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## The Economics of Renewable Energy - Economic Affairs Committee - [Contents](#)

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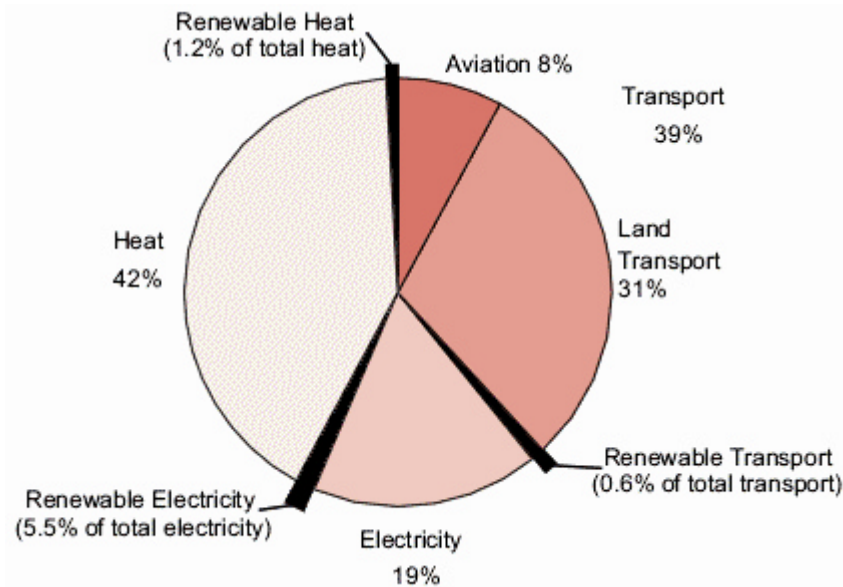
## CHAPTER 2: RENEWABLES AND THE UK ENERGY SYSTEM

10. Renewable energy differs from conventional fossil fuel or nuclear energy in that the latter are dependent on finite resources, while the former is not. Currently renewable energy supply is only a small part of Britain's energy system. In this chapter we give an overview of the energy system and the Government's energy objectives.

### Britain's energy system

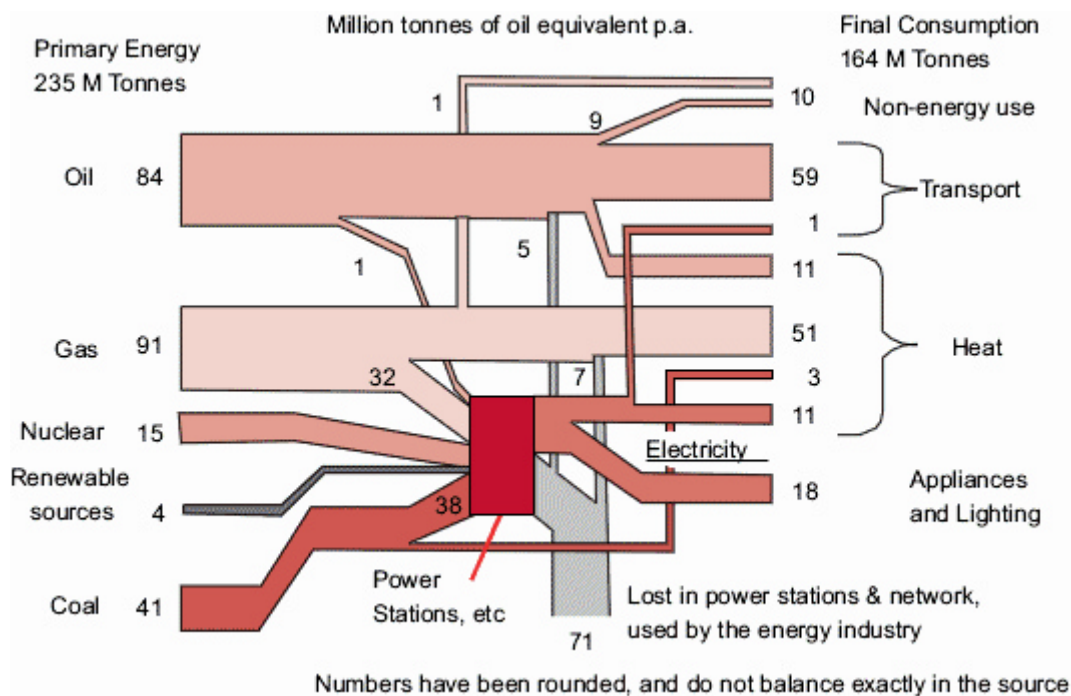
11. There are three main uses for energy—heating, transport and as electricity. In 2007 heat accounted for 42% of final energy consumption in the UK, transport for 39% and electricity for 19%.<sup>[3]</sup> The share of heat has been falling in recent years, and those of transport and electricity have risen. Overall, renewables accounted for only 1.8% of energy used in Britain, calculated on the basis used by the European Commission.<sup>[4]</sup> Most of this has been to generate electricity. About 5.5% of electricity came from renewables in 2007 but only around 1% of the energy used in heat and transport was renewable.

