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Nuclear power for Australia – an outline of the key issues

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1. INTRODUCTION

I will start with some facts to set the discussion of nuclear power into context.

1. Australia's greenhouse gas emissions are the highest per capita of any OECD country. 36% of our emissions come from the electricity sector. 92% of our electricity is generated with fossil fuels (77% coal, 15% gas) (figures from Energy in Australia 2011).

2. Australia's uranium exports enable other countries to generate electricity that in total exceeds Australia's electricity production by some 25%. Australia's uranium enables those countries to avoid CO_2 emissions equivalent to half Australia's total CO_2 emissions from all sources, or one and a half times the emissions from our electricity sector.

3. Australia's electricity demand is growing by 2.5% a year, requiring on average the construction of an extra 700 to 900 megawatts of capacity – one medium-sized power station – every year. This is without taking into account the need to replace old power stations.

4. The Government's target for renewable energy is 20% of electricity generation by 2020. Currently renewables contribute 7.4% of electricity, or excluding hydro, 2.7%. Even if the

ambitious 20% target can be met, this would still leave 80% of electricity to be provided by non-renewable sources – at the moment, this means coal and gas.

5. Some 70% of Australia's electricity demand is for base-load electricity. Only nuclear and hydro have proven capacity to supply low-carbon base-load electricity – and hydro appears to have limited further potential in Australia. We must be realistic about renewable energy. With the possible exception of geothermal, renewables are only intermittent sources and cannot provide reliable base-load power.

6. Nuclear has a major advantage over other energy sources – nuclear is not only a source of electricity, but can enable large-scale fuel substitution in the transport and manufacturing sectors. This is through the ability to provide high temperature heat for a range of processes such as hydrogen production, steelmaking, and coal gasification.

2. HISTORY

Nuclear power has been under discussion in Australia since the establishment of ANSTO's predecessor, the Australian Atomic Energy Commission, in 1952. The closest Australia came to a nuclear power station was the Jervis Bay project, which was abandoned in 1971 on cost grounds. This was a lost opportunity to demystify nuclear power for the Australian public.

In 2006 the Howard Government established the Uranium Mining, Processing and Nuclear Energy Review, better known as the Switkowski Review after its Chairman, Ziggy Switkowski. The Review found that nuclear was the least-cost low-emission technology for providing base-load power in Australia. Labor won the 2007 election and the Review was shelved. Currently both major parties say that nuclear power is "off-limits". While this is disappointing, at least it ensures neither side is making statements that will later be embarrassing to retract.

3. KEY NUCLEAR POWER ISSUES

The issues involved with introducing nuclear power in Australia were examined in depth by the Switkowski Review. Time does not permit detailed discussion here, suffice to say the Review's main findings remain valid today. I'll touch on some developments since the Review.

First, nuclear safety. Following the Fukushima accident the safety of nuclear power is being reviewed around the world. The technical aspects of Fukushima could take many months, if not years, to establish, but the following points can be made now:

- unlike Three Mile Island and Chernobyl, Fukushima was not due to human error but to natural catastrophe;
- it appears the reactors shut down as intended after the earthquake, but back-up power systems were overwhelmed by the subsequent tsunami;
- there has been no significant radiation exposure to any member of the public;
- the reactors were an old design, without the additional safety features of modern reactors;
- the lessons of Fukushima will be directly relevant for areas of earthquake and tsunami risk;
- the broader lessons may take some time to clarify – one consequence is likely to be greater international involvement in nuclear safety.

The safety of nuclear power should not be looked at in isolation but on a comparative basis. There is no perfect way to produce electricity, all energy sources have disadvantages and risks. In

considering nuclear power, all the risks, disadvantages and costs of using other sources need to be factored in. Better public education is needed on the relative risks of different energy sources.

In particular, much better public education is needed on radiation risks. We live in a sea of radiation, we are exposed to radiation from many sources – accidental radiation releases should be seen in perspective. The Chernobyl Forum, comprising the UN agencies addressing the environmental and health consequences of the Chernobyl accident, reported that the greatest public health effects were not from radiation but the impact on mental health due to the exaggerated fear of radiation.

Next, cost. Some of the critical comment after the Switkowski Report concerned the cost of nuclear power. The Report found that nuclear power is likely to be between 20% and 50% more costly to produce than power from a new coal-fired plant, if pollution is not priced. The critics overlooked that this estimate related to generation cost, which is around 40% of the consumer price. The increase to consumers would have been more like 8% to 20%.

Since then the price of electricity has increased sharply in any event – by 40% in the last three years. So the costs of nuclear power would be overshadowed by other increases. Nuclear power is not alone in requiring a higher electricity price to be viable. No power source is competitive with coal and gas without a carbon pricing mechanism or – as currently the case with renewable energy – substantial subsidies.

