energy, and for all the jobs and economic prosperity that go hand in hand with achieving this mission to be enjoyed by local communities.

Sustainability Connections work cross sector, but particularly closely with central and local government, with the voluntary sector, with community groups and with local SMEs, putting the growth of the local construction sector SMEs at the heart of everything they do. They work in partnership with Community Energy South in Kent, Sussex and Hampshire.

About Community Energy South

Community Energy South (CES) is an unincorporated association of community energy groups across Southeast England, including Sussex, Hampshire and Kent.

It aims to facilitate the transition to a distributed renewable energy network and promote reductions in energy consumption by facilitating and promoting the diverse activities and projects undertaken by its members.

The benefits of Community Energy South are the synergies obtained by uniting a group of people working with complementary skills and talents to provide support and knowledge sharing.

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<u>Energy Security Select Committee</u>

<u>Hearing 4</u>

Friday 4th December 2015

Witness Guide for Members

Below are suggested themes and questions. They have been provided in advance to the witnesses to allow them to prepare for the types of issues that Members may be interested to explore. All Members are welcome to ask these questions or pose additional ones to the witnesses via the Committee Chairman.

<u>Themes and Questions</u>

Stephanie Karpetas (Sustainability Connections & Community Energy South)

- Please introduce yourself and provide an outline of the roles and responsibilities of your post.
- How, if at all, can community energy schemes ensure energy security for Kent?
- What, in your opinion, are the most important forms of community energy?
- What is fuel poverty, and what is the condition of fuel poverty in Kent at present?
- How, if at all, can energy efficiency measures and retrofitting contribute towards energy security?
- Please discuss current and future employment and training opportunities concerning the energy sector in Kent.
- Please discuss any issues associated with community tariffs with regard to improving energy security.
- What is the current state of national and local funding for grassroots community energy projects?
- What role can local and regional partnerships play in promoting energy security? How are they performing at present?

- What, in your view, are the key initiatives that Kent County Council can implement to promote energy security within the county?

- Are there any other issues that you would like to raise with the Committee?

Community Energy South (CES) is an umbrella organisation for community energy groups across Sussex and Kent that will soon include Hampshire, Surrey and South London.