### FIGURE 1 Energy Mix 2007



Source: Digest of UK Energy Statistics

**FIGURE 2**  
**Energy flows in the UK, 2007**



Source: BERR

12. Figure 2 shows the main sources of energy, giving domestic production plus net imports of coal, oil, gas, nuclear electricity and renewable power, measured in millions of tonnes of oil equivalent. [5] Oil is by far the most important transport fuel, but around 11 million tons is used for heating. A small amount is burned in power plants to generate electricity, and a significant quantity is used outside the energy industry, as a chemical feedstock. Gas and coal are burned in power plants to generate electricity (in roughly equal amounts) and are also burned to provide heat. The other sources of electricity are from using uranium in nuclear power stations, and from renewable power sources. Only part of the energy that goes in to power stations is converted into electricity, while the rest is lost as waste heat. Electricity is also lost in the transmission and distribution wires, while some gas is used to power the compressors that move it around the pipeline network. These losses are shown in the flow that leaves the bottom of the diagram. Nearly two-thirds of our electricity is used for lighting and appliances, where it has no effective substitute, but much of the rest is used for heat. This is illustrated approximately in Figure 2, which shows a higher overall share of heat than Figure 1. A small proportion of our electricity is used in transport, mainly on the railways.

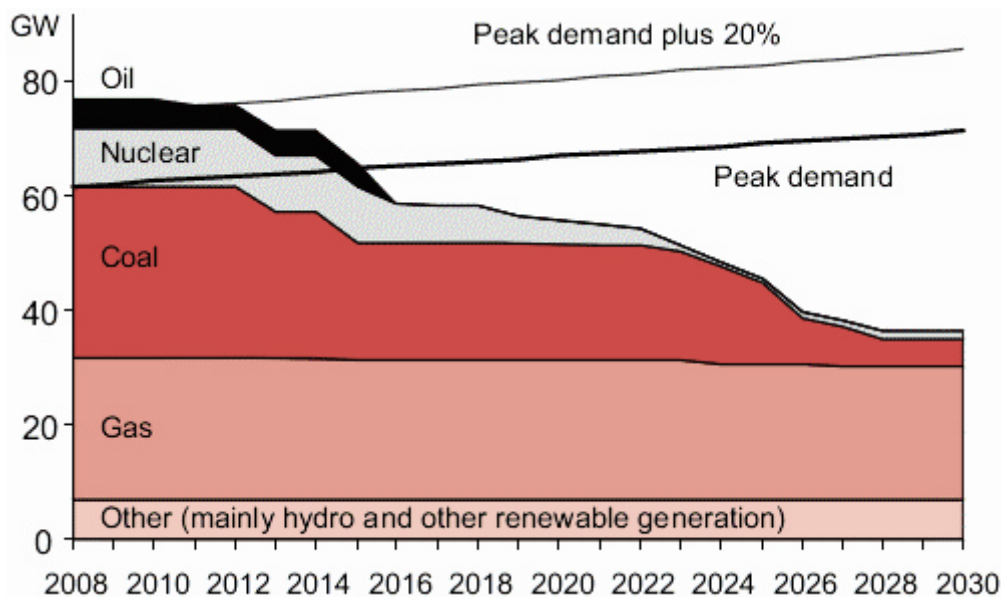
THE ELECTRICITY SYSTEM

13. Much of this report is concerned with the use of renewable sources to make electricity. Unlike coal, gas and oil,

electricity cannot be stored easily on a large scale. This means that we must consider the industry's capacity—the amount that can be produced at any moment—alongside the energy that it produces. Britain has 76 GW (1 GW = million kilowatts) of electricity generating capacity, a margin of roughly 25% over the highest electricity demand in 2007 of 61.4 GW. Average demand was just under 40 GW. The largest power station in Britain, Drax in Yorkshire, has a capacity of 4 GW, but most of the gas-fired power stations built in the last two decades have a capacity of between half and one GW.

