



Nuclear power will not save our climate: 40 facts and arguments

Mankind will not be able to avoid climate change by taking the nuclear route. This technology simply cannot be developed on the scale that is required and in the limited time that is left to save our climate. The money spent on this form of energy will only be to the detriment of options that are more efficient and better suited to national economies and to people's needs.

Based, as it is, on a foundation of lies and subsidies, this source of energy is the exact opposite of sustainable development. Waste that will be around for millions of years, the constant risk posed by accident and contamination, the lies and denials of democracy... this is what lies at the heart of our nuclear programmes.

Three arguments are often used to defend the nuclear industry in the face of the crisis now threatening our planet:

- the depletion of our oil and gas supplies;
- the development needs of the southern hemisphere;
- and climate change itself.

These arguments do not stand up to analysis. For one thing, it is simply absurd to link the decline in oil resources with nuclear development, since oil is mainly consumed in the transport sector – an area where nuclear power is used very little. Moreover, reserves of uranium will also run out at some point in the near future, and perhaps even before the end of the operating life of the reactors currently planned by the nuclear industry. The large-scale development of reactor systems capable of resolving this problem still only exists on paper and even according to the nuclear industry's own planning these new facilities will come too late to affect the pace of climate change. These new reactors would also require huge quantities of plutonium to replace part of the uranium. We are still a long way from the 'environmentally sound technologies' advocated in the Kyoto Protocol!

Concerning the developing countries, they will not be able to employ nuclear power to any significant extent since the technologies involved are far too costly and unsuitable for the local conditions and in any case are excessively slow to put in place.

When it comes to climate change nuclear power is simply not 'the solution', neither is it even 'part of the solution',.

In this document we have developed fifty reasons to convince the people that nuclear power is not the solution to the greenhouse effect. These arguments have been chosen to fuel the debate in Europe, where the role of nuclear power has been overstated.

Many journalists and politicians, as well as ecologists, have been disturbed by the manner of the debate between climate change and nuclear power. The case being put forward here seeks to return to the fundamental reasons why the Greens and most of the environmental groups reject nuclear energy: nuclear power will not save the planet, but in fact represents a threat to peace and security and will do little or nothing to help the poorest countries. There are simple arguments for this and there are more complex arguments too; there are arguments from a European perspective and there are arguments on behalf of the southern hemisphere countries... we do not expect to convince

everyone. But we are certain that you will find in our case some new ideas, some new angle that will challenge the prevailing view.

The century that has just commenced sees our planet threatened by major crises, whether it is climate change, bio-security, the depletion of our collective resources or the growing menace of food shortages. Why should we add to all this the massive burden of nuclear power ?

Can nuclear power save our climate?

Nuclear energy is not capable of resolving the problem of climate change. Even if we were to invest all our resources in it, the limited potential and high cost of nuclear electricity would still impose restrictions on the amount of emissions saved. Other resources, renewable energies and, more especially, energy saving measures all represent much less risky investments on a global scale and, more importantly, will provide a more effective response to the crisis facing our planet.

- 1- Electricity is not synonymous with energy. The production of electricity constitutes but a fraction of total energy production. In Europe electricity only represents about 20% of final energy consumption. The rest of the energy is used for transport, heating and industrial purposes, areas that are focal points for oil consumption¹. Nuclear power only meets a small fraction of total energy demand. The nuclear debate is restricted to one particular area – electricity production – which constitutes only 20% of the energy problem.
- 2- Nuclear based electricity production remains limited when compared with coal and gas fired generation capacity. Even hydro power produces more electricity worldwide than nuclear fuel. Nuclear based energy comprises about 17% of total world electricity production. If emissions from competing fuels are to be reduced significantly at current growth rates, the nuclear industry would have to build more than one thousand new reactors (there are 440 operating at present) before 2050², which would in fact only keep output at current levels³.
- 3- Nuclear production is going into decline. The proposed new power stations will not be enough to replace the current reactors that are scheduled for closure in the near future. The nuclear plants currently operating are already fairly mature (operating for more than 22 years). Even if China builds thirty nuclear power stations over the next twenty years, this will only replace 10% of the reactors that are to be withdrawn from service worldwide during this period⁴. This has been established by projections from the International Energy Agency (IEA), all of which point to an absolute or relative decline in nuclear production⁵. The small number of anticipated sales of plant to China, the USA and Europe will do little to affect the scale of the problem: if the 440 nuclear power stations currently operating worldwide are to be maintained in the long term we need to see ten international sales a year⁶. This is way ahead of the current projections.
- 4- Reserves of nuclear fuel are limited and will not last forever, since radioactive uranium is a fossil mineral that is only available in limited quantities. In fact, commercial reactors

¹ Oil-based electricity production currently accounts for a tiny fraction of this form of energy, most of this being destined for peak-load or insular power stations that cannot be replaced by nuclear plant.

² Massachusetts Institute of Technology, *The Future of Nuclear Power*; August 2003; <http://web.mit.edu/nuclearpower/>.

³ Rosenkranz G. 2006 'Nuclear Power – myth and reality', Nuclear issues paper N°1, Heinrich Böll Foundation p.21

⁴ Schneider M. & Froggatt A. 'The World Nuclear Industry Status Report 2004', Brussels, December 2004

⁵ AIE/IEA World Energy Outlook 2005.

