Special Briefing

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for the planet for people

Nuclear Power and Climate Change

Introduction

In November at The Hague in the Netherlands, the next meeting of the UN Framework Convention on Climate Change will be held. It will take decisions that may decide the future of the nuclear industry. Due to the combined effects of Chernobyl and appalling economics the nuclear industry has been stagnating for years. However the need to curb climate change by cutting carbon dioxide emissions has been seen by the nuclear industry as a potential life line. Some Governments have accepted this rhetoric. Friends of the Earth believes that the real solution lies with renewable energy and energy efficiency and that nuclear power - with its intrinsic accident risks, radiation risks and production of highly dangerous nuclear waste which we don't know what to do with - cannot be part of the solution to climate change. This briefing sets out those risks, outlines the real solutions and lets you know how you can take action.

Climate Change Negotiations

The present set of climate change negotiations began in 1992 at the Earth Summit in Rio. Here the United Nations Framework Convention on Climate Change (UN FCCC) was adopted. The ultimate aim of this convention is the '*stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system*'. Carbon dioxide (CO_2) is the most important greenhouse gas and as it is produced from burning fossil fuels the nuclear industry have seen the Climate negotiations as a life line.

At the Climate Summit in Kyoto, Japan in 1997, the 'Clean Development Mechanism' was developed as part of the landmark Kyoto Protocol.[1] This allows industrialised countries to buy credits for carbon dioxide reductions achieved in non industrialised countries which they can then count against their emissions reduction target. The reason for adding this flexibility is that it is considered to be cheaper to finance a project abroad than to initiate work domestically. Potentially the CDM could be used to finance nuclear power in developing countries. Between industrialised countries there is a similar mechanism to CDM known as Joint Implementation.

In the case of the Clean Development Mechanism, there is a requirement that the project helps the non industrialised country to achieve sustainable development[2] which makes it all the more strange that some Governments appear to be heeding the lobbying of the nuclear industry and arguing that nuclear power should receive subsidies as a result of climate targets. Nuclear power with its intrinsic accident risks and legacy of wastes is anything but sustainable.

In November at The Hague the sixth Conference of the Parties will be held and the detail of the CDM and the JI will be thrashed out. One of the key details that will be discussed is whether or not to give the green light for nuclear power to be eligible for credits under the flexible mechanisms. In April, at a ministerial meeting in New York, China, India, Canada, France, Britain and the US were in favour of including nuclear power in the CDM while Germany, Austria, Sweden, Denmark, Saudi Arabia and Indonesia wanted it kept out.[3] In June at the EU Environment Council it was agreed that a positive list of renewables and energy efficiency should be adopted, but nuclear has not been explicitly excluded.[4]

If nuclear is included in the CDM the capital cost of new stations in developing countries will be subsidised by up to 40 per cent.[5] This could transform the prospects for nuclear power.[6] Friends of the Earth believes that nuclear power has no role to play in developing solutions to climate change. On the evidence of the dangers of radiation, accidents, discharges, nuclear waste, nuclear proliferation and the nonsense of nuclear 'economics' nuclear power should be specifically excluded from the climate strategies adopted.

Radiation

Nuclear power is potentially lethal because it creates nuclear radiation. In large doses radiation can cause death by radiation sickness. At lower doses it causes a range of problems such as cancer or genetic damage. All nuclear stations have routine emissions of radioactivity and since there is no safe level of radiation all nuclear power stations will be adding to the health burden of the local population. More severe problems are likely to be caused by nuclear accidents.[7]

In the following sections the many ways in which nuclear power can release radiation are considered. These include accidents, discharges, uranium mining, nuclear waste, proliferation and terrorist threat.

Accidents

Over its forty year history, accidents and breaches of safety culture have become just another part of the routine of the nuclear industry. As a result an inevitable part of nuclear power is the risk of catastrophic release of radiation. In the following sections the chronology of major nuclear accidents and breaches of safety culture is set out.

Windscale, UK 1957

The Windscale No 1 Pile was one of two military reactors built on what is now the British Nuclear Fuels site at Sellafield in Cumbria. It was used for the production of plutonium for the nuclear weapons programme. In October 1957 during a routine release of energy the reactor overheated and caught fire. Some of the intensely radioactive smoke from the fire was released and spread over England Wales and northern Europe. It took two days and five million litres of water to put the fire out.

