GREENPEACE

BACKGROUND BRIEFING

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International experts additional comments on draft Nuclear Taskforce Report

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"Australia's best answer to climate change remains efficiency. Just getting Australia's energy per unit of GNP in line with Europe's would benefit Australian competitiveness while achieving substantial greenhouse gas emissions."

"The most effective, cleanest and most intelligent power plant is the one you do not have to build."

"… the nuclear industry is again trying to convince the public that a new generation of plants will really deliver on its promises. But after 50 years of failed promises, why should it be believed this time?"

"The nuclear power industry has had 50 years to prove itself and has failed. Now is the time to put full weight behind options that are unglamorous but which have huge potential such as energy efficiency and small-scale renewables."

"nuclear megawatts are symbolic for 20th Century technology, a dinosaur approach that has failed to learn how to walk without government crutches."

Introduction

An international panel of experts was convened by Greenpeace Australia ahead of the release of the Prime Ministers draft Nuclear Taskforce Report (Switkowski report) to be available to answer questions from the media and politicians between 15-17 November 2006. A compilation of these questions have been made available at http://www.greenpeace.org/australia/news-and-events/media/releases/international-experts-push-for

The panel has also made a series of comments on the Switkowski report. These preliminary comments were prepared during the day [UK, US and France) of the 21 November 2006.

This document provides some additional commentary according to the expertise of the panel members on aspects of the Switkowski report.

The panel members in any of these responses do not represent the views of Greenpeace but their own expertise. These responses have been provided within very short time-frames and do not cover all parts of the draft Switkowski report.

Panel Participants

- **Antony Froggatt,** international energy and nuclear policy consultant, United Kingdom (Panel Chair)
- **Peter Bradford,** former member, Nuclear Regulatory Commission, United States
- **David Milborrow,** renewable energy studies consultant, United Kingdom
- **Mycle Schneider,** international consultant on energy and nuclear policy, France
- **Stephen Thomas,** Professor of Energy Policy, Public Services International Research Unit, Business School, University of Greenwich, United Kingdom

Overview

The panel concludes it comments with two key points:

- The nuclear power industry has had 50 years to prove itself and has failed. Now is the time to put full weight behind options that are unglamorous but which have huge potential such as energy efficiency and small-scale renewables
- Australia's best answer to climate change remains efficiency. Just getting Australia's energy per unit of GNP in line with Europe's would benefit Australian competitiveness while achieving substantial greenhouse gas emissions.

In addition to previous commentary the panel considers two further aspects of the Switkowski report:

- that there is a consensus on nuclear waste disposal; and
- the merits of Australia considering nuclear fuel leasing and / or nuclear fuel supply options.

Nuclear – time is up

Civil nuclear power technology has a history now of half a century. This should have been more than long enough for it to become a fully commercial technology: an industry with predictable costs and performance, and one that does not need to rely on government support to survive. Government support continues to go far beyond the obvious needs of ensuring the availability of waste disposal facilities and providing an independent safety regulatory framework. For new nuclear orders to be feasible, governments will have to exempt nuclear power from competitive electricity markets ensuring there are guarantees, paid for by taxpayers and electricity consumers, that the output can be sold and guarantees that the price

will cover costs. In some cases, for example, the US Nuclear 2010 Programme, massive taxpayer subsidies are being offered to try to stimulate orders for a limited number of units (a maximum of 6 in this case).

From an economic point of view, the nuclear industry has always promised that the next generation of plants would be cheaper, more reliable, safer and their performance more predictable than their troublesome predecessors. These promises have seldom been fulfilled and it is hard to think of any nuclear plant that has been cheaper, more reliable or quicker to build than forecast: most have fallen short of forecast performance., The most modern plant project in the world, the Franco-German EPR Generation III reactor, has already revised twice the expected start-up date. After one year into the construction the expected delay currently stands at 18 months delay at least.

Now, the nuclear industry is again trying to convince the public that a new generation of plants will really deliver on its promises. But after 50 years of failed promises, why should it be believed this time? The history of increasing real cost and continuing design changes may be telling us that there are fundamental problems with nuclear technology that mean it will never mature and we are just 'throwing good money after bad'.

