Submission to Senate Select Committee on Fuel and Energy

www.aph.gov.au/SENATE/committee/fuelenergy_ctte/index.htm
fuelenergy.sen@aph.gov.au

Submission by:
Anti-nuclear & Clean Energy Campaign
Friends of the Earth, Australia

Contact:
Jim Green B.Med.Sci.(Hons.), PhD
National nuclear campaigner - Friends of the Earth, Australia
0417 318 368
jim.green@foe.org.au
PO Box 222, Fitzroy, Victoria, 3065.
<www.foe.org.au/anti-nuclear>

July 21, 2009

"The nuclear non-proliferation treaty continues to fracture. And there has been little if any progress on nuclear arms reduction – let alone nuclear disarmament."
Kevin Rudd
5 July 2007 – Lowy Institute.

"[T]he Nuclear Non-proliferation Treaty disintegrates before our very eyes … the current non-proliferation regime is fundamentally fracturing. The consequences of the collapse of this regime for Australia are acute, including the outbreak of regional nuclear arms races in South Asia, North East Asia and possibly even South East Asia."
Kevin Rudd
19 September 2006 - Sydney Institute.

CONTENTS

1. INTRODUCTION

Friends of the Earth, Australia (FoE) understands that the Select Committee is considering nuclear energy in the context of energy security, hence this submission.

While this submission focusses on nuclear power, references to a large and ever-growing number of scientific 'deep cuts' studies - most of which propose a mix of renewables plus concerted energy conservation/efficiency measures - are posted at: www.foe.org.au/anti-nuclear/issues/clean-energy.

Examples of useful literature dealing with Australia's energy options include:

Economics Report: Climate Leadership an Affordable Investment
www.climateinstitute.org.au//index.php?option=com_content&task=view&id=130&Itemid=1

Renewable Energy Generators of Australia.
Renewable Energy – a contribution to Australia's Environmental and Economic Sustainability: Cheaper and cleaner well into the future
Executive summary:
www.rega.com.au/Documents/Publications/J1281%20Final%20Report%20V3%20Exec%20Summary.pdf
Full report: www.rega.com.au/Documents/Publications/J1281%20Final%20Report%20V3.pdf

Beyond Zero Emissions - scoping document discussing a fast conversion to a near zero emissions stationary energy sector for Victoria.
beyondzeroemissions.org/zero-emission-stationary-energy

Review of 'deep cuts' studies : chapter 13 in Saddler, Hugh, Richard Denniss and Mark Diesendorf, 2004, "A Clean Energy Future for Australia", Report for the Clean Energy Future Group, wwf.org.au/ourwork/climatechange/cleanenergyfuture.

Clean Energy Future for Australia - national & state studies:
wwf.org.au/ourwork/climatechange/cleanenergyfuture

Turton Hal, Jinlong Ma, Hugh Saddler and Clive Hamilton, October 2002, " Long-Term Greenhouse Gas Scenarios: A pilot study of how Australia can achieve deep cuts in emissions" , Discussion Paper No. 48, The Australia Institute, Canberra. Summary at:
www.tai.org.au/WhatsNew_Files/WhatsNew/DP48sum.pdf.

The Australian Business Roundtable on Climate Change
www.acfonline.org.au/articles/news.asp?news_id=755
Related Resources:
* BLRT: The Business Case For Early Action report

www.acfonline.org.au/uploads/res_BLRT_BusinessCase.pdf
* BLRT: Allen Consulting report www.acfonline.org.au/uploads/res_BLRT_AllensReport.pdf
* BLRT: Factsheet www.acfonline.org.au/uploads/res_BLRT_factsheet.pdf
* BLRT: CEOs' statements www.acfonline.org.au/uploads/res_BLRT_CEOs_statement.pdf
* BLRT: CSIRO report www.acfonline.org.au/uploads/res_BLRT_CSIROReport.pdf

Growing the Green Collar Economy
www.acfonline.org.au/articles/news.asp?news_id=1796&preview=yes#related_resources