⁶ This assumes that nuclear plant are kept operating for 40 years and not the 30 years for which most are planned.

operate on enriched uranium and have a low output. According to data provided by the Atomic Energy Commission (CEA) itself, uranium reserves will only be able to meet world demand for a limited period, especially if the rate of consumption increases. Current worldwide reserves⁷ (based on 80\$/kg) are put at 2.528 million tonnes. Uranium reserves therefore constitute less than half of the proven reserves of oil and indeed of gas too⁸. This represents '60 years of fuel in the absence of further development in nuclear capacity', according to the French energy giant EDF⁹, and definitely less if nuclear construction picks up again. This limited availability of uranium resources is fully admitted by the industry, which uses this as an argument for developing fast-breeder systems and other types of new generation IV reactor.

- 5- The deadline is too tight for nuclear energy 'of the future'. The new-generation reactors that still have to be developed are presented as being more reliable and more efficient in terms of uranium consumption¹⁰. However, the Rio Agreement calls on nations to avoid 'dangerous interference with the climate system', and more specifically to stabilise greenhouse-gas concentrations¹¹ 'within a sufficient time frame'.¹² In order to limit the risk involved it will henceforth be necessary to reduce the rise in temperature to a maximum of 2°C in comparison with the pre-industrial period. In its third report the IPCC¹³ shows that in order to restrict the average global temperature rise to this level it will be necessary to achieve a massive cutback in greenhouse-gas emissions in the decades ahead¹⁴ so as to reduce emissions from developing countries to one quarter of the current output. It is interesting to note that this short deadline excludes any contribution from generation IV nuclear reactors or from nuclear fusion plants: even according to their promoters these installations will not be operational until after 2050¹⁵. With a thirty-year lead time even in the best-case scenario, the nuclear technology of the future – which absorbs more than two-thirds of public spending on energy in Europe – will find itself 'debarred' as a possible solution to the climate crisis.
- 6- No real consensus at international level. Nuclear power will only be able to develop fully if there is a global consensus on this form of energy. This is still a long way off, since even in Europe many countries reject nuclear generated electricity completely or are phasing-out

⁷ A reserve is a proven quantity for a given extraction price. CEA data.

⁸ Oil reserves are estimated at 140 billion tonnes (Energy Observatory 2004, 'energy', according to DIREM/Ministry of Industry), while gas reserves are put at some 155 700 billion m³, which is an equivalent quantity (same source, according to the World Energy Council (WEC)).

⁹ Source EDF (responses to the CPDP-EPR debate of 12/12/2005). http://www.debatpublic-epr.org/participer/questions_reponses.html?id=3.

¹⁰ Several very different types of 'generation IV' reactor exist on paper. France seems for the moment to favour a system fairly similar to that used by the ill-fated Superphenix reactor at Creys-Malville.

¹¹ The greenhouse gases listed under the Rio Convention and subsequently in the Kyoto Protocol are: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and fluoride gases. These gases are produced by the combustion of fossil fuels and by deforestation. The Protocol also covers nitrogen oxide (N₂O) produced by the agriculture and chemical industries, as well as fluoride gases (HFC, PFC, SF₆) used for air conditioning and refrigeration purposes and also by the electrical and electronics industry.

¹² The ultimate aim of the United Nations Convention on Climate Change is set out in article 2. The agreement seeks to achieve 'stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to allow economic development to proceed in a sustainable manner'.

¹³ International Panel on Climate Change (IPCC).

¹⁴ See for example 'Can we avoid a 2°C rise in temperature', by Malte Meinhausen, on the scientific debating site realclimate. <http://www.realclimate.org/index.php?p=246>.

¹⁵ Responses from EDF to questions put by the public during the CPDP-EPR debate: 'The marketing of new so-called generation IV fast-breeder reactors beyond 2040...' (29/12/05) or 'towards a 21st century environment' (EDF, same source, 4/11/05) or 'by the year 2050' (same source, 4/11/05). As far as fusion is concerned, 'pilot plants' are anticipated by mid-century.

this sector, notably our Belgian, Spanish and German neighbours. The other nations have, almost without exception, declared a moratorium in fact or in law on new construction projects. This lack of consensus among the nations of the world is illustrated by the Kyoto Protocol, which specifically mentions energy saving actions and renewable energies as the policies and measures to be encouraged, whereas nuclear power is not referred to at all¹⁶.

- 7- Investment spending on nuclear power remains much higher than that required for other solutions. Particularly with a view to the crucial period of the next twenty years, energy saving actions work out five to ten times less expensive than centralised electricity production based on nuclear power or other sources. Moreover, the financial risk associated with nuclear energy will considerably increase the cost of borrowing for this form of energy on the private-sector markets¹⁷.
- 8- Mankind can make a choice. A list of global options for solving the climate problem, as drawn up by the Oeko Institute in Darmstadt (Germany), shows that the ultimate potential of nuclear power, by way of a trebling of this energy output on a world scale, will result in emission levels of at least 5 gigatonnes (GT) of CO₂, which is one tenth of the available capacity (see table in the footnotes)¹⁸. When set against the reductions that will be needed to achieve the target of limiting climate change to less than 2°C above pre-industrial levels, namely 25 to 40 GT between now and 2050, it can be seen that nuclear energy will not be necessary even for the most ambitious scenarios. When it comes to resolving the problem on a global scale, therefore, nuclear power is merely an option not an obligation.
- 9- We cannot take up ‘all the options’. Some of the options are not mutually compatible, especially the decentralisation of production and moderate energy saving measures, on the one hand, and nuclear power, on the other. Indeed, nuclear power is both much more expensive than and incompatible with the optimised development of co-generation technology¹⁹ and decentralised resources. What is more, past experience has shown that the development of nuclear energy is always accompanied by a decline in energy saving

¹⁶ Renewables are referred to in particular in article 2 a) i) and iii) of the KP Article 2. Applies and/or sets out in greater detail the policies and measures to be adopted according to the national situation, for example the following:

(2.a.i.) Greater energy efficiency in the relevant sectors of the national economy.

