

Annex E

Energy and the environment

Introduction

E.1 The operations of the energy sector in the UK, as elsewhere, can affect the environment in many different ways. Detrimental effects can result from exploration, production, transportation, storage, conversion and distribution. The final use of the energy and the disposal of waste products can also damage the environment.

E.2 The particular areas of potential environmental concern related to the energy sector are:- ambient air quality; acid deposition; coal mining subsidence; major environmental accidents; water pollution; maritime pollution; land use and siting impact; radiation and radioactivity; solid waste disposal; hazardous air pollutants; stratospheric ozone depletion; and climate change. Fossil fuels are responsible for the majority of emissions of greenhouse gases and other pollutants such as sulphur dioxide, black smoke, oxides of nitrogen and carbon monoxide.

E.3 While the impact of energy use on the environment is important, information on emissions and oil spills are published elsewhere. Rather than replicate information, this annex gives an overview of some of the impacts of energy use on the environment without going into the detail of the methodology or providing the background data. The data sources are listed in the section at the end of this annex.

Greenhouse gases

E.4 Naturally-occurring greenhouse gases maintain the earth's surface at a temperature 33°C warmer than it would be in their absence. Water vapour is by far the most important greenhouse gas but there are also significant natural sources of carbon dioxide, methane, ozone and nitrous oxide. At present greenhouse gas concentrations in the atmosphere are increasing as a result of human activities. There is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities.

E.5 Targets for emission reductions cover a basket of six greenhouse gases: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride. The most important of these from an energy perspective is carbon dioxide, where 95 per cent of emissions come from fuel combustion. Carbon dioxide emissions contribute around 70 per cent of the potential global warming effect of anthropogenic emissions of greenhouse gases. Although this gas is naturally emitted by living organisms, these emissions are balanced by the uptake of carbon dioxide by the biosphere during photosynthesis; they therefore tend to have no net effect on atmospheric concentrations. The burning of fossil fuels, however, releases carbon dioxide fixed by the biosphere over many millions of years, and thus increases its concentration in the atmosphere.

E.6 In 2004, the main sources of carbon dioxide emissions (on an Intergovernmental Panel on Climate Change basis) were power stations (30 per cent), industry (25 per cent), transport (22 per cent) and the domestic sector (15 per cent). In 2004, 158½ million tonnes of carbon are estimated to have been emitted as carbon dioxide from the UK. Between 1990 and 2003, emissions fell by 4 per cent, despite increases in emissions between 1999 and 2001 and again between 2002 and 2004. Emissions of carbon dioxide in 2004 were 1½ per cent higher than their 2003 level; the rise resulted from and increase in energy demand, particularly and increased use of natural gas for electricity generation and oil use for transport. The use of coal and other solid fuels fell by half of one per cent; emissions from gas rose by two per cent, whilst emissions from oil increased by three per cent. Carbon dioxide emissions are directly related to the type of fuel used, gas emitting fewer emissions per unit of fuel than coal.

Air pollution

E.7 Air pollution can have a wide range of environmental impacts, with excessively high levels potentially affecting soil, water, wildlife, crops, forests and buildings as well as damaging human

health. The main air pollutants associated with fossil fuel combustion are sulphur dioxide, fine particles (measured as PM₁₀), nitrogen oxides and carbon monoxide.

E.8 Sulphur dioxide is an acidic gas produced by the combustion of sulphur-containing fuels such as coal and oil. In 2003 there were 1.0 million tonnes of sulphur dioxide emitted, 74 per cent lower than 1990 and 85 per cent lower than in 1970. The decrease is a result of lower coal and fuel oil consumption over the period, and introduction of flue gas desulphurisation at two coal fired power stations, operational from 1994. Sulphur dioxide emissions from road transport have decreased by over 87 per cent since 1998 following a reduction in the sulphur content of fuel.

E.9 "PM₁₀" refers to fine, suspended particles in the air that come from a wide range of man-made and natural sources, including incomplete fuel combustion, wind-blown soil, and dust generated by activities such as quarrying. By 2003 emissions of PM₁₀ are estimated to have fallen by 71 per cent since 1970, largely as a result of a 90 per cent fall in emissions from the residential sector.

E.10 A number of nitrogen compounds including nitrogen dioxide, nitric oxide and nitrogen oxides are formed in combustion processes when nitrogen in the air or the fuel combines with oxygen. These compounds can add to the natural acidity of rainfall. The total level of emissions in 2002 (at 1.6 million tonnes of nitrogen dioxide equivalent) was 44 per cent lower than in 1990, with substantial falls from both road transport and power stations, the two largest contributing sectors. Emissions from power stations declined since the mid-1990s due to increased output from nuclear stations, combined cycle gas turbine stations replacing coal-fired plant, together with the effect of the installation of low NOx burners at other coal fired power stations. The fall in emissions from road transport is mainly due to tighter emissions standards for passenger and goods vehicles, including the introduction of catalytic converters on all new cars since 1993.

E.11 Carbon monoxide is derived from the incomplete combustion of fuel. In 2003, 2.8 million tonnes of carbon monoxide were emitted, a level 67 per cent lower than 1990 and 78 per cent lower than in 1970. Three-fifths of carbon monoxide emissions in the UK come from road transport, despite large reductions over the past thirty years due to tighter emission standards and the introduction of catalytic converters.

Oil pollution, oil spills and gas flaring

E.12 The amounts of oil spilled are small around the coasts of the United Kingdom and offshore (North Sea) in relation to total oil production, with the amounts discharged on drill cuttings, and with produced water generally much larger than from offshore installation spills. The total amount of oil spilled offshore during 2003 was 83 tonnes.

E.13 The number of oil spills recorded fell from 392 in 1998 to 372 in 2003. The increase reflects the trend for reporting even the smallest of spills, 365 of those reported in 2003 were for spills of less than 1 tonne.

E.14 The discharge of oil-contaminated water from offshore installations is permitted by an exemption granted under the Prevention of Oil Pollution Act 1971, but the oil content must not exceed 40 parts per million. It has proved to be difficult for a few installations, in particular those operating in mature fields, to meet this target. **In 2002, of 74 installations discharging produced water, 3 exceeded this target when averaged over the whole year.** The average content of oil in produced water for 2003, for the UKCS as a whole, was 20 parts per million. This is in line with previous years figures and remains the lowest value yet recorded in the UKCS.

E.15 Under the terms of petroleum production licences, gas may be flared only with the consent of the Secretary of State. Flaring at onshore fields in 2004 was minimal, whilst 4.15 million cubic metres of gas a day was flared at offshore installations. Flaring at offshore installations in 2004 was 7½ per cent higher than in 2003.

Data sources

E.16 Greenhouse gas emissions and air pollution statistics up to 2003 are published in the National Atmospheric Emissions Inventory which is compiled by the National Environmental Technology Centre (NETCEN) on behalf of Department for Environment, Food and Rural Affairs (DEFRA). Data and information on how the data have been compiled can be found:

- on the National Atmospheric Emissions Inventory website at www.naei.org.uk;
- on the DEFRA website, as part of the Digest of Environmental Statistics at www.defra.gov.uk/environment/statistics/index.htm;
- in a news release that was published on 31 March 2005 on the DEFRA website at www.defra.gov.uk;
- in the *Energy Sector Indicators* publication from the DTI.

E.17 The 2004 carbon dioxide figures are provisional DTI estimates. They were published in an article that formed part of the March 2005 edition of Energy Trends and can be found on the DTI website.

E.18 Figures for the total number of oil spills reported are collected by the Advisory Committee on Protection of the Sea Annual Surveys of Oil Pollution around the Coasts of the United Kingdom.

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