Wind Farms: The facts and the fallacies, Andrew Macintosh and Christian Downie, Australia Institute, Discussion Paper Number 91, October 2006,
www.tai.org.au/documents/downloads/DP91.pdf

Hung out to dry: Federal neglect of renewable energy research and development in Australia
A report by Greenpeace Australia Pacific, September 2007
www.greenpeace.org/australia/resources/reports/climate-change/hung-out-to-dry-federal-negle
or direct download:
www.greenpeace.org/raw/content/australia/resources/reports/climate-change/hung-out-to-dry-federal-negle.pdf

National Framework for Energy Efficiency www.nfee.gov.au/home.jsp?xcid=48
* November 2003 paper, Towards a National Framework for Energy Efficiency - Issues and Challenges, www.nfee.gov.au/about_nfee.jsp?xcid=64.
* numerous reports at www.nfee.gov.au/default.jsp?xcid=41
* web links at www.nfee.gov.au/links.jsp?xcid=42
* NFEE implementation committee info for these sectors - Buildings - Commercial and Industrial - Appliances and Equipment - Government - Trade and Professional Training and Accreditation - Consumer Information - Finance - www.nfee.gov.au/implementation_committees.jsp?xcid=69

WWF Australia et al., May 2006, report showing the electricity sector could reduce emissions by 40% by 2030 at modest cost: www.wwf.org.au/news/reducing-greenhouse-gas-emissions-is-affordable-and-achievable

Naughten B., P. Pakravan , J. Dlugosz J., and A. Dickson, 1994, " Reductions in greenhouse gas emissions from the Australian energy system : a report on modelling experiments using ABARE's MENSA model", Canberra: ABARE.

Business Council for Sustainable Energy report
Australian Photovoltaic Industry Roadmap
www.bcse.org.au/docs/Publications_Reports/PV%20Roadmap-web.pdf

WWF-Australia, 'Power to Change: Australia's Geothermal Future',
www.wwf.org.au/publications/powertochange

WWF-Australia. 'Power to Change: Australia's Wave Energy Future',
wwf.org.au/ourwork/climatechange/powertochange

2. NUCLEAR POWER AND CLIMATE CHANGE

Some simple calculations show that nuclear power could at most be a very partial 'solution' to the challenge of sharply reducing greenhouse emissions. A major limitation is that nuclear power is used almost exclusively for electricity generation (a very small number of reactors are used for heat co-generation and desalination) and electricity generation accounts for just 16–30% of global greenhouse

emissions.

Ian Hore-Lacy from (now defunct) industry-funded Uranium Information Centre (UIC) claims that a doubling of nuclear power would reduce greenhouse emissions from the power sector by 25%. But the figure of 25% falls to just 4–7.5% if considering the impact on overall emissions rather than just the power sector. The figure needs to be further reduced because the UIC makes no allowance for the considerable time that would be required to double global nuclear output. It is unlikely that nuclear output could be doubled before the middle of the century. A fixed additional input of nuclear power will have a relatively smaller impact if measured against increased overall greenhouse emissions. Under a business-as-usual scenario, overall emissions could be expected to double by the middle of the century so the estimated emissions reduction of 4-7.5% would be halved.

One important assumption has not yet been mentioned. The above calculations assume that nuclear power displaces coal. But compared to most renewable energy sources, nuclear power produces more greenhouse emissions per unit energy produced. For example, the 2006 Switkowski report states that nuclear power is three times more greenhouse intensive than wind power. Nuclear power is far more greenhouse intensive than many energy efficiency measures.

The Switkowski report found that even a major nuclear power program in Australia - 25 reactors by mid-century - would reduce emissions by a modest 17% compared to business-as-usual (assuming nuclear displaces black coal).

