

Part I

The Global Context



Chapter 1

THE RADICAL CHALLENGE

Human use of energy has grown enormously, based overwhelmingly on burning fossil fuels. This is causing a significant change in the composition of the atmosphere which, unless halted, is likely to have very serious consequences

1.1 Energy, both as heat and work, has played a central part in the development of human societies throughout the world. Early communities depended on heat from burning wood, dung or agricultural residues and on work performed by human and animal muscles. Many millions of people in rural areas of developing countries still do. But as societies have become industrialised, other sources of energy have been harnessed on an increasing scale. For centuries, wind and water have driven pumps and mills. The industrial revolution was made possible by the invention of steam engines that could obtain work from heat, using coal as fuel.

1.2 During the 20th century, the rate of worldwide energy use has increased ninefold. As figure I-1¹ shows (red curve), nearly all the increase has occurred since 1945. From then until the early 1970s the rate at which primary energy was being used grew at almost 5% a year; growth slowed to around 2% a year following the sharp increase in oil prices in 1973-74, but quickened again in the 1980s. Expressed as an average per person (black curve), energy use has not increased significantly in recent years, but total energy use worldwide continues to rise.

1.3 The most rapid growth in demand has been for electricity and mobility. Between 1971 and 1995, final demand for electricity increased by 147% and final energy demand for mobility by 82%. These two sectors now account respectively for 25% and 17% of global final energy consumption.² Worldwide demand in all sectors will inevitably grow further as lower-income countries develop.³

1.4 There have been accompanying changes in energy sources. In 1930 over three-quarters of the energy being used worldwide came from fossil fuels, among which coal predominated.⁴ By 1971 97% of the energy being used came from fossil fuels, but half was from oil. Following the oil crises of the 1970s, however, the relative importance of oil declined, while gas, nuclear and hydro power all increased rapidly in importance. In 1995, about 90% of world primary energy supply came from fossil fuels (about 40% from oil, 28% from solid fuels, 22% from gas), 7% came from nuclear, 3% from hydro power and 0.4% from other renewable sources.⁵

1.5 The benefits provided by energy – warmth, light, and the power used in industry and transport – are easy to identify. But it has long been apparent that the extraction, processing, movement and use of all kinds of fuel brings risks not only to workers in the relevant industries but also to the population at large, and plant and animal life, through the environmental damage that some of these activities cause.

1.6 Adverse effects associated with use of fossil fuels prompted some preventive actions. In Britain, the premature deaths caused by days of heavy smoke and sulphur dioxide pollution in urban areas in the 1950s led not only to domestic smoke controls, but also to a new generation of large power stations in rural areas, with tall stacks to ensure dilution of the emitted gases.

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Recognition that this did not prevent the deposition of acid sulphate and nitrate – and indeed favoured their international dispersion to fall as acid rain thousands of kilometres from source – led to demands for fuels with a lower sulphur content, flue gas desulphurisation and low-nitrogen oxide burners. Alarm over the oxidant smogs produced largely by pollutants reacting in sunlight, and the effects these have on human health and sensitive crops (first voiced in California), focused attention on emissions from vehicles, which like industrial emissions are subject to increasingly stringent limits.

1.7 Even so, current levels of air pollution are judged to have both acute and chronic effects on human health. In Britain exposures over short periods to small particles, sulphur dioxide, nitrogen dioxide and ozone have been estimated to contribute to 24,000 deaths and 24,000 hospital admissions each year.⁶ The deaths are labelled as ‘brought forward’ because the exposures are thought to precipitate death in people with pre-existing illness; there is no reliable estimate to indicate by how much they are brought forward. In addition, longer-term exposure to air pollution may have effects on initiation of disease, but estimates of the size of such effects in the UK are not available.

1.8 While these risks associated with using fossil fuels can hopefully be controlled more effectively by applying reasonably well-established technology, the issues raised by nuclear power have proved to be less tractable. The initial enthusiasm in the 1950s for what was hailed as a clean and potentially limitless source of electricity became muted when it emerged that some of the wastes from that industry, and some of its disused installations, would inevitably contain very long-lived radioisotopes requiring isolation for many millennia. Accidental releases of radioisotopes, especially in the disaster at Chernobyl in Ukraine in 1986, together with concerns about the safety and costs of disposal of nuclear wastes and the decommissioning of plants, halted the construction of new nuclear stations in many countries, and led to commitments in Sweden and Germany to phase out nuclear power.