International agencies, such as the International Energy Agency and World Energy Council tell us that we need to pursue all options, renewables, energy efficiency, clean coal, nuclear, if we are to combat climate change. This is an intuitively plausible view, but the reality is that choices have to be made. We do not have the resources (human and political as well as financial) to pursue all options to the full especially when they are as hungry for resources as nuclear power. We can spend a dollar only once. Nuclear power has had its chance and failed and for many countries, just dealing with the existing legacy of disposing of waste and decommissioning retired plants will consume many resources. Now is the time to put full weight behind options that are unglamorous but which have huge potential such as energy efficiency and small-scale renewables.

Unless citizens on all levels, from the individual to national governments, from the city council to international institutions reorient their thinking from the primitive supply and resource oriented approach to an energy service approach, choices will be made according to short-term, corporate or state interest criteria, far from public scrutiny and collective benefit. The most effective, cleanest and most intelligent power plant is the one you do not have to build. Negawatts are smart, microwatts are the future, but nuclear megawatts are symbolic for 20th Century technology, a dinosaur approach that has failed to learn how to walk without government crutches.

The current debate on nuclear power in Australia is an unhealthy remake of the debates in the US and Europe from the 1970s. The only difference is that the nuclear proponents – often the same individuals that already ran for the nuclear lobby in the 1970s – abuse of climate change factor and simply pretend to ignore 35 years of failure and unpaid bills.

Energy efficiency and renewables solutions

The panel would like to stress the importance of energy efficiency. The Switkowski report, predicts *'Australia's demand for electricity will more than double before 2050'*. The wording suggests that the increase of power consumption is a fait accompli. This is strongly misleading. Australians consume 80% more energy per head than the European average and if electricity consumption was reduced, substantial savings in capacity needs could be realised. If Australian citizens consumed the same amount of electricity as the Europeans, it could save

half of the installed generation capacity, or 22,000 MW away, rather than building new plants. Furthermore, the European Union has set itself an objective to increase energy efficiency by 20% by 2020, to further reduce energy demand and increase its economic efficiency.

The panel agrees the potential of a 'mix' of measures is the best way forward. Renewables will have a vastly increased potential of application if the possibilities for passive energy design, energy conservation and efficiency have been exhausted first.

According to the Switkowski report *"greenhouse emissions reductions from nuclear power could reach 8 – 18 per cent of national emissions in 2050"*. These figures appear to be based on the construction of between 12,000 and 25,000 MW of nuclear capacity by 2050. It may be noted that the upper figure implies that a new 1200 MW reactor would need to be completed about every 18 months from 2020 (the 'most probable' date for the first reactor) onwards.

All the commercially available renewable energy sources, on the other hand, can be exploited immediately. Since renewables and nuclear both emit negligible greenhouse gas emissions, the corresponding targets for renewables can be derived simply by looking at the electricity-generating potential of 12 and 25 GW of nuclear capacity. Assuming a load factor of 90%, 12,000 MW of nuclear would generate about 95 TWh of electricity. Assuming a linear build-up of electricity from renewable sources, that requires just over 2 TWh of renewable generation per year between now and 2050.

Between 1995 and 2005 renewable generation in the European Union from wind, hydro and biomass increased by about 150 TWh. Wind accounted for about half of this total, hydro and biomass the remainder. Assuming the same split for Australia suggests an extra 1 TWh per year from wind and 1 TWh per year from hydro and biomass is required. Making conservative assumptions about load factors suggest this requires 400 MW per year of wind to be built, and about 200 MW of hydro and biomass (combined).

400 MW per year of wind energy is not an onerous target. Spain – which uses a similar amount of electricity as Australia - has been installing over 1000 MW per year for at least five years. Similarly, 200 MW of hydro and biomass is not challenging, either. A doubling of these targets to match the higher figure for nuclear would, similarly, appear to be quite feasible.

It is believed that the Australian electricity network could readily accommodate at least 8000 MW of wind energy[1]. As it would be nearly 20 years – based on the above reasoning – for this figure – which is not a ceiling – to be reached, it is highly likely that improved forecasting techniques would be available by this time should wind be required to make a bigger contribution.

Noting that Spain (see above) has installed over 1000 MW of wind every year since the turn-of-the-century, there seems no reason why Australia should not match this. In practice, the capacity would initially increase at a lower rate and then accelerate – in line with experience elsewhere. If this were matched by 500 MW of hydro and biomass (combined), the potential reduction in CO_2 emissions by 2016 would be about 52 million tonnes per annum.