A more modest (and realistic) program of, say, six nuclear power reactors in Australia would reduce Australia's overall emissions by just 4% - and that underwhelming figure assumes that nuclear power displaces coal. If nuclear power displaced gas-fired plants, the reduction would be about 2%. If nuclear power displaced renewables and energy efficiency/conservation measures, the result would probably be a small *increase* in greenhouse emissions.

Nuclear advocates justify the comparison with coal on the grounds that, unlike renewables, coal and nuclear are reliable 'baseload' power sources. But geothermal 'hot rocks' can provide baseload power. Bioenergy can provide base-load power. Depending on the water source, hydro can provide base-load, intermediate-load or peak-load power. Dispersed wind farms with a small amount of back-up (e.g. from gas) can provide base-load power. Solar with storage can provide baseload – this is an expensive option at the moment, but an Australian government-funded Cooperative Research Centre reported in 2006 that solar thermal technology "is poised to play a significant role in baseload generation for Australia" and will be cost-competitive with coal within seven years. Lastly, energy efficiency and conservation measures can reduce demand for base-, intermediate- and peak-load power. (A briefing paper on the issue of baseload power, by Dr Mark Diesendorf, is posted at <www.energyscience.org.au>.)

Climatic consequences of nuclear war

Alan Robock noted in *The Bulletin of the Atomic Scientists* in 2008:

> *"The greatest danger that humans pose to Earth isn't geoengineering, ozone depletion, or even global warming. Rather, it's the climatic consequences of nuclear war. As recent work (<http://climate.envsci.rutgers.edu/nuclear>) by Brian Toon, Gera Stenchikov, Luke Oman, Rich Turco, Chuck Bardeen, and myself has shown, we now understand that the atmospheric effects of a nuclear war would last for at least a decade - more than proving the nuclear winter theory of the 1980s correct. By our calculations, a regional nuclear war between India and Pakistan using less than 0.3 percent of the current global arsenal would produce climate change unprecedented in recorded human history and global ozone depletion equal in size to the current hole in the ozone, only spread out globally. We need to solve this problem so that we have the luxury of worrying about global warming and the consequences of geoengineering."*

(Alan Robock, 14 August 2008, 'We should really worry about nuclear winter', <www.thebulletin.org/web-edition/roundtables/has-the-time-come-geoengineering>

Nuclear power *and* climate change

Energy expert Mycle Schneider notes that countries and regions with a high reliance on nuclear power also tend to have high greenhouse emissions:

Nuclear analyst Mycle Schneider notes that countries and regions with a high reliance on nuclear power also tend to have high greenhouse gas emissions:

> *"The largest generators of nuclear power also have energy sectors with the highest CO2 emissions. Western Europe and the United States produce about two-thirds of the nuclear electricity in the world [yet] their energy sectors also produce 39% of the world's energy-related CO2 emissions.*
>
> *"The same analysis applies to overall CO2 emissions per country or region. There is an interesting correlation between nuclear generation and CO2 emissions. The United States alone, [with] less than 5% of the world's population, accounts for 25% of the world's total CO2 emissions and generates 29.4% of the world's nuclear electricity. Western Europe, with only 6.5% of the world's population accounts for about 15% of global CO2 emissions and 34% of the nuclear power production.*
>
> *"China is the counter example. With 21.5% of the world's population, the country emits 13.5% of global CO2 and generates 0.6% of the world's nuclear power. The example of China illustrates well the potential role of energy efficiency in greenhouse gas abatement. Analysis of developments between 1980 and 1997 shows that while the country reduced its CO2 emissions through penetration of "carbon-free fuel" by hardly more than 10 million tonnes of carbon, the reduction due to energy efficiency measures delivered savings of more than 430 million tonnes of carbon over the same period.*
>
> *"Projections for Germany, produced by Prognos, suggest that while nuclear power output is expected to decrease by 40% by 2020, CO2 emissions per kilowatt-hour are expected to decrease significantly (probably by around 20% or more). This is not only because of a lower coal content in the fuel mix, but also especially because of an expected 22% decrease in the energy intensity of the German economy.*
>
> *"It seems obvious that there is no forced correlation between a high level of nuclear generation and low CO2 emissions of a given country. So far France is the exception. France is also the most nuclear-intensive country in the world, apart from Lithuania. France operates 59 nuclear reactors that produce 75% of its electricity while nuclear plants represent about 55% of the installed capacity. At the same time, France has a relatively low level of greenhouse gas emissions. The question is therefore justified whether a combined policy of nuclear power and energy efficiency is a possible alternative over the long run and whether it is cost efficient.*
>
> *"A recent major study carried out by the French national planning commission (Commissariat général au plan) which looked into three different scenarios ("market oriented", "industrial", "environmental") came up with some interesting results:*
> ** even in the "environmental" scenario, France's final energy consumption would increase by 9% by 2020 (compared to a reduction of at least 5% projected by Prognos for Germany);*
> ** the scenario with the lowest greenhouse gas emissions is not the most nuclear and "there is no evident correlation, even in France, between emissions and nuclear power", according to Benjamin Dessus, Chairman of the Long Term Working Group undertaking the study;*