14. Even without renewables, Britain's electricity system will go through a period of heavy investment. 18 GW—almost a quarter—of electricity generating capacity is due to close by 2020. Of this, 8.5 GW of coal-fired plants will close to meet EU requirements on pollution<sup>[6]</sup> as will another 2.5 GW of oil-fired stations. A further 7 GW of nuclear power is scheduled to close by 2020, based on the published lifetimes of the plants (which have, in the past, been extended, subject to meeting safety requirements). The impact of these closures on Britain's electricity generating capacity is shown in figure 3 below. In the meantime, demand for electricity is also expected to increase which will also have to be met by greater capacity. The dotted line shows a 20% margin over peak demand which is the current amount of spare capacity available to ensure there are no power cuts when power plants need to be turned off for maintenance and repairs. If this margin is to be maintained at around 20% then new power stations need to be built in good time to replace these closures and to meet increases in demand. On this basis, the Government has calculated that around 20-25 GW of new power stations will be needed by 2020.<sup>[7]</sup> These figures do not take the new renewables targets into account.

**FIGURE 3**  
**Predicted electricity demand and generation capacity after forecast closures**



Source: E.ON UK

#### Energy policy objectives

15. In last year's energy white paper the Government said, "Our four energy policy goals are:

- to put ourselves on a path to cutting the UK's carbon dioxide emissions—the main contributor to global warming—by some 60%<sup>[8]</sup> by about 2050, with real progress by 2020;
- to maintain the reliability of energy supplies;
- to promote competitive markets in the UK and beyond, helping to raise the rate of sustainable economic growth and to improve our productivity; and
- to ensure that every home is adequately and affordably heated".<sup>[9]</sup>

16. The Government's second objective—maintaining the reliability of electricity of energy supplies—has several aspects. The country must have access to sufficient supplies of primary energy; it must have an adequate infrastructure for delivering those supplies to consumers; and that infrastructure must be available when required.<sup>[10]</sup> Long-term security of supply—availability of primary energy—is normally improved by having access to a portfolio of energy sources, diversified both in terms of fuel and (if imported) source country. Increasing the use of renewable energy in the UK will add diversity to our portfolio, but will not necessarily add to reliability of supply, as some forms of renewable electricity generation will not always be available when required, depending on the wind, the waves, the tides or the sun.

#### Renewables and energy policy

17. The Government's main reason for increasing the share of renewable energy is to contribute to the reduction of carbon emissions. Some renewable generators emit practically no carbon dioxide when they are running (such as wind power). In others such as those using biomass (fuel from organic matter) most of the carbon released was taken from the atmosphere by the plants used.

18. The EU has agreed on a legally binding target for renewable energy equal to 20% of the total of all member states' overall energy consumption in 2020.<sup>[11]</sup> At present, the European Commission has proposed different targets for different countries in order to meet the overall 20% target. Some of these are still the subject of dispute within the EU. In

the UK's case the proposed EU target is 15% of energy from renewables, which the Government describes as "very challenging".<sup>[12]</sup>

19. Renewable energy is not the only way to reduce carbon emissions. Nuclear power is a well established low carbon source of electricity. Coal-fired power plants with carbon capture and storage (CCS) might at some point be another option but it is still unclear if and when they will become practicable (EDF p 272, British Energy pp 238, 243).<sup>[13]</sup> Although the main technologies involved are all, separately, in operation, no commercial-scale power plant has yet been fitted with CCS (E.ON QO 237-9). E.ON expects CCS to be competitive with costs of conventional fossil generation if the price per tonne of CO<sub>2</sub> under the EU Emissions Trading Scheme rises to Euro 40-50—roughly double the current level (Q 213).