(2.a.iii.) Greater research, promotion and utilisation of renewable energy sources, processes for carbon-dioxide capture and environmentally sound and innovative technologies...

¹⁷ According to the economist Steve Thomas 40% of the power stations (most of them nuclear installations) operating in the UK electricity market are owned by companies that are either in serious financial difficulties or bankrupt, a fact that justifies interests rates of around 15% for this sector. In Thomas S. 2005 ‘The economics of nuclear power’, Nuclear issues paper N°5, Heinrich Böll Foundation.

¹⁸ F. Mathes/Oeko Institute ‘Nuclear Energy and Climate Change, p.36, N°6 December 2005, Heinrich Böll Foundation.

The global ‘menu’ of solutions to the problem of climate change

Potential output up to 2050, in gigatonnes of CO₂.

Threefold increase in world nuclear production	5
Energy efficiency in buildings	4
Energy efficiency in industry	5
Energy efficiency in the transport sector	7
Improvements in the various energy sectors	2
Switching fuels (coal to gas)	3.6
Development of renewables (electricity and heat)	15
Carbon capture and sequestration	4 to 10
	Total 45 to 51.6

Source: Felix Mathes, Oeko Institute 2005 / IPCC

¹⁹ Cogeneration involves producing heat and power simultaneously, which means that global output is markedly higher than when producing electricity alone.

practices²⁰. According to the nuclear physicist Amory Lovins, author of the famous ‘Factor Four’²¹, ‘the slogan *we need all the options* has no analytical basis and is false ; we cannot in fact afford all the options. In actual practice allowing nuclear energy to survive means diverting public and private investment’ away from cheaper options and towards those that are destined to be market losers and also present the most drawbacks.

- 10- Nuclear’s sensitivity to climate change poses problems by way of changes to the rates of flow of water courses and flooding. During the heatwave of 2003 in France, the regulations governing warm water discharge into rivers from nuclear power stations had to be disregarded as a matter of urgency. An improvised water spraying system had even to be set up to reduce overheating on the roof of a nuclear reactor. Such incidents are likely to become increasingly common in the future. Such an argument, which is being put forward here in respect of nuclear power, could equally be applied to other centralised sources of energy. Strategies based on energy saving policies will, for their part, all help in creating a future that is better adapted to the process of climate change.
- 11- Emissions from nuclear plant are not insignificant. This is especially true when consideration is given to the entire process from construction through to the nuclear phase itself. During its life cycle a nuclear power station releases about 20% of the emissions produced by recent-generation gas fired installations, which is relatively little²². However, it should also be pointed out that nuclear stations, which have a particularly rigid operating regime, have to have their input to the electricity grid backed up by thermal generating plant during peak load periods, this means using coal fired power stations, which emit sizeable quantities of greenhouse gases.
- 12. Renewable energies are outpacing nuclear energy. In fact growth in this sector is far superior to that of either oil or nuclear power. In the course of the last ten years the growth rate of renewables based energy worldwide has far outpaced the increase in nuclear use.

Comparative global growth rates for different energy forms ²³ (average rate per year)	
Growth in wind generation capacity 2000–2004	+28%
Growth in photovoltaics	+32%
Growth in bio-fuels	+18%
Growth in oil production	+1.6%
Growth in nuclear capacity 1999-2004	0%

World nuclear production has been stagnating at about 2 500 TWh since 1999. The average rate of growth recorded during the preceding periods fell dramatically from about 20% in the early 1980s to less than 7% by the end of that decade, to be followed by growth levels of 3% and 1.6% respectively in 1990-95 and 1995-2000.²⁴

²⁰ Greenpeace France 2003 ‘The EPR, a technology from the past for an outdated vision’ on <http://www.greenpeace.org/raw/content/france/press/reports/dossier-de-presse-l-epr-de-t-2.pdf>.

²¹ E. U. von Weizsäcker, Amory B. Lovins, L. Hunter Lovins, *Factor Four, doubling wealth, halving resource use*. French version: Mens, Terre Vivante, November 1997

²² Some studies estimate that emissions are about one third of those produced by gas fired plant, notably that by S. van Leeuwen 2001 (www.oprit.rug.nl/deenen/Introduction_supply_of_costs_rev3.pdf)

²³ Source: Worldwatch Institute *Renewables 2005: Global Status Report* (wind); Paul Maycock/PV Energy Systems (solar PV); International Energy Agency (biofuels); BP *Statistical Review of World Energy 2005* (oil); Energy Information Administration (oil and renewables).