** nuclear power plants would have almost disappeared by 2020 under the "market oriented" scenario if their lifetime cannot be pushed from 30 to 40 years.*

(Schneider, Mycle (WISE Paris), April 2000, "Climate Change and Nuclear Power", published by World Wide Fund for Nature, <www.panda.org/downloads/climate_ change/fullnuclearreprotwwf.pdf>.)

In relation to India, Leonard Weiss, a former staff director of the US Senate Subcommittee on Energy and Nuclear Proliferation, noted in the May/June 2006 issue of the *Bulletin of the Atomic Scientists* that a concerted program of improved energy efficiency could substitute for all the future power output from nuclear reactors being planned in India between 2006 and 2020.
http://thebulletin.metapress.com/content/d71g6943ph8ju506

More information on the nuclear/climate debate:
* Friends of the Earth et al., 2005, Nuclear Power: No Solution To Climate Change', <www.foe.org.au/campaigns/anti-nuclear>.
* Prof. Ian Lowe, Quarterly Essay, Issue 27, September 2007, Reaction Time: Climate Change and the Nuclear Option, <www.quarterlyessay.com>.
* Mycle Schneider (WISE Paris), April 2000, "Climate Change and Nuclear Power", published by World Wide Fund for Nature <www.panda.org/downloads/climate_ change/fullnuclearreprotwwf.pdf>.
* Pete Roche, April 2005, Is Nuclear Power a Solution to Climate Change <www.no2nuclearpower.org.uk/reports/index.php>.
* Brice Smith, 2006, Insurmountable Risks: The Dangers of Using Nuclear Power to Combat Global Climate Change <www.ieer.org/reports/insurmountablerisks>.
* Greenpeace, "Nuclear Energy: No Solution to Climate Change", <archive.greenpeace.org/comms/no.nukes/nenstcc.html>.
* Mark Diesendorf, June 16, 2006, "Nuclear power: not green, clean or cheap", Online Opinion <www.onlineopinion.com.au/view.asp?article=4581>.
* Charles D. Ferguson, Nuclear Energy: Balancing Benefits and Risks April 2007, US Council on Foreign Relations <www.cfr.org/publication/13104/nuclear_energy.html?breadcrumb=%2Fpublication%2Fby_type%2Fspecial_report>.
* Statement of Dr. Thomas Cochran, Natural Resources Defense Council, on the Environmental, Safety, and Economic Implications of Nuclear Power Before the Science and Technology Committee House of Representatives
Washington, April 23, 2008, <http://docs.nrdc.org/nuclear/files/nuc_08042301A.pdf>

3. NUCLEAR POWER AND NUCLEAR WEAPONS

"The push to bring back nuclear power as an antidote to global warming is a big problem. If you build more nuclear power plants we have toxic waste at least, bomb-making at worse."
-- Bill Clinton, former US president

Any country with a nuclear power program "ipso facto ends up with a nuclear weapons capability".
-- Paul Keating, former Australian Prime Minister

Uranium is the only energy source with a direct and repeatedly-demonstrated connection to the proliferation of Weapons of Mass Destruction.