[1] National Wind Power Study. An estimate of readily accepted wind energy in the National Electricity Market A report prepared on behalf of Unisearch Ltd. for the Australian Greenhouse Office, November 2003

In terms of 'delivery' the most successful support mechanism for renewables has undoubtedly been the 'feed in' tariff.[2] This is simply a tariff, set by government, that is paid to renewable generators, per kilowatt hour of electricity generation, for a fixed period. In the early days, these were heavily criticised for being over-generous, but the most recent versions are significantly more cost-reflective.

Current German feed-in tariffs are: Current German feed-in tariffs are given in the table below[3].

	Duration (yrs)	2006 €-Cents/kWh	Degression
Hydropower	30	6.65 – 9.67	0%
Biomass	20	8.15 – 21.16	1.5%
Geothermal energy	20	7.16 – 15.00	1.0% (as of 1 Jan. 2010)
Wind energy (onshore)	20	5.28 – 8.36	2.0%
Wind energy (offshore)	20	6.19 – 9.10	2.0% (as of 1 Jan. 2008)
Photovoltaics	20	40.6 – 56.8	5.0 – 6.5%

This show the range of financial support given to different technologies, for onshore wind power for example this is likely to mean that the higher figure is paid for at least 5 years, then the lower figure is paid, depending on the site windspeed. The 15-year weighted average is at least €-cents 6.6/kWh[4].

The concept is disliked by some economists and still suffers from its somewhat arbitrary nature and the fact that it is liable to be withdrawn. Germany has got round this problem, to a certain extent, by publishing the year-by-year starting tariff in advance (it declines, year by year).

Nine out of the original 15 EU States use 'feed in' tariffs[5], which perhaps testifies that the simplicity of the concept is attractive.

Britain pioneered the 'tender' approach, which was widely emulated elsewhere (Ireland and France, for example) – and then Britain abandoned the concept. Recent invitations for tenders in Canada and Denmark, for onshore and offshore wind respectively, have yielded attractive (i.e. low) electricity prices. Once a tender is accepted, the tenderer is guaranteed their payment for a fixed period. The concept is simple, but does not necessarily encourage long-term investor confidence unless the continuity of the tendering process is guaranteed.

[2] The 2000 German Renewable Energy Sources Act that pioneered generalised feed-in tariffs is available in an English version at http://www.solarserver.de/solarmagazin/eeg-e.html#text
[3] Personnel Communication to Mycle Schneider from German Energy Agency, 5th December 2006.
[4] Calculation based on date provided in http://http://www.bmu.de/english/renewable_energy/doc/6465.php
[5] Commission of the European Communities, 2005. The support of electricity from renewable energy sources. COM(2005) 627.

The American 'Production Tax Credit' is another variation, whereby a fixed addition (currently 1.9Usc/kWh) is paid for renewable generation. Unless its continuity is guaranteed, this also does not encourage long-term investor confidence.

Quotas and obligations are used in Sweden, the United Kingdom and some American states. Depending on the exact structure, generators or electricity retailers who fail to meet their obligation incur 'buyout' penalties, but are awarded certificates for renewable generation. These certificates are tradeable. Although the system has accelerated the rate of renewable energy deployment in the United Kingdom, it is proving expensive and complicated. One of the reasons for this is that the wholesale price of electricity (paid as well as the 'certificate' price) has increased substantially, which, in turn, has increased the total price paid for renewable electricity.

The Australian Mandatory Renewable Energy Target goes down the 'obligation' route and it is suggested that the additional cost to electricity consumers will be modest.[6]

Nuclear waste

The Switkowski report states: "there is a consensus that disposal in appropriately engineered deep (500-1200 metres) underground repositories is the answer" to disposal of the high level wastes generated by nuclear power plants.

It is clearly wrong to suggest that there is a consensus that deep geological disposal will be the only management route for high level radioactive waste. In fact the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management does not give any suggestion of a preferred route for waste management or disposal.

No country, after all, has developed such a repository, though many believe that such a repository is the most promising approach. However, the 'answer' will have to include many factors, including development of a suitable canister, resolving the issues of interim storage and transportation, dealing with the host community and a licensing process that credibly verifies that the chosen site and methodology has the desired characteristics.