²⁴ Energy Observatory according to IEA/OECD

- 13- Even renewable and decentralised forms of energy are outstripping nuclear production. According to Amory Lovins, electricity generated from decentralised resources and renewables (apart from major hydro projects) overtook nuclear output in 2003 in terms of power expansion and in 2005 in terms of total production.²⁵ Nuclear capacity is therefore destined to decline even when set against the ‘environmentally sound and innovative’ alternatives²⁶. In the specific case of China, which is frequently cited as the probable centrepiece of nuclear expansion, even solar energy is beginning to catch up with nuclear power²⁷. In China solar fuelled water heaters alone are already replacing the equivalent of half that country’s nuclear generating capacity and by 2020 this technology will be generating the same output as the 30 reactors currently being proposed by the Chinese nuclear industry.
- 14- There are many more employment opportunities to be created in the energy saving and renewable energy sectors than in the nuclear industry. Climate change is now forcing us to re-think our consumption habits and our approach to energy saving, which means that we have to come up with measures that inflict the least damage while creating as many new jobs as possible. In France for instance, according to the Renewable Energies Syndicate the total number of jobs that this sector provides could well increase from 38 900 in 2004 to 115 000 in 2010, which is double the total workforce of the French nuclear industry²⁸. This job creation potential, which is clearly quite high for a given quantity of energy, can mainly be explained by the labour intensive nature of some of the measures undertaken in this sector, such as fitting insulation in houses, but also by the fact that centralised production facilities (refineries, nuclear power stations) pay out much more in the form of income on invested capital than by way of salaries to the employees²⁹.

²⁵ A.B. Lovins, ‘Nuclear power: economics and climate-protection potential’, September 2005, www.rmi.org.

²⁶ Expression used in Article 2 of the Kyoto Protocol (National Policies and Measures).

²⁷ According to a study by the Dutch public agency NOVEM published in *Renewable Energy World*, January-February 2005, solar units in China will take up more than 230 million m² by 2015 and are already providing some 200,000 jobs.

²⁸ AREVA workforce numbers 33 500, CEA 15 000, EDF nuclear operations 15 000, making a total of 63 500 persons, including those engaged in research and waste disposal.

²⁹ Quirion P., ‘Getting out of nuclear: there’s work in it’, *Revue ECOREV*, October 2002.

Nuclear energy versus development

Nuclear power poses formidable problems in the countries of the southern hemisphere, even those that are considered as developing nations: nuclear proliferation, the particular dangers presented by dictatorships, specific financial costs and so on...

- 15- Nuclear energy does not lead to development. The funding earmarked for nuclear projects in southern-hemisphere countries only makes a fractional contribution to national development. This has to do mainly with the nature of the nuclear energy industry itself, which is tied up with military-industrial issues. The technologies being used in this sector tend not to spill over into the rest of the economy. What is more, unlike its competitors (renewables and energy saving measures) nuclear power has no further scope for technical progress. This aspect is essential for value creation in the new industries, according to Brazilian scientist and former government minister José Goldenberg³⁰, who observes that industrial apprenticeships in the nuclear sector no longer exist since the costs involved continue to increase tendentially.
- 16- Nuclear energy leads to corruption in southern hemisphere countries. This is primarily a result of the exclusively bilateral nature of the nuclear trade. Global financial institutions such as the World Bank and other international bodies generally rule out direct intervention in the nuclear sector³¹. Exports therefore depend on aid from the vendor nations, Such sales are very much marred by corruption and by the danger of safety infringements. Examples include the Marcos regime in the Philippines, the Peronist era in Argentina and the period of dictatorship in Brazil, which resulted in unsuitable and dangerous purchases of reactors that in many cases never worked³². The same question is currently being asked about the markets in China and India.
- 17- The ‘white elephants’ of the southern hemisphere³³. Nuclear power stations built in the southern hemisphere constitute a significant part of the national debt of the developing countries. In the Philippines, the Bataan plant, which has not yet come on stream, has for the last twenty years been the largest item of overseas debt in a country that has already paid out 906 million dollars in bills between 1996 and 1998. Then there is the Atucha II reactor in Argentina that has still not been completed twenty five years after work started at the site (one billion dollars in losses)³⁴. Similarly, the Angra III plant in Brazil will never be finished, while in Mexico dismantling work is soon set to begin on the Laguna Verde installation, which only started up thirty years after the initial order was placed³⁵.
- 18- Nuclear energy and nationalism. Examples abound of countries that are developing nuclear power exclusively for nationalistic reasons, notably with a view to building atomic

³⁰ This nuclear physicist is considered as one of the ‘founding fathers’ of Brazil’s bio-ethanol programme. Goldenberg J and Lucon O. ‘Is Nuclear Energy Sustainable?’ Environment Agency of the State of Sao Paulo. Presented at the Montreal Climate Conference (December 2005).

³¹ The reasons are a lack of consensus among states, but also the excessively high financial risk and deadlines that are impossible to predict, according to Steve Thomas (cited above).

³² For example, the start-up of the power station built in the Philippines by Westinghouse over a seismic fault has been put on hold since the end of the Marcos regime and the restoration of democracy, despite the fact that construction has been completed and the fuel is already on site. More than 4 000 defects were discovered in the plant design and litigation is still ongoing some twenty years later.

³³ The term ‘white elephant’ refers to the pharaonic projects set up in the southern-hemisphere countries that have benefited no-one other than the suppliers from the northern hemisphere and the networks of bribery and corruption.

³⁴ Like several other of these white elephants this plant is listed as one of the twenty or so reactors currently ‘under construction’ around the world.