Of the 60 countries which have built nuclear power or research reactors, over 20 are known to have used their 'peaceful' nuclear facilities for covert weapons research and/or production. Of the 10

countries to have built nuclear weapons, five acquired the necessary nuclear facilities and materials through their 'civil' nuclear programs (India, Pakistan, Israel, South Africa, North Korea)

There is also overlap between civil nuclear programs and WMD programs in the five 'declared' nuclear weapons states (US, Russia, UK, France, China). It is no coincidence that these five states account for almost 60% of global nuclear power output.

The greenhouse benefits of a global doubling of nuclear power would be small. The same cannot be said of the proliferation risks. Doubling nuclear output by the middle of the century would require the construction of 800-900 reactors to replace most of the existing cohort of reactors and to build as many again. These reactors would produce over one million tonnes of nuclear waste (in the form of spent fuel) containing enough plutonium to build over one million nuclear weapons.

Former US Vice President Al Gore has neatly summarised the problem: "For eight years in the White House, every weapons-proliferation problem we dealt with was connected to a civilian reactor program. And if we ever got to the point where we wanted to use nuclear reactors to back out a lot of coal ... then we'd have to put them in so many places we'd run that proliferation risk right off the reasonability scale."

The development of a nuclear power industry in Australia could encourage other south-east Asian nations to move closer to a weapons capability. There is a history of nuclear posturing in the region, e.g. between Australia and Indonesia in the 1960s.

The extensive overlap between civil and military nuclear programs is detailed in papers posted at <www.foe.org.au/anti-nuclear/issues/nfc/power-weapons>.

A paper on the WMD proliferation potential of so-called 'fourth generation' nuclear power - fast neutron reactors including 'integral fast reactors', thorium, fusion etc - is posted at: www.foe.org.au/anti-nuclear/issues/nfc/power-weapons/g4nw

The limitations of safeguards

Nuclear power plants have produced enough plutonium to build over 160,000 nuclear weapons. Safeguarding this material is the responsibility of the International Atomic Energy Agency. Yet the former Director General of the IAEA, Dr. Mohamed El Baradei, has noted that the IAEA's basic rights of inspection are "fairly limited", that the safeguards system suffers from "vulnerabilities" and it "clearly needs reinforcement", that efforts to improve the system have been "half-hearted", and that the safeguards system operates on a "shoestring budget ... comparable to that of a local police department ". (Statements posted at: <www.iaea.org/NewsCenter/Statements/index.html>.)

The IAEA has no mandate to prevent the use of 'civil' nuclear facilities and materials for weapons production, and no capacity to prevent weapons production. At best, the IAEA's safeguards system detects misuses/diversion and then the matter is handballed to the UN Security Council and to the realms of international diplomacy more generally. Numerous examples illustrate how difficult and protracted the resolution (or attempted resolution) of such issues can be, e.g. North Korea, Iran.

Meanwhile, there is no resolution in sight to some of the most fundamental problems with safeguards, e.g. countries invoking their right to pull out of the NPT and developing a weapons capability as North Korea has done.

The cornerstone of IAEA safeguards involves inspections of nuclear plants and materials stockpiles. These inspections are at best periodic and partial and at worst (e.g. Russia) non-existent.

The uranium industry and its promoters (e.g. ASNO's John Carlson) routinely claim that safeguards "ensure"' that Australian Obligated Nuclear Materials (AONM - primarily uranium and its derivatives such as plutonium) will not be used in nuclear weapons. Such assertions are false. Such is the level of deceit that ASNO even claimed that safeguards would "ensure" that AONM is not diverted in Russia, despite the fact that there has not been a single IAEA safeguards inspection in Russia since 2001 (a fact which ASNO conspicuously failed to tell the Joint Standing Committee on Treaties) and there is no requirement under the Howard/Putin uranium agreement for there to be a single IAEA safeguards inspection in future.