After the accident 2 million litres of milk were thrown away because of the threat posed by radioactive iodine that it was contaminated with. Despite this effort the predicted cancer deaths because of the accident are 100 - 8 in Cumbria, 95 in UK and 5 in the rest of Europe.[8] These deaths are predicted to occur over 40 years.[9]

Chelyabinsk-40, Russia 1957/1958

This accident contaminated thousands of square miles in the Central Ural Mountains of Russia and may have caused hundreds of human casualties. However news of the accident was suppressed for many years. Following a mention of the accident by Zhores Medvedev in the New Scientist twenty years later in November 1976 research was uncovered that indicated that lakes, soil and more than 200 animal and plant species in an area covering several thousand square miles had been contaminated by radiation.[10]

One commentator driving in the area said that there was a road sign warning drivers not to stop for 30 km and to drive through at maximum speed. He said:

'*On both sides of the road for as far as one could see, the land was "dead": no villages, no towns, only the chimneys of destroyed houses, no cultivated fields or pastures, no herds, no people... nothing.*'[11]

The exact cause of the accident is speculative. One possible explanation is a conventional chemical explosion involving either gases or ammonium nitrate.[12]

Three Mile Island - USA 1979

A serious accident occurred in the USA on March 28th 1979 at Three Mile Island 15 km from the town of Harrisburg (population 60,000) and 240 km from New York. The nuclear reactor core overheated and partially melted. In the immediate aftermath of the accident experts could not agree on the possibility of an explosion which would breach the containment vessel. Finally 3,500 children and pregnant women were evacuated and 400,000 people left of their own accord. As it happened the reactor containment was not breached.

This accident - which was caused by an initial failure in a pump compounded by human error - released much more radioactivity than the Windscale accident. However it was mostly in the form of inert gases and so the effect on human health would be much lower.[13]

Chernobyl - Ukraine 1986

On April 26th 1986 operators lost control of Chernobyl Unit Four reactor after they had been carrying out improper experiments. Within four seconds the reactor reached 100 times normal power. This caused a steam explosion which blasted apart its 1000 tonne lid. There was a second hydrogen explosion hurling radioactivity a mile into the sky. More than thirty fires were started by the flaming reactor debris and the graphite core of the reactor was alight.[14] Three to four per cent of the radioactive content of the core was lost, and 31 people were killed directly trying to minimise the escape - 29 due to radiation sickness.[15]

According to a Soviet estimate half of Chernobyl's fallout fell within 35 km of the reactor. One hundred and thirty five thousand people were evacuated from a 30 km diameter zone centred on the reactor. The other half of the fallout fell on more than twenty countries world wide stretching as far as North America - resulting in limitations on food. The US DOE - a pro nuclear body who would be expected to give estimates at the lower end of the range - calculated that world wide there would be around 40 000 deaths from Chernobyl induced cancers. This figure does not include the other health effects such as non-fatal cancer, brain damage or genetic abnormality.[16]

Tokai Mura - Japan 1999

On September 30th 1999 three workers involved in a fuel fabrication process breached the proper procedures resulting in what is known as a nuclear 'criticality' that exposed these workers to serious levels of radiation. Two of the workers received such high doses that they died as a result. In addition over 400 others were exposed.[17]

Workers used an unapproved version of the operational manual that had not been shown to the regulator because it was known it would not be accepted. Even these unsatisfactory rules were themselves flouted.[18]

BNFL - UK 2000

On February 18th 2000 the UK nuclear regulator reported that the UK company BNFL had repeatedly falsified key safety data on fuel that they manufactured.[19]

Although this incident did not result in an accident it indicates that the contempt for safety procedures shown at Tokai-mura and Chernobyl is endemic to the nuclear industry.

Discharges

Apart from the risk of accidental release of radiation, nuclear power stations release radiation deliberately into the skies and surrounding waters routinely. This is despite the fact that there is no safe level at which radiation will not damage DNA and initiate cancer. According to the International Commission on Radiolgical Protection whose judgements are used as the international standard on radiation:

"*It is assumed that there is no threshold for the induction of the molecular change at specific DNA sites involved in the initial events that result in malignant transformation and ultimately cancer.*"[20]

Thus despite the fact that it is known that no safe level of radiation exists, nuclear power stations continue to routinely discharge radiation into the environment.

