Conclusion

In view of its original ambitions and the considerable technical and economic efforts that it has required, the huge French nuclear programme developed between 1975 and 2000 shows a particularly disappointing balance sheet. The perennial trumpeting of "France's energy independence" does not stand up to analysis, given that France's per capita oil consumption in 2007 was higher than that of its large neighbours, and that the contribution of nuclear power to overall consumption was a mere 14% while oil products accounted for 49%.

Admittedly, nuclear power's contribution does reduce France's dependence on gas and coal, but oil dependence is by far the most restricting factor in terms of energy security. Moreover, with more than 80% of its electricity being of nuclear origin and reliant on a single technique, the pressurised water reactor, the French electricity system has created a new source of vulnerability for itself.

In overall economic terms, the 'all electric, all nuclear' approach which has been the cornerstone of French energy policy for the last three decades – and which continues to be so, in the face of all economic and practical reason, with the EPR reactor construction programme – has brought France no particular advantage, for example by comparison with Germany. On the contrary, the nuclear monoculture has left France a long way behind in renewable energy development and has obstructed its efforts towards energy efficiency, particularly where electricity is concerned.

Faced with the consequences of an increase in greenhouse gases, the proponents of nuclear power present it as the essential solution in that it emits much less carbon dioxide than the combustion of oil, gas or coal. But on closer inspection it becomes clear that this miracle cure is nothing of the sort. It is true that nuclear electricity generation contributes to the reduction of greenhouse gas emissions – but even in the extreme case of France, this reduction amounts to at most an estimated 15-20% of total emissions. While this figure is not negligible, it needs to be balanced against all the risks posed, and pollution generated, by the whole complex and dangerous nuclear power system, with its power stations, its fuel plants and its radioactive material transports – both now and in the long term (dismantling of the installations, management of the radioactive waste).

Nuclear power is liable to suffer serious accidents that may affect extensive areas for long periods of time. No satisfactory solution has been found for the management of long-term waste. Finally, proliferation remains a major risk for global security and it is dishonest to maintain that a country can be equipped with civil power stations without a military use being possible.

Moreover, nuclear power can only contribute to the production of electricity, which (adding all sources together) represents only around 20% of a developed country's end-user energy consumption. The remainder comes from the petrol and diesel burned in cars and lorries, the oil or gas used to heat buildings and power industrial production – and also from biomass and solar energy (of course hydro and wind power produce electricity).

The unavoidable fight against greenhouse gas emissions therefore requires, first of all, a policy of energy saving and research into greater energy efficiency. Next, it calls for a greater reliance on renewable energy.

The continuation of present-day global energy consumption trends runs up against insurmountable obstacles and leads to a developmental impasse, accentuating the inequalities between rich and poor countries and contributing to social breakdown. Economic and social development can only be held back, if not made impossible, by energy insecurity (in terms of physical supply faced with geopolitical constraints, rising prices, increasing scarcity of resources in the medium term, and risks both technological and posed by external stresses of all kinds) and by the degradation of the local environment (by pollution and accidents) and the global one (through climate change). The rising price of oil is already wrecking the most fragile economies. Besides, 'business as usual' scenarios of the energy future clearly highlight the political, economic and environmental impasse to which they lead.

Energy security and environmental constraints pose a considerable challenge for social and economic development on a global scale. The limiting of energy consumption is now the policy most urgently in need of adoption, in that it has the greatest potential to develop, is applicable to all sectors and in every country, is the best instrument with which to combat climate change, and can help slow down the depletion of fossil fuel resources and ensure that a growing proportion of energy demand is met by renewable energy. It can also contribute to economic development by reducing expenditure on energy and by creating new business activities and employment. It is a key imperative of energy and economic policy.

This fundamental change in the energy paradigm which gives priority to demand rather than to supply profoundly alters the citizen's relationship with the energy system. The need to provide an 'energy service' instead of an 'energy supply' brings new actors to the fore: businesses, communities, households, and professionals in the construction, transport and manufacturing industries, in agriculture and in the service sector. Cities and local authorities become key drivers and promoters of these new policies.

By applying such a strategy, industrialised countries can reduce their energy consumption to a significant degree. Developing countries need to increase theirs, but they can do so at a much slower rate than that undergone by rich countries in the past, with the damaging consequences we know all too well. For most countries, including major energy producers, the reduction of energy consumption will represent their main national energy resource for the decades to come.

Europe can play a lead role in promoting this policy: indeed both its energy security and the fight against climate change oblige it to. The March 2007 European Summit's decisions on the "three 20 per cents" (energy efficiency, renewable energy and greenhouse gas emissions) and the "energy package" presented by the European Commission are an encouraging signal within the European Union. But the "burden sharing" between Member States remains to be organised, and this will be the touchstone of their individual political will.

In this context, and considering what is at stake in terms of the climate risk, energy security and economic and social development, nuclear power's real contribution will continue to be marginal for Europe. Conversely, the physical and geopolitical risks that further expansion of the technology in its present state would entail are so great that the balance of benefits and drawbacks is very clearly against such an expansion. Moreover, nuclear power requires massive centralisation of the energy system, based on high-output power stations, whereas technological progress is increasingly concerned with an energy system based on decentralised actions and initiatives in the fields of energy efficiency, renewable energy and combined heat, cooling and power production.

About Global Chance

Global Chance is a non-profit organisation gathering scientists and experts who share the strong belief that a better balanced developement of the world can and must arise from growing awareness of the threats weighting on our global environment.

In the face of these threats, Global Chance puts its members' competencies together to serve a pluralist and contradictory public expertise, so as to identify and promote new and positive collective answers in various fields – scientific and technical, economic and financial, political and regulatory, social and cultural. It also aims for such answers to be inspired by solidarity between the North and the South, humanism and democracy.

The organisation has regularly published its views in *Les Cahiers de Global Chance* since 1992 (two issues per year), but it is also participating in the public fora through its members' publications and their individual implication in various debates.

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Engineer and economist, Benjamin Dessus started working in Marcoussis labs on quantum electronic and lasers before he joined the R&D department of EDF. He entered the AFME (Agence Française de la Maîtrise de l'Energie, later to become ADEME) when it was created in 1982, and directed its technical services until 1987. He then joined CNRS where he directed successive interdisciplinary research programmes (PIRSEM, Ecotech, ECODEV) on energy and environment. He contributed meanwhile to the elaboration of the climate strategy of the Global Environment Fund (GEF) and was from 1991 to 1994 a member of its Scientific and Technical Advisory Panel; from 1994 to 2003 he chaired the Conseil scientifique et technique of the Fonds Français pour l'Environnement Mondial (FFEM). A recognized expert of energy and nuclear issues, he was co-author of the Charpin-Dessus-Pellat report on the prospective economic evaluation of the French nuclear option, published in 2002, and published a large number of books, including *So Watt ? L'énergie, une affaire de citoyen* (with Hélène Gassin, Ed. de L'Aube, 2004).

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Born in 1938, Bernard Laponche is an independent consultant, expert on energy and energy efficiency policies. An engineer from the École Polytechnique, State Doctor in Science, and Doctor in Energy Economics, he worked in the nuclear reactors Department of the French Atomic Energy Commission (CEA) during the 1960s and 70s, and was active during this period in the workers union CFDT. He was Director of Planning and then Director General of the Agence Française de la Maîtrise de l'Énergie (AFME, which has since become ADEME) from 1982 to 1987, then co-founder and director of the International Conseil Energie (ICE) consultancy firm from 1988 to 1998, and technical advisor on energy and nuclear safety to Dominique Voynet, Minister of Territorial Planning and the Environment, in 1998 and 1999.

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