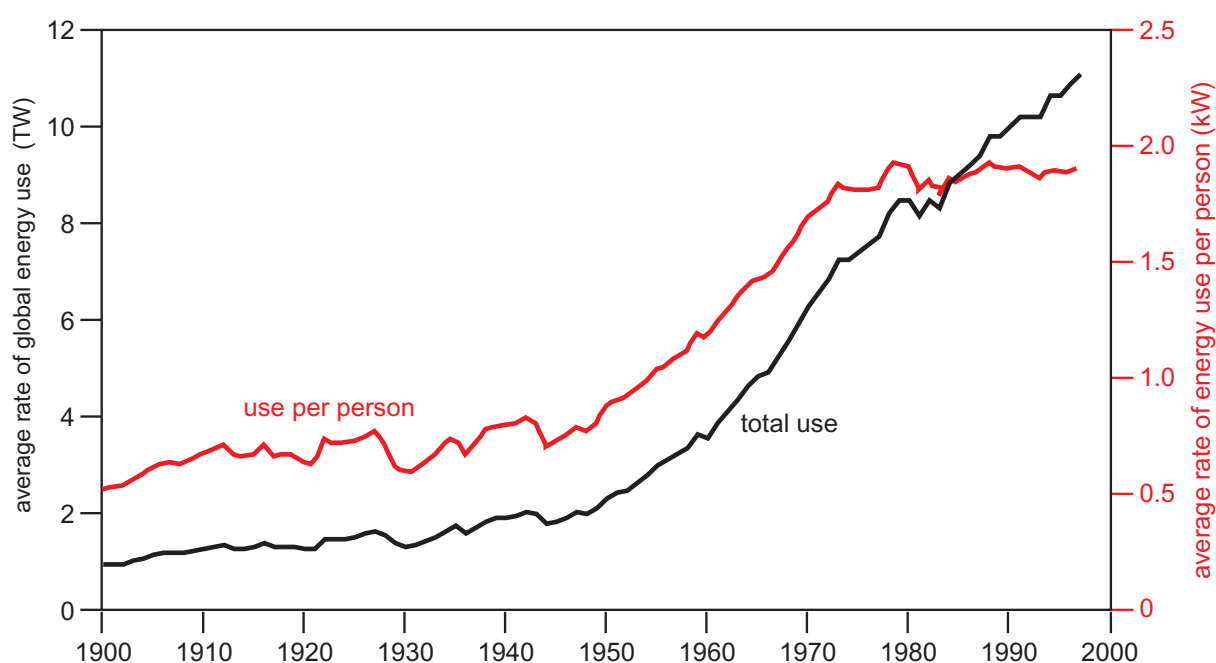
1.9 Building the installations required to obtain and transport energy has also caused controversy. Debates over the siting of power stations and large hydro power schemes – and the acceptability of their impact on landscape, amenity, local human communities and wildlife – have been impassioned. Visual intrusion caused by wind farms is now also the subject of heated arguments in the UK and other countries.

1.10 These experiences emphasise that there is no energy source without its environmental problems.

1.11 During the last decade a new concern about the environmental effects of energy use has become dominant. It arises because burning fossil fuels converts the carbon present in all such fuels into the gas carbon dioxide. The concentration of carbon dioxide in the Earth’s atmosphere is rising steadily. The effects are likely to be significant warming of the world’s climate, a rise in sea level, changes in weather patterns, and according to most studies a greater frequency of extreme events. The environmental and social consequences of such changes are potentially catastrophic.

1.12 The world community is confronted with a radical challenge of a totally new kind. Modern civilisation currently depends heavily on the use of fossil fuels. That situation cannot easily or quickly be modified. Yet continuing use of fossil fuels on anything like the present scale may make the whole process of development unsustainable: it may (using the words of the Brundtland Commission) ‘meet the needs of the present’ but compromise ‘the ability of future generations to meet their own needs’.⁷

Figure 1-1
Growth in global energy use 1900-1997



1.13 The situation is particularly challenging because the natural processes that could bring about such damage are global, whereas action to deal with the problem has to be agreed and implemented by many independent nations. Decisions are made more difficult because those natural processes have very long time-scales. Today's actions – harmful or beneficial – will not take full effect for many decades. That makes it all the more urgent to start now on framing appropriate policies and putting them into effect.

1.14 Because of favourable circumstances, it is relatively easy for the UK to meet its international obligations to reduce emissions of carbon dioxide and other greenhouse gases, which so far extend only a decade ahead (4.7-4.8). As a result, we as a nation have not yet begun to confront the hard choices we shall have to face. **Part II** of this report deals with the energy policies the UK should adopt in order to cope successfully with the challenges of the next 50 years.

1.15 **Part I** of this report deals with the global context. The increased concentration of carbon dioxide is a global phenomenon which can be controlled only through concerted global action. In **chapter 2** we summarise current scientific knowledge about the natural processes involved, analyse the relationship between scenarios for future emissions and carbon dioxide concentrations, and consider the possible effects of climate change. In **chapter 3** we discuss actions the world community might take to limit the increase in the amount of carbon dioxide in the atmosphere. These include attempts to manage other aspects of the global carbon cycle, raising efficiency in order to limit the amounts of energy required, and large-scale replacement of fossil fuels by other energy sources.

1.16 In **chapter 4** we consider the international agreements already signed, what kind of international response is appropriate to the scale and nature of the challenge, the implications such a response may have for the UK, and the position the government ought to adopt in future negotiations.

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1.17 Chapters 2-4 provide the essential background for the more detailed examination in subsequent chapters of the UK's current energy policies, the scope for reducing energy use in the UK, the availability of alternative energy sources, and the possibility of a future UK energy system based on a drastic reduction in use of fossil fuels. Based on this analysis, we recommend a wide range of measures the government should take now to begin the fundamental reshaping of the UK's energy policies that will be essential in the medium and long term.

In addition to previously recognised risks from obtaining and using energy, the world is now faced with a radical challenge of a totally new kind, which requires an urgent response. The longer the response is deferred, the more painful the consequences will be