2.7 Energy in a Sustainable Development Perspective

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The Challenges

If the historic trends of the world continue unfettered, mankind will be faced with catastrophes that are currently inconceivable. These catastrophes will be triggered off by hunger and poverty, by the destruction of the natural resource base for life or by man-made destabilisation of the earth’s climate. These problems are all directly linked to the energy supply system

- since providing an increasing amount of energy services is a necessary precondition for eradicating hunger and poverty and even limiting the global population increase,
- since about three-quarters of anthropogenic emissions of CO$_2$ are released by the energy system,
- since today’s energy system consumes the major share of finite fossil resources and is the single most important source of air pollution,
- since securing the economic productivity of developed countries will not be possible without a functioning energy infrastructure and competitive energy prices.

This is why energy issues featured prominently in the discussions of the earth summits from the United Nations Conference on Environment and Development in Rio de Janeiro in 1992 to the World Summit on Sustainable Development in Johannesburg in 2002. As far as these energy related challenges are concerned there is widespread agreement that they exist. However, there is a lack of consensus with respect to the targets and ways to achieve the necessary changes. Controversial, sometimes even contradictory opinions exist amongst important groups in society – at least in the industrialised countries – on the course to be taken. Resolving the ‘trilemma’ between the economic aspirations of a rapidly expanding global population, ensuring available resources, and the environment, is one of the most critical challenges of the twenty-first century.
Access to energy is of central importance to human welfare, economic and social development including poverty alleviation. Although global primary energy use grew in the past by about 2 percent a year, on a per capita basis, the increase in total primary energy use has not resulted in any notable reductions in the difference between energy services access in industrialised countries and developing countries. Slightly more than one billion people in the industrialised countries (about 20 percent of world's population) consume nearly 60 percent of the total energy supply whereas the five billion people in developing countries consume the other 40 percent of total energy supply. Affordable commercial energy is still beyond the reach of one-third of humanity. Although energy intensity in modern economies is decreasing, more energy will clearly be needed to fuel global economic development and to deliver opportunities to the billions and still increasing number of people in developing countries who do not have access to adequate energy services.

The rate of global commercial energy consumption is a thousand times smaller than the energy flows from the sun to the earth. Primary energy use is reliant on fossil fuels (oil, natural gas and coal), which represent nearly 80 percent of total consumption. Nuclear power contributes about 7 percent, and hydro power and new renewable each contribute about 2 percent. Traditional, non commercial sources of energy, like firewood, are the dominant fuel source in low income developing countries, and account for about 10 percent of the total fuel mix.

The environmental impacts caused by energy use is not a new issue. For centuries, wood burning has contributed to deforestation. In the past 100 years, during which world’s populations more than tripled and the use of fossil fuels increased more than 20-fold, human environmental impacts grew from being locally based to generating global impacts. At every level (local, regional, global), the environmental consequences of current patterns of energy use contribute a significant fraction of human impacts on the environment. Energy provision involves large volumes of material flows, and large-scale infrastructure to extract, process, store, transport and use it, and to handle the waste. Particulate matter, which is both emitted directly and formed in the air as a result of the emissions of gaseous precursors in the form of oxides of sulphur and nitrogen, and hydrocarbons impacts human health. So too does ozone, which is formed in the troposphere from interactions among hydrocarbons, nitrogen oxides, and the sunlight. Precursors of acid deposition can be transported over hundreds of kilometres and the resulting acidification is causing significant damage to natural ecosystems, crops and human made structures. Large hydropower projects often raise environmental issues related to flooding, whereas in the case of nuclear power, issues such as waste disposal raise concern. On the global scale, the possibility of significant climate change, caused primarily by greenhouse gas emissions from fossil fuel burning presents a great challenge for the future of human civilisation. There is growing evidence that much of world’s energy is currently produced and consumed in ways that can not be sustained if technology development is static and if overall quantities consumed increase substantially.