CLIMATE CHANGE & NUCLEAR POWER

A statement by the European Nuclear Society

April 2003

The European Nuclear Society believes that the world's capacity for generating electricity from nuclear energy must be increased substantially if we are to meet the ambitious targets for reducing world-wide emissions of carbon dioxide while also meeting the projected growth in demand for electricity.

Like water, food, clothing and shelter, energy is a basic need, but it is also an essential element of economic development and each person uses more energy as their living standards improve. Energy is needed for modern agriculture, for the construction of buildings and keeping them comfortable, for transport, communications and leisure.

Large quantities of additional energy will be needed to fuel economic growth, especially in developing countries with large populations like China, India and Brazil. Currently, the only access some 2 billion people have to energy is "traditional" biomass – firewood and animal waste. Many more are quite poor by EU standards and all will need more energy in the future. If recent trends in energy use continue, as most economic analysts expect, then world-wide demand will grow by about 50% by 2020 and will double by 2050 [1-2]. The growth will be even larger for electricity since, more than any other form of energy, electricity is an essential ingredient of economic development. World **electricity** demand is likely to triple by 2050, again with a major component in the developing countries. The demand for electricity will be for continuous, reliable supply on a large scale (i.e. base-load power), as at present.

Fossil fuels – coal, oil and gas – currently meet more than 85% of energy needs and will continue to dominate for the next few decades, whatever corrective measures are taken now. Yet there is no longer any doubt that the increase in atmospheric CO_2 measured since the beginning of the industrial era is due to our growing use of these fuels without any containment of the CO_2 waste. Furthermore, the great majority of climate researchers now agree that the effect of increased levels of CO_2 on the earth's climate will be significant and often damaging, with rising sea levels, more storms, floods and droughts, and destruction of precious habitats. The need to mitigate the present levels of climate change, rather than allow it to accelerate with increased energy use, is an urgent and necessary precaution against its uncertain and potentially devastating consequences.

Unfortunately, no progress has been made in meeting the target of the 1992 Rio Convention and the 1997 Kyoto Protocol to reduce carbon dioxide emissions below 1990 levels by 2008-2012. In fact, world carbon dioxide emissions have **increased** since 1992, even if this increase would have been greater without the accord. Paradoxically, non CO_2-emitting nuclear power has been excluded from two of the three "flexibility mechanisms" provided for in the Kyoto Protocol, for the first commitment period ending in 2012.

Today, about one-quarter of the world's carbon dioxide emissions come from the United States, one-quarter from the rest of the OECD countries, and the remaining one-half from the

rest of the world. The world's total carbon dioxide emissions are expected to grow from 21 billion tons in 1990 to 36 billion tons in 2020 (table 1).

To have any real impact on reducing future carbon dioxide emissions, a variety of measures will have to be adopted and implemented:

1. energy conservation in the developed countries,
2. increased use of energy sources other than fossil fuels,
3. eventual CO_2 sequestration.

We recognize that limiting the growth of energy demand in developed economies, through increased efficiency, conservation measures and modified consumer behaviour, is probably the most important single factor, be it only to get the agreement of Third World countries to an international carbon limitation regime. However, it is also important to shift our energy mix to increase the share of non-carbon emitting sources, including renewables and nuclear energy.

Renewable energy sources can contribute to the solution. The only large-scale renewable source today is hydro-electricity, providing about 18% of the world's electric power. Unfortunately, there is limited capability for expansion of hydro-electric resources around the world, and such expansion may raise environmental issues.

Solar and wind generation of electricity will play an increasing role as technology improves. These sources are not expected to take over the burden of meeting base-load demand for continuous reliable power, due largely to their intermittence and our present inability to store massive amounts of electricity. They are, however, well suited for decentralised generation.

Nuclear power too is practically free from carbon dioxide emissions. After more than four decades of development, it currently provides about 16% of the world's electricity, as much as hydropower. In terms of primary energy, it is equivalent to the Saudi Arabian oil production and avoids the emission of about 2.3 billion tons of carbon dioxide per year, relative to coal.

However, nuclear power is the subject of strong controversy, and poor public or political acceptance has led several European countries to announce plans to phase out its generation. As the topics that give rise to most public concern are the safety of nuclear facilities and the disposal of radioactive wastes, we must address them.

The safety record of the Western technology-based nuclear power plants is very good, with no loss of human life due to a reactor accident in almost 10,000 commercial reactor-years of experience. National activities and international co-operation, especially through the Convention on Nuclear Safety, are aimed at monitoring the safety status world-wide and suggest further improvements, if it is deemed necessary.

Conscious since the beginning of the nuclear era that they are potentially hazardous, the nuclear industry safely manages its radioactive wastes, containing them in licensed interim storage where they cause no short-term threat to human health. There is, however, no definitive civilian waste repository in operation today in the world. On the other hand, there is a growing international consensus that geological disposal does constitute an adequate technology for the permanent disposal of wastes, and several countries are taking action to license and implement such repositories. A very significant amount of R&D is devoted to finding ways to improve

upon the present situation, and reduce both the quantity and long-term toxicity of the waste to be permanently disposed of.

Beyond electricity generation, there are serious prospects for the future use of hydrogen both as a clean fuel for transportation and as a clean means of energy storage. Nuclear power, and especially high-temperature reactors, would represent a very attractive way to produce large amounts of hydrogen without carbon emission.

Nuclear energy is economically competitive with other sources of energy in many countries. For new plants, capital costs are a major factor, with fuel and other operational costs being relatively small. Thus, once built, nuclear power plants can produce electricity at a predictable cost almost regardless of fuel price fluctuations.

Nuclear energy is also a sustainable energy option [3-5]. Its fuel sources are readily extendable for hundreds of years using already demonstrated "breeder" technology. Moreover, thorium can also be used as a nuclear fuel, which extends even more the sustainability of nuclear power, as far as mineral resources are concerned.

For Europe, which today imports 50% of its energy needs and is likely to import much more in a few decades [6], nuclear power is also an important factor in reducing its vulnerability to imports and price disruptions.

In short, we do not think that nuclear power is *the* answer to the problem of supplying more energy while reducing carbon emissions, **but we are convinced there is no solution without it**. We all share the same planet. If the developed countries, which have the ability to use nuclear power safely and economically, choose to forego this option, it is mostly the poorer countries, which do not have the same choice, which will suffer.

References

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4. A fresh look at nuclear power; EURATOM Scientific & Technical Committee Report EUR 19786 EN, 2001.
5. The energy challenge of the 21st century: The role of nuclear energy; EURATOM Scientific & Technical Committee Report EUR 20634 EN, 2003.
6. Towards a European strategy for the security of energy supply; Commission of the European Communities "Green Paper" COM 769, 2000.

Table 1

Global Carbon Dioxide (CO_2) Emissions by Region and by Sector[2]
(Millions of Tons of CO_2)

Emissions	World	OECD	Transition Economies	Developing Countries
1990	20,878	10,640	4,066	6,171
1997	22,561	11,467	2,566	8,528
2010	29,575	13,289	3,091	13,195
2020	36,102	14,298	3,814	17,990