There is good evidence that the level of childhood leukaemia is higher in the vicinity of some nuclear installations.[21] The exact cause is controversial, but it could be associated with the discharges. Elaborate measures are now called for to cut nuclear discharges. For example in June 2000 the OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic signed up to a decision to cut maritime discharges to close to zero for artificial radioactive substances.[22]

It has been calculated that even if very low levels of discharge are achieved the overall discharge is still very large and unacceptably dangerous.[23]

Uranium Mining

In addition to the routine discharges from nuclear operation radiation exposure is caused by mining the uranium used to make the fuel for the nuclear reactors. Uranium miners - such as those in Canada, the USA, Namibia and Sweden - breathe radon which is derived from uranium. This gets into their lungs where it emits so-called 'alpha particles' which can cause lung cancer.[24] One risk assessment indicates that each year 44 uranium miners receive fatal doses of radiation.[25]

Nuclear Waste

Nuclear power produces long-lived radioactive wastes for which no disposal route has been found. The Royal Commission on Environmental Pollution stated;

"*We must assume that these wastes will remain dangerous and will need to be isolated from the biosphere for hundreds of thousands of years. In considering arrangements for dealing safely with such wastes man is faced with timescales that transcend his experience.*"[26]

Despite having had over forty years to deal with the problem created, no repository for high level wastes has been established anywhere in the world. Forty years' research has only demonstrated the failure of the idea that nuclear waste can be "disposed of" underground, without leaking back into the environment and threatening the health of future generations. The fact there is no disposal facility is a result of this failure. In 1997 the UK Government rejected the nuclear industry's plan to begin building a nuclear dump because of the appalling science that was put forward to support the plan.[27]

That same year the British Government Panel on Sustainable Development reported;

"*the options for handling radioactive waste, and the danger that nuclear waste might contribute to the proliferation of nuclear weapons, are all issues which warrant urgent consideration at the highest international level*"[28]

Proliferation and Nuclear Terrorism

Plutonium is made in nuclear reactors. Some countries such as France and the UK separate it so that it is readily available as the raw material for nuclear bombs. Monitoring the stocks of plutonium both in the spent fuel and in the raw form to ensure that it is not made into a bomb (either by Governments or terrorists) is difficult. The monitoring body the International Atomic Energy Agency lack confidence in their own system. They have commented:

"*The IAEA's verification system cannot physically prevent diversion of nuclear materials or the setting up of any undeclared or clandestine nuclear weapons programme.*"[29]

In 1976 the Royal Commission on Environmental Pollution concluded:

"*it is entirely credible that plutonium in the requisite amounts could be made into a crude but very effective weapon that would be transportable in a small vehicle. The threat to explode such a weapon unless certain conditions were met would constitute nuclear blackmail and would present any government with an appalling dilemma. ...**We should not rely for energy supply on a process that produces such a hazardous substance as plutonium unless there is no reasonable alternative.***"[30]

Since this seminal report was published nothing has changed. International reports of a terrorist threat associated with an Australian nuclear power station to coincide with the Sydney Olympics indicate that we cannot let down our guard on nuclear power.

It can be seen that nuclear power is simply not a sustainable option. From all angles - the first stages of uranium mining to the final stages of disposal - together with the pernicious risk from routine discharges and the ever present risk of a catastrophic accident during operation - nuclear power carries a greater environmental burden than can be compensated for by its low carbon dioxide emissions. In the following sections the alternatives to nuclear power will be considered.

The Real Solutions

The total amount of sunshine reaching the Earth's surface is more than 10,000 times humanity's current rate of consumption of nuclear and fossil fuels. Energy from the sun is the ultimate source of renewable energy sources that range from solar electricity to biofuels and hydro, wind and wave power. However the huge potential of renewable energy is only just beginning to be tapped.[31] Renewable energy does not present the radiation, accident and proliferation threats of nuclear power and it offers a sustainable way to meet the challenge of climate change.

Renewables are seen as making a very substantial role in the long term by most institutions producing projections of future energy needs. In 1990 the EC estimated the world market for renewables at £31 billion. Estimates based on World Energy Council projections indicate cumulative investment in renewables ranging from £150 to £400 billion between 2000 and 2010. Shell research which assumes pressure towards sustainability show renewables meeting 40 per cent of world energy needs by the middle of this century [32] In March 2000 a UK Parliamentary Select Committee reported that in order to meet the challenge of climate change a renewables target of 50% of UK electricity should be set. [33] In contrast for nuclear energy the report notes:

"*it can also be argued that the high costs and unresolved waste issues should rule out the option of building new nuclear capacity.*"[34]

Today wind power from the latest turbines on good sites costs around 3.5p/kWh, which is cheaper than power from new nuclear and coal-fired stations, and almost competitive with the cheapest gas-fired plant.[35] However, some other renewables still require subsidy and the on-going subsidy of nuclear power competes with these necessary subsidies.