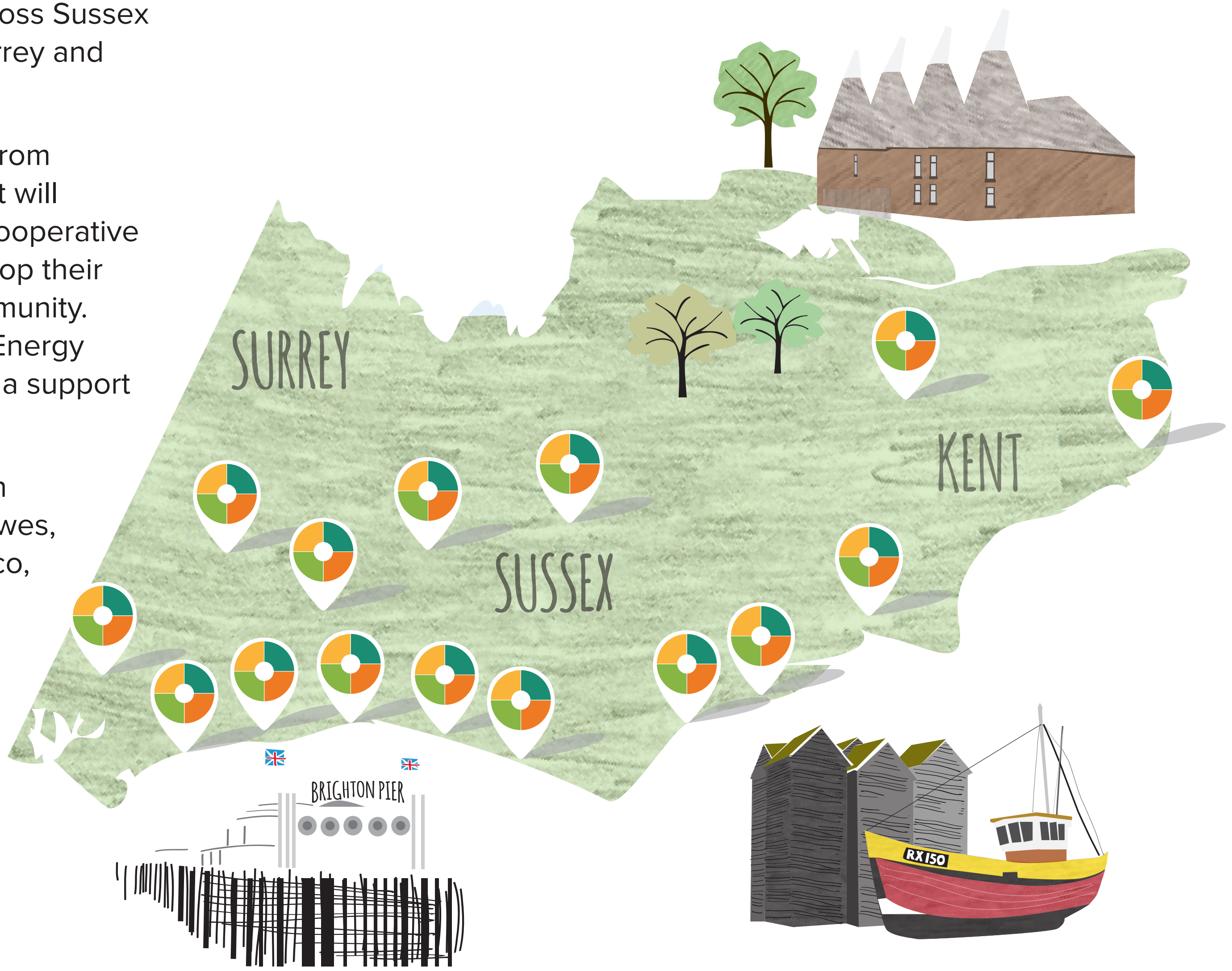
Community Energy South

Community Energy South: Who are we?

Community Energy South (CES) is an umbrella organisation for community energy groups across Sussex and Kent that will soon include Hampshire, Surrey and South London.

We currently have 15 member energy groups from Chichester to Deal. We are a Ltd Company that will become a Charity. Each group is set up as a Cooperative and has a board of directors that help to develop their own Community Energy practice for their community. Each group works in both Energy Saving and Energy Generation. Community Energy South acts as a support mechanism and a voice for the groups.

Current Directors are the founders of their own community energy enterprises in Worthing, Lewes, Barcombe, Brighton, Hastings and Kent: Ovesco, BHesco, Energise Sussex Coast, Barcombe Energy Group, Worthing Community Energy and Sustainability Connections.



Our strategy

BRINGING
LOCAL POWER

TO OUR
COMMUNITIES

Power supply: Our tariff strategy

CES seeks to look for Energy Supply partners to introduce our three local community energy tariffs including a Fixed pay monthly tariff.

The service would be named the Community Energy South tariff:

- A 100% renewable energy tariff
- Fixed energy tariff - 30 or 50% renewable
- A fairer PAYG tariff for prepayment meter customers

The tariffs will be supported over time by local renewable energy projects developed by our members. Our energy company partners will have opportunities to purchase our collected generation capacity.

The referral fee that CES earns from switching residents to the Community Energy Tariff will provide a steady cash flow that will build our local service for local people. We want our communities to be able to bring their bills to us and we help them face to face.

Who are our customers?

There are approximately 600,000 households in Sussex and 500,000 households in Kent.

Our Community Energy Network has close working relationships with other voluntary organisations, local authorities and social housing providers who would all support and promote a community energy tariff.

This would be popular and self-sustaining due to:

- The public trust that community groups enjoy and the appeal of community owned, decentralized energy generation
- CES being able to offer a consistent local energy service regardless of political change
- CES being closely linked to local groups, including neighbourhood planning groups and community and voluntary sector groups.

67% of people would like to see the energy industry re-nationalised. Community energy represents a step towards this aim.

What is special about Community Energy South?

Since CES was formed we have jointly contributed more than 12,000 volunteer hours to setting up local support networks and delivering energy services to our communities.

Together the CES network of community energy groups numbers over 5,000 local people.

Since 2013 CES members have delivered the Department of Energy and Climate Change (DECC) Big Energy Saving Network (BESN) scheme.

In 2014/2015 fifteen CES community energy champions were trained to provide energy saving and tariff switching advice and we directly helped over 2000 residents with their energy bills and trained over 650 frontline workers.

We estimate that we saved the region £375,000 on energy.

As a result of the Cabinet Office's 2014/2015 Community Energy Peer Mentoring Project we have mentored the growth of 12 new Community Energy Groups all registered as Community benefit Societies - in 2016 we projecting 20MW's of energy generation across these groups.

Our contact

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