20. Some have argued that renewables can also help with another aim, increasing security of supply. (BERR p 210, EDF pp 272-273, Scottish & Southern p 92). As noted in paragraph 16 above, renewables might do so by increasing the diversity of Britain's energy sources. This could be important as Britain's domestic sources of oil and gas dwindle—three-quarters of the UK's gas is expected to be imported by 2015 compared to around 20% today (Centrica p 96). Many of these imports are expected to come from regions where political as well as market factors could affect supply.

21. These developments are occurring amid high and volatile wholesale energy prices. The risk is less that Britain's oil and gas supplies would be cut off and more that it would be exposed to volatile price swings by having to rely more on imported oil and gas. In addition to the political and price risks, while new oil and gas reserves continue to be found they are in less accessible locations from which they are expensive to extract. James Smith, chairman of Shell UK, said: "The 'easy' oil and gas has probably been found and produced." (Q 336)

22. Exposure to price volatility could be lessened by using renewables. But greater use of nuclear power and/or coal—of which Britain and close geopolitical allies such as Australia still have large supplies—could provide similar benefits.

23. Furthermore, renewables have a potential **negative** effect on security of supply in that they can be markedly less reliable than fossil fuels in generating energy to meet peak demand. For example, wind turbines produce no power if the wind does not blow or blows too hard. To provide an acceptable level of security, it is necessary either to have strong interconnections to other countries (which the UK lacks) (British Energy p 238) or to build a significantly higher level of overall capacity than in an equivalent system without wind power. Both of course significantly add to the cost of electricity.

24. We have received different estimates of where the 15% share of renewable energy might come from. All expected a higher share of renewable electricity than of transport fuel or heat. The range of estimates of the share of electricity generation from renewables needed in 2020 to meet the target is from 30 to 40%. Those based on a 10% share of renewable energy in transport (the level set by EU policy) and on 10% in heat imply 40% renewable electricity. The Government expects to achieve a heat share of 14%, reducing the share expected of renewable electricity to 32%. Given the much larger share expected in electricity, we turn to this sector in Chapters 3 and 4. We return to heat and transport in Chapter 5.

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3 Digest of UK Energy Statistics, 2007 edition. Electricity used to provide heat is counted as "electricity" rather than as "heat". Final energy consumption, as defined in UK statistics, also includes non-energy use—mainly when oil and gas are used as chemical feedstocks—which makes up 6% of it. [Back](#)

4 The European Commission excludes the non-energy use of oil and gas, and includes electricity used at power stations and lost in transmission and distribution networks—both changes have the effect of raising the share of electricity in final energy consumption, compared to the standard UK definition. [Back](#)

5 A million tonnes of oil equivalent—the unit used in Figure 2—is the amount of energy released by burning 1m tonnes of crude oil, and is equal to 11.63 billion kilowatt hours (the standard unit of electrical energy). A one bar electric fire consumes approximately one kilowatt of power. [Back](#)

6 The Large Combustion Plant Directive requires coal- and oil-fired power stations either to fit Flue Gas Desulphurisation equipment or to close by the end of 2015. [Back](#)

7 Department of Trade and Industry, *Meeting the Energy Challenge*, A White Paper on Energy, May 2007, p 128-129. [Back](#)

8 The Secretary of State for Energy and Climate Change announced on 16 October that "The Government accept all the recommendations of the Committee on Climate Change. We will amend the Climate Change Bill to cut greenhouse gas emissions by 80 per cent by 2050, a target that will be binding in law." Hansard, 16 October 2008, cols 935-937. [Back](#)

9 Department for Trade and Industry, *Meeting the Energy Challenge—A White Paper on Energy*, May 2007, p 6. [Back](#)

10 Department for Business, Enterprise and Regulatory Reform and Ofgem, *Energy Markets Outlook*, October 2008, Chapter 3. [Back](#)

11 The House of Lords EU Committee, 27th Report (2007-08) *Renewable Energy: The EU's 20% by 2020*, (HL 175). [Back](#)

12 Department for Business, Enterprise and Regulatory Reform, *UK Renewable Energy Strategy* consultation, June 2008, p 3. [Back](#)

13 In May 2007, Alistair Darling, the then Secretary of State for Trade and Industry, warned that carbon capture and storage at coal-fired power plants "might never become available". Hansard, 23 May 2007, column 1289 [Back](#)

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