In addition to renewable energy another key part of the solution is energy efficiency. In September 1998 at its conference in Houston, Texas, the World Energy Council, a high level federation of energy producers, concluded:

"*Increased efficiency in the end use of energy offers the most immediate, largest and most cost-effective opportunity to reduce consumption and environmental degradation.*"[36]

"*In order for nuclear power to remain a viable option for the next millennium, the cost of electricity from nuclear*

Different studies reach different conclusions on the actual improvement in energy efficiency that is possible - generally the range is from 30 to 50%. Amory Lovins's Rocky Mountain Institute estimates that for the US the potential for saving is over 70% of current power consumption. [37]

China provides a good example of the potential of energy efficiency for greenhouse gas reductions. Between 1980 and 1997 the country reduced CO_2 emissions by just 10 million tonnes through the use of non-fossil fuels, but at the same time it achieved reductions of 430 million tonnes through energy efficiency measures.[38]

In April 1999 the UK Energy Saving Trust reported that they had identified a realistic programme of home energy efficiency measures to reduce annual emissions in the UK by 7.6 MtC by 2010[39] and in March 2000 the Department of Environment Transport and the Regions (DETR) estimated that there was a potential for almost 11 MtC savings in the business sector.[40] The total of 18.6 MtC is comparable with the 12-24 MtC avoided through the use of nuclear power.[41] This means that through energy efficiency alone the UK could avoid the nuclear contribution to carbon abatement.

Economics

One of the major reasons why nuclear power will not be favoured against renewables and energy efficiency, unless it receives a subsidy, is that it is far too expensive to consider realistically. In February 2000 the Nuclear Energy Agency of the OECD published a report on 'Reduction of Capital Costs of Nuclear Power Plants'.[42] It was reported that there had been very few orders for nuclear power since the early 1990s and that energy liberalisation would place nuclear economics under increased scrutiny. It was noted that although attempts have been made to cut capital costs of nuclear - which account for some 60% of generation costs - through development of new reactor designs "*[t]o date it is not clear to what extent this had been achieved.*"[43] However, it was noted that in the future significant technical progress is needed to reduce capital costs and increase efficiency.[44] The report concluded:

power plant must be greatly reduced to be competitive with alternative sources"[45]

Research financed by the British Nuclear Industry Forum concluded that nuclear power required a subsidy of the order of £232 per year per kW of installed capacity.[46] It was noted above that some renewables are cheaper than coal and nuclear and therefore require no subsidy. Gordon MacKerron, senior fellow in science and technology policy research at the University of Sussex has stated:

"*it will still be the case for most of the countries most of the time that nuclear power will not be the best way of reducing carbon emissions*"[47]

Although at present the future is bleak for nuclear power, the present stagnation could be ended if a subsidisation mechanism is agreed at the climate negotiations. Such a subsidisation mechanism would be a significant drain on precious resources which would be much better spent on the real solutions.

Colonialism

In the case of the CDM the proposed project must be consistent with sustainable development. Friends of the Earth advocates that nuclear power is specifically excluded from the CDM because it is not sustainable. However it has been argued by the UK Department of Environment, Transport and the Regions that:

"*[w]e would not wish to be seen to be prejudging this assessment or to be dictating to developing countries*"[48]

However, foisting nuclear on developing countries when the developed countries do not want it themselves is itself a form of colonialism. When Westinghouse tried to sell their new AP600 reactor design in China, the Chinese asked why the US weren't building them themselves. [49]

According to the Nuclear Energy Agency in a document published in February 2000:

"*The short-term prospect of nuclear power in the OECD countries is stagnant. .... Several countries have even decided to exclude, temporarily or indefinitely, new nuclear power plants in their power system expansion plans.* "[50]

Furthermore the nuclear share of total electricity capacity in the OECD is due to drop from 1997 to 2010.[5i] Far from the neo-colonialism presented by the DETR, putting nuclear in the CDM would be an old-style colonial dumping of problems on developing countries. Agus Sari an Indonesian delegate has commented:

"*I think it is simple colonialism to push nuclear power onto developing countries, leaving them with all the burdens that come with it.*"[5ii]

Take Action

For the CDM to be an effective tool for sustainable development and for Joint Implementation not to become a means of propping up an otherwise dying industry it is essential that at The Hague the delegates establish simple straightforward text that excludes nuclear power. The Association of Small Island States (AOSIS) whose members are among those most threatened by climate change have proposed the following text for CDM projects that they "*Not support the use of nuclear power*"[5iii]

Write to your Head of Government and ask that they attend the Hague Summit and argue for text that specifically excludes nuclear from both the CDM and JI.

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Printed on 100% recycled paper
September 2000

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