In addition to resource constraints, issues relating to national sovereignty and commercial confidentiality have also adversely impacted on safeguards. In a 2004 paper, Harvard University academic Matthew Bunn points to the constraints enshrined in the IAEA's basic safeguards template, "INFCIRC 153":

> *"INFCIRC 153 is replete with provisions designed to ensure that safeguards would not be too intrusive. They are to be implemented in a manner designed "to avoid hampering" technological development, "to avoid undue interference" in civilian nuclear energy, and "to reduce to a minimum the possible inconvenience and disturbance to the State". The IAEA is not to ask for more from the state than "the minimum amount of information and data consistent with carrying out its responsibilities", and specific upper bounds are placed on the number of person-days of inspection permitted at various types of nuclear facilities."*

More information on the limitations of safeguards:
* Medical Association for the Prevention of War and the Australian Conservation Foundation, 2006, An Illusion of Protection: The unavoidable limitations of Australia's safeguards on nuclear materials and the export of uranium to China. <www.mapw.org.au/Illusion%20of%20Protection%20index.html>
* Friends of the Earth <www.foe.org.au/anti-nuclear/issues/oz/u/safeguards>
* Medical Association for Prevention of War <www.mapw.org.au/nuclear-chain/safeguards>
* Who's Watching the Nuclear Watchdog? A Critique of the Australian Safeguards and Non-proliferation Office, Prof. Richard Broinowski et al., 2007, EnergyScience Coalition Briefing Paper #19, <www.energyscience.org.au/factsheets.html>.
* Professor Richard Broinowski, "Fact or Fission? The Truth About Australia's Nuclear Ambitions", Melbourne: Scribe, 2003.
* Non-Proliferation Policy Education Centre, Feb 2008, "Falling Behind: International Scrutiny of the Peaceful Atom", <www.npec-web.org>.
* Nuclear Power Joint Fact Finding Dialogue, June 2007, "Final Report, Nuclear Power Joint Fact-Finding", <www.keystone.org/spp/energy07_nuclear.html>

4. NUCLEAR POWER AND WATER SCARCITY

A number of problems associated with the nuclear industry are much-discussed – the contribution of "peaceful" nuclear programs to the proliferation of nuclear weapons, the nuclear waste legacy, and the risk of catastrophic accidents or attacks. Less well understood are the various impacts of the nuclear industry on water resources.

Water scarcity is already impacting on the power industry in Australia, largely because of our heavy reliance on water-guzzling coal-fired plants. Introducing nuclear power – *the most water-intensive of all electricity sources* – would exacerbate those problems.

Current problems and issues in Australia include:
* expensive long-distance water transportation to some power plants because of dwindling local water supplies;
* reduced electrical generating capacity and output at some coal and hydro plants;

* increased prices for water;
* higher and more volatile electricity prices;
* relaxation of laws and regulations concerning usage of river water and groundwater for some power plants;
* increased risks of blackouts; and
* intensified competition for scarce water resources between power plants, agriculture, residences, industries, environmental flows, etc.

The Commonwealth-State Ministerial Council on Energy met in early 2007 to discuss the impact of water shortages on electricity generation, and has requested regular updates from the National Electricity Market Management Company.

Current problems have led power utilities to explore alternatives such as the use of wastewater, groundwater or desalination. There is also an expectation that new plants are more likely to be built on the coast and use seawater. The use of dry (air) cooling systems may become more common but air-cooled plants are more expensive, less efficient and emit more greenhouse gases.

The Energy Supply Association of Australia notes that: “Australia is a water constrained continent and the issue of adequacy of water supplies for generator cooling purposes is already becoming problematic in some areas. There are restrictions on the volume of water that generators may draw and in some States this is beginning to present as a limitation on the amount of electricity that some baseload generators may be able to deliver in hot months”.