The multi-decade US experience with Yucca Mountain shows how difficult the actual development of such a repository can be. The US government, which committed itself to accepting wastes in 1998, has yet to do so, and the most optimistic prediction for the opening of the repository is now put at 2017, which means that it has slipped a year for every year since Yucca Mountain was singled out by the US Congress in 1987.

Nuclear fuel leasing and fuel supply centres

The concept of nuclear fuel, leasing, nuclear fuel fabrication, particularly when linked to Australia becoming an international nuclear waste site has ongoing media attention in Australia. Yet the Switkowski Report is actually relatively silent on these issues while acknowledging some challenges in regard to domestic enrichment.

The Nuclear Fuel Leasing Group (NFLG) outlined its concept in its submission to the Switkowski Committee:

> ***The main elements of the nuclear fuel leasing concept*** *as conceived by the NFLG are a service that provides an alternative to nuclear power plant (NPP)*

[6] Reardon, J and Mallon, K, 2004. The cost of federal and state renewable energy targets. A Report for the Australian Wind Energy Association.

> *operators in which the Australian Nuclear Fuel Leasing company (ANFL) contracts for uranium from Australian mines only, buys conversion services, contracts for enrichment services with the technical specifications provided by the NPP fuel designers, contracts for fuel fabrication services to specifications provided by the NPP operator and contracts for all fresh fuel transportation services. After some 3 to 5 years generating electricity in the lessee's NPP reactor, the spent fuel is removed from the reactor and placed in the NPP cooling pond for between 9 to 20 months. ANFL will then contract for spent fuel transportation services and provide final reprocessing or storage and disposal facilities.*
> *The leased, Australian owned, spent fuel will be moved from the NPP reactor to the site of cooling spent fuel storage. ANFL will arrange for spent fuel to be stored for approximately 27 to 30 years in Australia and then be transferred to a co-located spent fuel geological disposal facility.* [7]

The NFLG concept is a based on a long list of speculations that empty the proposal of any credibility. It is not by coincidence that NFLG has been in existence for some 10 years without making *any* progress towards the implementation of its proposed scheme. There are only 5 countries – China, France, Japan, Russia, UK, US, all but one are nuclear weapon states – that master the entire fuel system from uranium mining to spent fuel reprocessing. No country in the world has an operating high-level radioactive waste disposal site. It took the main nuclear countries several decades to develop the system. The idea that Australia, which does not even have an embryonic nuclear power industry, could not only would catch up with the big players but actually be more competitive than they are seems totally unrealistic if not of scary arrogance.

There is a long history of attempts to set up international schemes to deal with nuclear materials and waste (e.g. International Plutonium Store, Pangea-Australia, Non-Proliferation Trust)[8]. None of these ever materialised. There are multiple reasons for this. Besides public opposition against the import of nuclear waste, non-proliferation concerns have been on top of the list.

The Australian Safeguards and Non-Proliferation Office (ASNO) has severely criticised the NFLG concept[9] and in particular from a non-proliferation angle:

> *The proposal for Australia to lease fuel fails to address the real proliferation danger. Actual cases (Iraq, DPRK, Libya, Iran) show the danger lies, not with diversion of declared materials from safeguarded facilities, but with clandestine nuclear facilities and undeclared materials.*

In fact the NFLG concept adds significant additional non-proliferation concerns. It would indeed vastly increase the volumes of strategic nuclear materials shipped over long distances all over the planet. In particular the suggestion to reprocess spent fuel would require the shipping of fresh plutonium fuels (MOX) around the globe. Such shipments, as they are practiced in Europe to some extent, contain in the order of 250 kg of unirradiated plutonium that can easily be chemically separated from the fuel and serve as bomb ingredient. The multiplication of such shipments would be a nightmare for any nuclear security official. ASNO concludes:

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[7] NFLG, *Submission to Uranium Mining and Processing and Nuclear Energy Review*, 18 August 2006
[8] For a good overview of various initiatives, see Jim Green, *Multilateral Nuclear Fuel Cycle Proposals*, Fact Sheet 13, November 2006, http://www.energyscience.org.au/factsheets.html
[9] ASNO, *Annual Report 2005-06*, 2006

There is a need for clarity in assessing the case for nuclear development in Australia. The proposition for Australia to export all uranium as leased fuel assemblies is unrealistic and confuses the broader nuclear debate.