³⁵ Source: RISAL http://risal.collectifs.net/article.php3?id_article=1437.

bombs. Many of the technology transfer deals of the past could not have taken place without a certain measure of government compliance, for example the sale of nuclear reactors by to Saddam Hussein's Iraq.³⁶ Even if nuclear weapons were not involved this desire for power is completely inconsistent with the kind of sustainable development that is of benefit to everyone.

- 19- The ambiguous nature of the treaties. International regulations governing the civil nuclear industry, and notably the rules for states that are party to the Nuclear Non-Proliferation Treaty (NPT),³⁷ seek both to reject military nuclear programmes and to promote 'the right to civil nuclear power', with technology transfer in this area being strongly advocated. The international community thereby encourages the signatory states to set up or use administrations or to promote studies in the field of nuclear energy, not least in the poorer nations that would never have access to or interest in nuclear power. The German Chancellor Willy Brandt denounced this situation many years ago, as it debased the trade in nuclear technologies and suppressed human resources in the form of research personnel, who could have been much better used elsewhere³⁸.
- 20- Nuclear power at the mercy of geopolitics. Trade in atomic energy is primarily the decision of states and public electricity utilities. Contrary to what is claimed by advocates of nuclear power, developing countries are taking a political risk when they invest in nuclear energy. Embargos are frequently applied (India has been the subject of one since 1971). Conflicts between political blocs or former blocs exert a considerable influence on this trade and create a situation of double standards: witness the fact that Georges W. Bush is currently opening up nuclear trade with India while at the same time allowing that country to make full use of its plutonium reactors, which are intended for military use. At the same time Iran has been left isolated and risks imminent international embargo. As far as southern-hemisphere operators are concerned, nuclear power therefore presents many more uncertainties than other sources of energy.
- 21- Nuclear energy outside the Kyoto Protocol. The use of nuclear energy has been excluded from the Clean Development Mechanism (CDM)³⁹. Rejection by the countries of the southern hemisphere is primarily motivated by the fact that the less developed or most vulnerable nations derive little or no benefits in terms of development from the use of nuclear power. The inclusion in the mechanisms of large-scale nuclear projects would have seriously prejudiced the participation of the less developed countries in the Kyoto arrangements. The environmental benefits of nuclear energy would be especially difficult to prove in the case of the developing nations⁴⁰. In spite of the wishes of the nuclear industry this rejection of nuclear power by the Kyoto Protocol has been included in the Marrakesh

³⁶ See especially Goldschmidt B., 1981, 'The nuclear complex', CEA Editions.

³⁷ The Nuclear Non-Proliferation Treaty (NPT) dates from 1968. Its application is guaranteed by the International Atomic Energy Agency (IAEA) based in Vienna.

³⁸ The 'Brandt North-South Report' of 1980 is both an appeal for development and a manifesto against nuclear power and in favour of solar energy.

³⁹ The mechanism is laid down in article 12 of the Kyoto Protocol, which describes the policies whose benefits are shared out among the countries of the northern and southern hemisphere. The aim is to assist southern-hemisphere countries 'in achieving sustainable development and in contributing to the ultimate objective of the Convention » (Article 12.2.). These activities should have 'real, measurable and long-term benefits' (Article 12.5.b).

The rejection of nuclear power in the CDM is given concrete expression by the commitment of all the northern-hemisphere countries not to resort to CDM for projects based on the use of nuclear energy. In view of the decision making system that applies, via the CDM Board, this essentially means that nuclear power will be ruled out for the next decade at least.

⁴⁰ Bonduelle A., 2000, 'Twelve reasons to reject nuclear energy in the CDM', INESTENE.

Accords and confirmed by those states that ratified the Kyoto Protocol meeting in Montreal in December 2005⁴¹.

- 22- Delays to reactor construction, which now exceed twelve years in most cases and even twenty or thirty years in some instances, involve a considerable opportunity cost⁴² for developing economies, whose growth and financing needs tend to be short term. Most of the cost of nuclear power in fact comes from the interest that has to be paid during the construction phase, and these rates are higher for the less developed countries. This is also the reason why private-sector construction (project financing) has never applied to the nuclear industry.
- 23- The absence of an appropriate electricity grid. Southern hemisphere countries do not have the high-voltage grid required to transmit the current generated by large-capacity power stations. Such transmission networks are not within their financial reach and would not be suitable for the national consumption patterns. Reactors could only be supplied to those densely populated nations that are now beginning to emerge economically; however, in such cases the lengthy construction periods involved would only place nuclear power at a disadvantage compared with other forms of energy.
- 24- The huge size of nuclear power stations is a handicap for the majority of countries. The electricity grids needed to absorb production from nuclear stations are outside the range of, and often of little use to, the sparsely populated countries of the southern hemisphere. Electricity transmission networks must in fact develop at the same pace as the national economy. This effect applies because nuclear reactors are not well suited when it comes to responding to demand: they create a temporary overcapacity when first commissioned because the construction programme can only follow electricity demand by taking large-scale 'steps'. The scale of the reactors (over 1 000 MW) even encourages waste⁴³. This effect is aggravated by uncertainty over the length of the construction phase – a characteristic feature of nuclear projects in the southern hemisphere that prevents nuclear power from keeping pace with economic development.
- 25- No small-scale reactors available. Yet in spite of this the promoters of nuclear power have announced they are to start building small-scale nuclear reactors. However, this hypothetical development will only make the risk of accident far more likely, not only because of the increased number of operating sites and transport operations but also because of the absence of the operational experience needed to introduce new reactor systems. This is how the concept of the South African 'pebble bed' reactor, sometimes presented as a solution for the southern hemisphere, has in reality become more proliferous and more dangerous than other models. This particular technology has already failed in the USA and in Germany⁴⁴. Another example of the irresponsible attitude behind the development of

⁴¹ For example two leading figures from the IAEA suggested that 'the two flexibility mechanisms from which nuclear power projects are currently excluded (CDM and JI) could, were the exclusions reversed, become instrumental in nuclear technology transfer and environmental protection', and expressed the hope that this exclusion might one day be deleted from the wording of the text adopted at Montreal. Their hope was to prove futile. H-H Rogner and A. McDonald, 'Nuclear Power Revival: Short-term anomaly or long-term trend?', IAEA, Vienna, 2005.