Water for a nuclear power plant can be sourced from a river, lake, dam, or the ocean. The water has two uses - it is converted to steam to drive a turbine, and cooling water converts the steam back to water.

Nuclear power plants consume large amounts of water – typically 13-24 billion litres per year, or 35-65 million litres per day. A December 2006 by the Commonwealth Department of Parliamentary Services states: "Per megawatt existing nuclear power stations use and consume more water than power stations using other fuel sources. Depending on the cooling technology utilised, the water requirements for a nuclear power station can vary between 20 to 83 per cent more than for other power stations."

Water outflows from nuclear plants expel relatively warm water which can have adverse local impacts in bays and gulfs, as can heavy metal and salt pollutants. The US Environmental Protection Agency states: "Nuclear power plants use large quantities of water for steam production and for cooling. When nuclear power plants remove water from a lake or river for steam production and cooling, fish and other aquatic life can be affected. Water pollutants, such as heavy metals and salts, build up in the water used in the nuclear power plant systems. These water pollutants, as well as the higher temperature of the water discharged from the power plant, can negatively affect water quality and aquatic life."

A US report, 'Licensed to Kill: How the Nuclear Power Industry Destroys Endangered Marine Wildlife and Ocean Habitat to Save Money', details the nuclear industry's destruction of delicate marine ecosystems and large numbers of animals, including endangered species. Most of the damage is done by water inflow pipes, while there are further adverse impacts from the expulsion of warm water. (See the report and video at: <www.nirs.org/reactorwatch/licensedtokill>.)

Reactors in numerous European countries have been periodically taken off-line or operated at reduced output because of water shortages driven by climate change, drought and heat waves. Nuclear utilities have also sought and secured exemptions from operating conditions in order to discharge overheated water.

The water consumption of renewable energy sources and energy efficiency and conservation measures is negligible compared to nuclear or coal. Tim Flannery notes that hastening the uptake of renewable energy sources such as wind, solar, and geothermal 'hot rocks' will help ease the water crisis as well as reducing greenhouse gas emissions.

More Information on nuclear power and water scarcity:
* Friends of the Earth paper <www.foe.org.au/campaigns/anti-nuclear/issues>
* National Generators Forum <www.ngf.com.au>
* National Electricity Market Management Company, April 2007, "Potential drought impact on electricity supplies", <www.nemmco.com.au>
* Greenpeace, 2007, "The Impact of Coal-Fired Electricity Generation and Australia's Freshwater Resources", <www.greenpeace.org/australia>
* Dr. Ian Rose, October 2006, Nuclear Power Station, <www.thepremier.qld.gov.au/library/office/NuclearPowerStation261006.doc>.

5. RADIOACTIVE WASTE

Suffice it here to note that there is still not a single permanent repository for high-level nuclear waste in the world. The most advanced project was Yucca Mountain in the USA - a $10 billion fiasco that was 23 years behind schedule when it was permanently cancelled by the Obama administration earlier this year.
More information: www.foe.org.au/anti-nuclear/issues/nfc/waste

In Australia, the thuggishness and racism of the Howard and Rudd governments has led to nothing - there is still no national repository for Australia's radioactive and nuclear waste.
More information: www.foe.org.au/anti-nuclear/issues/oz/nontdump

Synroc – the ceramic waste immobilisation technology developed in Australia – seems destined to be a permanently ‘promising’ technology, i.e., its practical use will be negligible or non-existent.

6. NUCLEAR ACCIDENTS

In addition to the potentially catastrophic effects of nuclear accidents, radioactive emissions are routinely generated across the nuclear fuel cycle. The United Nations Scientific Committee on the Effects of Atomic Radiation has estimated the collective effective dose to the world population over a 50-year period of operation of nuclear power reactors and associated nuclear facilities to be two million person-Sieverts. Applying the standard risk estimate to that level of radiation exposure gives an alarming total of 80,000 fatal cancers.