Switkowski's findings on relative costs of nuclear power and other energy sources have been supported by more recent studies. For example, the 2009 MIT study on the Future of Nuclear Power concluded that in the US nuclear would be competitive with coal with a carbon charge of $25 per ton of CO_2. A 2010 study by the Electric Power Research Institute shows that in Australia nuclear would be competitive with other energy sources, and significantly cheaper than some renewable energy technologies. The levelised cost of electricity from nuclear is in a range of $142 to $205 per megawatt/hour (estimates for 2015). This compares with estimates for:

- gas and coal with carbon capture and storage, which are in the range $99 to $199 and $124 to $212 per megawatt/hour respectively;
- wind in the range $114 to $225, and solar $224 to $741 per megawatt/hour.

Taking into account that wind and solar are intermittent power sources, their effective costs are substantially higher still.

Finally, spent fuel and nuclear waste. Nuclear waste is more a political than technical problem. Switkowski found there is scientific and technical consensus that high level waste can be safely disposed of in deep geological repositories. The report noted that several countries were proceeding with repositories. Since the Report, Finland has made substantial progress with construction of its repository, and Sweden has started the licensing process for its repository.

Switkowski also noted other international developments, including the possibility of multilateral arrangements for spent fuel management and recycle using Generation IV reactors. Since the Report, multilateral fuel cycle proposals are gaining increasing international attention. Australia would need to provide for interim storage of our spent fuel, and to plan for geological disposal, but we could benefit from future international arrangements for spent fuel recycling.

4. WHAT ARE THE SUGGESTED ALTERNATIVES TO NUCLEAR POWER?

Gas – both natural gas and gas produced from coal and shale seams – is the easiest alternative in terms of established technology. Gas produces less CO_2 than coal, especially brown coal, but CO_2 emissions from gas are still substantial – around 60% compared with black coal. Methane is a much more potent greenhouse gas than CO_2 – considering inevitable losses ("fugitive emissions"), gas is less benign than commonly thought. US studies suggest that gas from coal and shale seams may be no better in terms of overall greenhouse gas emissions than black coal.

Hydro Apart from lack of suitable sites in Australia, hydro is affected by the uncertainties of climate change. For example the Snowy Scheme, which represents 7% of Australia's installed generating capacity, now produces only 1.5% of our electricity.

Renewables Wind and solar, the main sources today, suffer from intermittency – they can only supply power for part of the time. The average capacity factor for wind in Australia – the ratio of actual output to installed capacity – is around 34%. For solar the average capacity factor is 20% – generating time can be extended with thermal storage, but at lower capacity and still subject to the vagaries of the weather (e.g. cloudy days). Wind and solar are even more expensive than the direct costs indicate, considering that back-up power is required to cover times power is not being produced.

Clean coal – the feasibility and real cost of large-scale carbon capture and storage will not be known for some time. One issue to be addressed is the long-term safety of carbon storage.

5. WHAT IS NEEDED FOR NUCLEAR POWER TO PROCEED?

The key point here is that constitutionally decisions on power stations are primarily for State and Territory governments to take. The Commonwealth's responsibility is to provide a national regulatory and economic framework, and to ensure international obligations are met. First and foremost a nuclear power project will require a willing State or Territory host.

Next, the project will require a proponent. Considering the substantial costs and the long lead and payback times, investors need political and regulatory certainty. Nuclear power will not proceed without bipartisan political support. Since the Coalition has no ideological objection to nuclear power, this means what is required is ALP support – Labor must be prepared to reconsider the issue, otherwise nuclear power will remain a non-starter.

6. NEXT STEPS?

The key requirement is an informed public discussion. This issue is too important to our national future to be decided on the basis of emotion or ideology. There needs to be a dispassionate look at the facts, including cost/benefit and risk analyses that realistically compare nuclear power with other low-carbon energy sources.

Governments have the responsibility of ensuring an objective process. An essential part of this will be to provide factual information to the public – including through making available the considerable expertise that exists in government authorities. The media also have an important responsibility to look beyond sensationalism and to assist public understanding in this complex area.

One of the first steps should be to refresh the Switkowski Report – to bring it up to date as necessary, convening a small taskforce for the purpose.

7. CONCLUSION

The governments of most major industrial economies have concluded that if the world is serious about mitigating greenhouse gas emissions, nuclear power, along with conservation and renewables, must be part of the energy mix. This applies just as much to Australia as to other countries. Considering the long lead times for establishing nuclear power – 10-15 years for a country starting out – we cannot afford to defer the issue indefinitely. If we continue to exclude nuclear power, the likelihood is we will remain the OECD's highest per capita greenhouse gas emitter.