⁴² In economics the opportunity cost is the difference between the incurred expenditure (in this case capital investment that will not be paid off for decades to come) and the absence of any return that might have been obtained by way of other options.

⁴³ This criticism also applies to major hydroelectric schemes, which create a temporary overcapacity and encourage wastefulness in power consumption from the moment they come into service.

⁴⁴ According to Steve Thomas the demonstration reactor designed by teams from ABB and Siemens has failed. The South African prototype, originally scheduled for 2003, has been put back for ten years. (project already mentioned in p.14).

'mini reactors' is the desire displayed initially by the Soviets and more recently by the Russians to increase the number of reactors installed on barges and designed to supply power to the more-remote regions.

- 26- Nuclear energy does not help solve the problems of poverty and inequality. Only the rich nations and the privileged classes in countries where development is well under way are capable of using atomic power. The colossal sums swallowed by nuclear projects around the world – including research into future-generation reactors and nuclear fusion – will never be of benefit to the poorer half of mankind. However, the message from Rio is that poverty should be combated. This situation is made all the more unfair by the fact that the poorer countries will be the first to suffer the consequences of climate change, while it is the developed nations that are primarily responsible for it⁴⁵. By continuing to allocate most of their resources to nuclear projects the developed countries are contravening the spirit of the Rio Convention, which provides for 'funding, insurance and the transfer of technology' that is required 'to meet the specific needs and concerns of the developing countries'. The agreement refers specifically to small island nations, countries with low-lying coastal areas and countries with arid areas that are prone to natural disasters and desertification⁴⁶... These are all precisely the countries that will never use nuclear power.
- 27- The absence of democracy and the lack of an effective opposition only increases the risk. The classic argument used by the defenders of nuclear power when discussing the Chernobyl incident is that this tragedy was caused by the Soviet system and by narrow-minded, mendacious people who cared little about the principles of safety promoted by the party⁴⁷. The same argument about bureaucratic irresponsibility, the absence of trade unions and the lack of press freedom also applies to the current situation in China. Dictatorship combined with an absence of the rule of law is compounding the risks associated with nuclear energy in the only countries that are currently procuring nuclear projects.

General arguments against nuclear energy.

These are of a much more conventional nature: e.g. inherent dangers, the risks associated with waste disposal and plant dismantling, nuclear proliferation and terrorism

- 28- The risk of nuclear accident remains a permanent danger, whether this concerns the operation of the reactors, the handling of waste or the other operations in the cycle. Accidents of this type are not fantasy and their consequences can truly be vast in scale, as illustrated by the current situation in Belarus and Ukraine some twenty years after the Chernobyl incident. The same threat is also present in western Europe⁴⁸.
- 29- The question of nuclear waste, which will be inherited by future generations. High-activity long-term waste (several hundreds of thousands of years) poses particular scientific and moral problems that have still not been resolved to this day. In many countries this problem alone is enough to justify the rejection of nuclear energy⁴⁹.

⁴⁵ The principles enshrined in the Rio Convention (Article 3.2) state that 'the specific needs and special circumstances of developing country Parties, especially those that are particularly vulnerable to the adverse effects of climate change, should be given full consideration...'. The preamble to the Convention also recalls that: 'the largest share of historical and current global emissions of greenhouse gases has originated in developed countries...'

⁴⁶ United Nations Convention on Climate Change, Article 4.8(a) to (f).

⁴⁷ See for example C. Charpak, R. Garwin, V. Journé, 2005, 'From Chernobyl to Chernobyls', Odile Jacob, Sciences P. 215.

⁴⁸ A. Froggatt, 'Nuclear Reactor Hazards', December 2005, Nuclear Issues N°2, Heinrich Böll Foundation.

⁴⁹ J. Kreuzsch, W. Neumann, D. Appel, P. Diehl, 'Nuclear Fuel Cycle', 2006, Nuclear Issues N°3, Heinrich Böll Foundation.

