

Energy and sustainable development

Principles and major issues

Sustainable development can be broadly defined as living, producing and consuming in a manner that meets the needs of the present without compromising the ability of future generations to meet their own needs. It has become a key guiding principle for policy in the 21st century. Worldwide, politicians, industrialists, environmentalists, economists and theologians affirm that the principle must be applied at international, national and local level. Actually applying it in practice and in detail is of course much harder! In the international context, the word 'development' refers to improvement in quality of life, and, especially, standard of living in the less developed countries of the world. The aim of sustainable development is for the improvement to be achieved whilst maintaining the ecological processes on which life depends. At a local level, progressive businesses aim to report a positive *triple bottom line*, i.e. a positive contribution to the *economic, social and environmental* well-being of the community in which they operate. The concept of sustainable development became widely accepted following the seminal report of the World Commission on Environment and Development (1987). The commission was set up by the United Nations because the scale and unevenness of economic development and population growth were, and still are, placing unprecedented pressures on our planet's lands, waters and other natural resources. Some of these pressures are severe enough to threaten the very survival of some regional populations and, in the longer term, to lead to global catastrophes. Changes in lifestyle, especially regarding production and consumption, will eventually be forced on populations by ecological and economic pressures. Nevertheless, the economic and social pain of such changes can be eased by foresight, planning and political (i.e. community) will.

Energy resources exemplify these issues. Reliable energy supply is essential in all economies for lighting, heating, communications, computers, industrial equipment, transport, etc. Purchases of energy account for 5–10% of gross national product in developed economies. However, in some developing countries, energy imports may have cost over half the value of total

exports; such economies are unsustainable and an economic challenge for sustainable development. World energy use increased more than tenfold over the 20th century, predominantly from fossil fuels (i.e. coal, oil and gas) and with the addition of electricity from nuclear power. In the 21st century, further increases in world energy consumption can be expected, much for rising industrialisation and demand in previously less developed countries, aggravated by gross inefficiencies in all countries. Whatever the energy source, there is an overriding need for efficient generation and use of energy.

Fossil fuels are not being newly formed at any significant rate, and thus present stocks are ultimately finite. The location and the amount of such stocks depend on the latest surveys. Clearly the dominant fossil fuel type by mass is coal, with oil and gas much less. The reserve lifetime of a resource may be defined as the known accessible amount divided by the rate of present use. By this definition, the lifetime of oil and gas resources is usually only a few decades; whereas lifetime for coal is a few centuries. Economics predicts that as the lifetime of a fuel reserve shortens, so the fuel price increases; consequently demand for that fuel reduces and previously more expensive sources and alternatives enter the market. This process tends to make the original source last longer than an immediate calculation indicates. In practice, many other factors are involved, especially governmental policy and international relations. Nevertheless, the basic geological fact remains: fossil fuel reserves are limited and so the present patterns of energy consumption and growth are not sustainable in the longer term.

Moreover, it is the *emissions* from fossil fuel use (and indeed nuclear

power) that increasingly determine the fundamental limitations. Increasing concentration of CO₂ in the Atmosphere is such an example. Indeed, from an ecological understanding of our Earth's long-term history over billions of years, carbon was in excess in the Atmosphere originally and needed to be sequestered below ground to provide our present oxygen-rich atmosphere. Therefore from arguments of: (i) the finite nature of fossil and nuclear fuel materials, (ii) the harm of emissions and (iii) ecological sustainability, it is essential to expand renewable energy supplies and to use energy more efficiently. Such conclusions are supported in economics if the full external costs of both obtaining the fuels and paying for the damage from emissions are internalised in the price. Such fundamental analyses may conclude that renewable energy and the efficient use of energy are cheaper for society than the traditional use of fossil and nuclear fuels.

The detrimental environmental effects of burning the fossil fuels likewise imply that current patterns of use are unsustainable in the longer term. In particular, CO₂ emissions from the combustion of fossil fuels have significantly raised the concentration of CO₂ in the Atmosphere. The balance of scientific opinion is that if this continues, it will enhance the *greenhouse*

effect, and lead to significant *climate change* within a century or less, which could have major adverse impact on food production, water supply and human, e.g. through floods and cyclones (IPCC). Recognising that this is a global problem, which no single country can avert on its own, over 150 national governments signed the UN Framework Convention on Climate Change, which set up a framework for concerted action on the issue. Sadly, concrete action is slow, not least because of the reluctance of governments in industrialised countries to disturb the lifestyle of their voters. However, potential climate change, and related sustainability issues, is now established as one of the major drivers of energy policy.

In short, renewable energy supplies are much more compatible with sustainable development than are fossil and nuclear fuels, in regard to both resource limitations and environmental impacts (see Table 1.1).

Consequently almost all national energy plans include four vital factors for improving or maintaining social benefit from energy:

- 1 increased harnessing of renewable supplies
- 2 increased efficiency of supply and end-use
- 3 reduction in pollution
- 4 consideration of lifestyle