Applying the standard risk estimate to the IAEA’s estimate of human exposure to radiation from the Chernobyl disaster gives a figure of 24,000 fatal cancers. While the death toll is subject to uncertainty, the broader social impacts are all too clear, including those resulting from the permanent relocation of about 220,000 people from Belarus, the Russian Federation, and the Ukraine. As the OECD’s Nuclear Energy Agency notes, Chernobyl “had serious radiological, health and socio-economic consequences for the populations of Belarus, Ukraine and Russia, which still suffer from these consequences.”

Comparative studies (calculating deaths / GW) purporting to demonstrate the safety of nuclear power typically ignore the Chernobyl death toll (other than the immediate deaths) and also ignore estimated deaths from routine emissions.

Safety concerns are not limited to the ex-Soviet states. For example, the Japanese nuclear power industry has been in periodic turmoil since the August 2002 revelations of 29 cases of false reporting

on the inspections of cracks in numerous reactors. There have also been a number of serious accidents, including fatal accidents, at nuclear reactors and other nuclear facilities in Japan in the past decade.

Commercial pressures and inadequate regulation have clearly played some part in the flawed safety standards in Japan. Such pressures are by no means unique to Japan, and they will intensify if privatisation and liberalisation of electricity markets proceeds.

Calculations indicate that the probability of an accident involving damage to the reactor core is about one in 10,000 per reactor per year for current nuclear power reactors. In a world with 1,000 such reactors, accidents resulting in core damage would occur once per decade on average.

The hype about future reactor designs with supposedly 'passive' safety systems has attracted scepticism and cynicism even from within the nuclear industry, with one industry representative quipping that "the paper-moderated, ink-cooled reactor is the safest of all."

References for the above statements/reports in the paper at:
www.foe.org.au/anti-nuclear/issues/nfc/nuclear-climate

7. ECONOMICS OF NUCLEAR POWER

Ben McNeil from the University of New South Wales concluded an article in the Journal of Australian Political Economy (issue #59) as follows:

> *"The most recent available international costs calculations and the Switkowski commissioned EPRI review both suggest that the direct costs of nuclear energy are likely to be at least $90/MWh. Australia's lack of experience with the necessary economic, labour and regulatory environment could drive the costs yet higher. From a marginal cost perspective, the Switkowksi report's conclusion that nuclear energy is the 'least cost low-emission baseload technology option' is particularly dubious, given that costs of other baseload options like biomass, carbon capture and storage and geothermal technologies were not reviewed.*
>
> *"Moreover, an examination of the likely subsidies required to ensure nuclear energy viability in Australia's partially liberalised energy market suggests considerable political and economic risk in comparison to other more agile and less risky energy options.*
>
> *"When assessing energy supply options, external costs related to their use also need careful consideration in the decision making process. For nuclear energy and other forms of energy, these can be broadly separated into climate externalities (associated with climate change) and nonclimate externalities (any environmental effect not related to climate change). An effective and genuine environmentally sustainable energy policy must take both categories into account. Although nuclear energy has a substantial climate benefit via low-carbon electricity, it also imposes substantial environmental costs in relation to the legacy of nuclear waste, uranium mining, decommissioning, accident risk, water use and proliferation concerns which cannot be considered as environmentally sustainable.*
>
> *"Other technologies, such as renewable energy (wind, solar, biomass, geothermal), also provide low-carbon electricity but are not fraught with the significant negative non-climate externalities associated with nuclear energy. Renewable energy technologies (particularly wind and biomass) have also demonstrated direct economic viability. These other technologies, along with carbon capture and storage, could be used in conjunction with other baseload energy sources (particularly natural gas) to move Australian energy policy towards a sustainable future that genuinely addresses climate change, without the need to introduce the*

significant economic costs, strategic problems (of proliferation and terrorism) and environmental / health risks associated with nuclear energy."

See also the paper on the economics of nuclear power posted at: <www.energyscience.org.au>. A critique of the Switkowski report is posted on the same website.