- 30- The myth of waste recycling. ‘Recycling’ is a quite inappropriate term to use for the separation of products contained in spent fuel from nuclear power stations, since the reprocessing of this material results in mixed oxides (MOx) of plutonium and uranium. At the end of the process there is even more waste than at the start. These fuels, which are presented as ‘recycled’, are not in fact themselves recyclable.
- 31- The question of dismantling and the end of the life cycle of nuclear facilities. This question is at the same time tied in with the problem of nuclear waste – waste from dismantling represents a considerable amount – and the issues surrounding the financial cost involved – this cost factor being deferred until the end of the plant’s useful life and then spread out over the decades ahead. A serious risk is therefore present in both cases: the risk to the health of the public and the workforce and the risk of not being able to finance the dismantling operation, which in France is mainly scrutinised by the Court of Financial Auditors⁵⁰. In the United Kingdom the cost of dismantling currently exceeds 100 billion euros, and that is only for twenty installations⁵¹. The generating companies, with a remit geared towards profitability, find themselves tempted to postpone reactor shutdown and dismantling as long as possible, a fact that only increases the risk associated with older facilities.
- 32- Nuclear proliferation. The threat of bombs being produced from nuclear fuel features permanently in the debate on the use of nuclear energy in the southern hemisphere. At the last ministerial meeting of the United Nations Environment Programme (UNEP) at Dubai in February 2006, for example, energy was one of the topics on the agenda for the various Ministers and delegates; the subject of nuclear power was sounded out around the table, but the debate was immediately interrupted after an extravagant plea from Iran in favour of nuclear energy... civil of course. The fear of proliferation is all the more real now that the nuclear industry has established itself in numerous countries with poor infrastructure conditions and where this technology is being applied by private enterprise. Even the very pro-nuclear physicist Georges Charpak is fearful of the current situation and has called for international controls on nuclear waste so as to prevent hijacking...⁵²
- 33- Vulnerability to terrorism and war. This has been an obvious threat since 11 September 2001. The fact that nuclear reactors are vulnerable to damage by an airliner falling out of the sky is now common knowledge, though in France reports on this subject are classified as top secret.⁵³ More specific again to our country is the fact that the La Hague plant and its huge stock of fissile material represents a choice target for terrorists. According to a study carried out by WISE-Paris in 2001 each of the deactivation pools in use at COGEMA-La Hague contains 67 times more caesium than that released by the Chernobyl accident⁵⁴.
- 34- The European Union is stuck in the nuclear mire. The Euratom Treaty is contemporaneous with the creation of the Common Market. The wording of the Treaty is still in force⁵⁵ in spite of its obvious flaws, such as the overlapping remits for promoting

⁵⁰ Summary of report on www.ccomptes.fr/actualite/dossiers_presse/nucleaire.pdf.

⁵¹ 30/03/2006 – AFP. On Thursday the UK announced that it would entrust the dismantling of twenty of its nuclear installations to private companies at a total cost of 70 billion pounds (101 billion euros).

⁵² Charpak G. Journé V. Garwin R. ‘From Chernobyl to Chernobyls’, Odile Jacob Sciences 2005, P. 191. This entire work sends a shiver down the spine as to the risk mankind is taking with nuclear energy.

⁵³ ‘Nuclear energy: when the public debate comes up against defence secrets’, Le Monde, 15/09/2005.

⁵⁴ In Schneider M., ‘The threat of nuclear terrorism’, Assemblée Nationale, 10 December 2001 on <http://www.wise-paris.org/francais/rapports/011210TerrorismeNucleaire3.pdf>.

⁵⁵ Following a robust intervention from the German Minister (Green Party) Joscha Fischer, the wording of the Euratom Treaty was not incorporated in Title III of the draft European Constitutional Treaty. Only the announcement of a future

nuclear energy and for nuclear research and safety⁵⁶. Euratom has allowed the nuclear industry and the countries that support it to give nuclear energy the odour of sanctity. More importantly, Euratom research funds and loans granted for this purpose do not come under the European Parliament, which is an institution set up by subsequent treaties. Democratic representation in Europe is unable to express an opinion on nuclear energy, a fact that creates confrontation with the European Parliament, starting with the first blocking of the budget in 1993⁵⁷ and including more recently a vote in committee agreeing a 10% reduction in the funds allocated to Euratom under the Seventh Framework Programme⁵⁸. This situation is paradoxical, because at the same time the Union does not have any authority over energy affairs, for example when it comes to implementing energy saving policies that would be viable and coherent on a European scale. EU directives and attempts at introducing energy policies, even of the most progressive kind, always come up against the same blocking manoeuvre. As far as the period 2003-2010 is concerned the Directive on Renewable Energies⁵⁹ only mentions 'indicative national objectives' for total electricity consumption based on renewable electricity, and cites the measures to be adopted in order to achieve these objectives.

- 35- Nuclear power means increased subsidies and greater unfairness. In addition to highly biased research funding in Europe and in France, nuclear energy benefits from numerous subsidies and expedients that affect a significant proportion of the contracts involved, but which are sometimes hidden among the numerous budget lines or are constituted from obscure transfers of expenditure for the national account⁶⁰. Schemes to promote rural electrification, for example, which were originally motivated by the call for greater equity between citizens, now serve simply to subsidise electric heating to the detriment of locally obtained renewable resources⁶¹. Nuclear subsidies have an even greater impact on competition between energy sources. According to Amory Lovins, for example, the programme for the revival of the nuclear industry being proposed by George W. Bush brings the total amount of subsidy on offer to the industry to the equivalent of six large nuclear reactors⁶². The same author also states that the level of subsidy granted to nuclear energy in the United States has been 24 times greater than that allocated to renewables.
- 36- Nuclear energy is linked to narrow nationalism. Some of the problems connected with the nuclear industry (waste disposal, safety and so on) can only be resolved within a perfectly functioning supranational system. This is completely contradictory to the current and previous development of nuclear programmes, which have always been associated with a form of nationalism and with the relations between states⁶³. History has shown that we

amendment of the Treaty by countries that are opposed to nuclear energy (Germany and Ireland) was included in the text that was submitted for referendum.

⁵⁶ This overlapping of roles is even more pronounced here than in the IAEA, since the officials of the European Commission (who in theory are guarantors of the general interest) are also responsible for applying the provisions of the Euratom Treaty in those areas that involve the promotion of nuclear energy.

⁵⁷ This 'trial of strength' over the budget for the 1994-1999 period was led by the German nuclear physicist Rolf Linkohr of the SPD and was aimed at obtaining budget parity between nuclear energy and renewables. The undertaking made by the European Commission of the time was subsequently left unheeded.

⁵⁸ Vote in the Environment Committee of 23 February 2006. This vote was not upheld in the House but it did help bring about a significant increase in the budget allocations for renewable energies.

⁵⁹ Directive of 27 September 2001 relating to the promotion of electricity produced from renewable sources on the single electricity market.

⁶⁰ 'Support and subsidies for nuclear energy in France', INESTENE – December 1998 – Report for Greenpeace France.

⁶¹ Colombier M., 'Tariff distortions brought about by cross-subsidisation', 1998, ICE (International Consulting on Energy), Annales des réalités industrielles, August 1997.

⁶² A. Lovins (cited above), page 17.

⁶³ For example, guaranteed fuel delivery systems with return of waste, of the type proposed by Georges W. Bush (without financing), could only be put in place in the context of the continued hegemony of the United States. This would mean guaranteeing this state of hegemony *in the long term*, something that is clearly impossible.

cannot count on the permanence of nations and this has been demonstrated all too clearly with the end of the Soviet empire.

- 37- The myth of hydrogen and the ‘nuclear one-stop-shop’. The idea is to produce hydrogen using energy from the nuclear reactors of the future; this gas will then replace petrol as a transport fuel and in this way will help reduce the rate of climate change. However, this development assumes that we have solved most of the technical and economic problems⁶⁴ involved. Furthermore, the pace of change in the world of transport is far too slow to allow the development of a hydrogen society based, as it is today, on private car ownership. Even in the most favourable circumstances the switch to a different fuel would have little impact for several decades to come⁶⁵. Such a scenario is also founded on the notion that electrical energy will be in abundant supply and available almost free of charge because of the hypothetical generation IV reactors. In reality there is little hope of establishing the economic equilibrium required for a thriving nuclear power sector by the year 2050 given the other resources available to us, whether renewable or not (coal-derived hydrocarbons, biofuels, gas and oil), even if the financial conditions are favourable.

Positions for and against nuclear energy

Finally we come to those points that concern the opinions of European citizens and the positions taken up by environmental groups on the subject of nuclear energy and also by those scientists who defend the nuclear industry. These do not as such constitute irrefutable arguments, but they can help all those involved to reach an opinion.

- 38- Public rejection. Opinion polls taken over the last thirty years in Europe have constantly shown that there is general opposition to the building of new reactors and a high level of mistrust towards the nuclear industry⁶⁶. On the other hand, there has been overwhelming support for solar power, while nuclear energy is at best only accepted as a stop-gap solution.. It is therefore difficult to claim that any revival of the nuclear industry could be achieved with the assent of the public, the vast majority of whom (over 80%) want to be consulted on any future nuclear projects.
- 39- Environmental NGOs are unanimously opposed to the nuclear industry. This is a sector that simply passes on its costs (dismantling and waste disposal) to future generations and makes public authorities and other bodies responsible for its risks. The aforementioned organisations, along with the majority of countries, do not consider nuclear energy to be one of the ‘environmentally sound technologies’ whose development is called for under the Kyoto Protocol.
- 40- Supporters of nuclear power are weird. Still, we shall not ignore the last item on our list, which is mainly aimed at those who sympathise with the environmental cause. This particular point involves the rather bizarre conduct of nuclear energy’s most ardent supporters. Several marginal groups⁶⁷ support the full-scale revival of nuclear energy by basing their arguments on those copied directly from the environmentalists. The names featured on the list of supporters drawn up by such groups speak for themselves, since they

⁶⁴ Dessus B. 2005: ‘The hydrogen civilisation – myth or reality’, Cahiers de Global Chance N°20, the technological utopias, available for consultation on www.agora21.org.

⁶⁵ See especially ‘Cars and the greenhouse effect: cut down on car travel to reduce the greenhouse effect’, CLIP, March 2001, <http://www.iddri.org/iddri/html/publi/cahiers-du-clip.htm>.

⁶⁶ For example, the Eurobarometer poll taken in January 2007 showed that only 20% of the European citizens were in favour of nuclear energy, while 80% were in favour of solar energy!

⁶⁷ See for example the websites run by groups such as ‘SOS Climat’ and ‘ecologists for nuclear energy (sic!)’ or the scientific journal ‘fusion’, three sites that are outspokenly anti-environmental in content.

include various professors and scientists who are well-known for their pro-GMO stance and dismissive of the risks that chemicals pose for our environment. What is even more bizarre, at the Conference of Parties in Montreal (COP11) the very serious European Nuclear Society and the American Nuclear Society had invited a very strange guest who spoke in defence of nuclear energy... and repudiated the science of climate change⁶⁸.

Arguments developed by E&E Consultant
on behalf of the Greens/EFA in the European Parliament,
Marie-Anne Isler-Béguin, French Member of the European Parliament



⁶⁸ ECO, n°8 COP-MOP1, 'Oscar for the best *comic side-event*'. Montreal, December 2005.