

Comments on the tentative findings on Electricity Generation

In the following pages, I make comment on the tentative findings on electricity generation. My justification for these comments is from my experience, currently as nuclear specialist adviser to the UK government on new nuclear build, my previous experience as Head of Nuclear Development at the OECD Nuclear Energy Agency and my over 30 years of experience in the nuclear industry, in the UK, Australia, France and with the IAEA in Vienna. A short CV is appended to this response.

The Tentative Findings on electricity generation were:

- A. Taking account of future demand and anticipated costs of nuclear power under the existing electricity market structure, it would not be commercially viable to generate electricity from a nuclear power plant in South Australia in the foreseeable future.
- B. However, Australia's electricity system will require low carbon generation sources to meet future global emissions reduction targets, Nuclear power may be necessary, along with other low-carbon technologies. It would be wise to plan now to ensure that nuclear power would be available, should it be required.

My responses to these findings are given below.

1. Overall the findings are valid and the Commission should be commended for its attempt to assess the evidence and give a considered response.

Tentative Finding A

2. With regard to the first finding (A above), there are a number of elements of this finding and it is worthwhile to consider them. These comments take as read the finding on public acceptance, which is essential for nuclear to go forward. Without that, the debate cannot proceed. Likewise, I will not comment on the issue of future demand, which must logically be taken from the data provided by the NEM and others. My comments are on the economics of nuclear in current markets, as this has been my area of expertise for over 6 years with the OECD and now the UK government.
3. I make only a short comment on the findings on the anticipated costs of nuclear power. In drawing its conclusion, the Commission has relied heavily on assessments made by DGA Consulting, Ernst & Young, and Parsons Brinckerhoff (which typically range between \$A7400 and 8800/kW). These costs should be compared with those in the 2015 version of *Projected Costs of Electricity*¹, produced by the IEA and OECD NEA and which looked at 182 proposed power plants, of which 14 were nuclear from 10 countries. The latter gives overnight costs per kW of between US \$4-6000 (AUD 5-8000) and total investment costs between US \$5-7500 at 7% interest rate. It is noted that the Commission's numbers sit at the higher end of these ranges. In addition, it is noted that

¹ Projected Costs of Electricity, 2015 Edition, OECD/IEA, 2015

in China, the equivalent costs range from US \$2-3000 (AUD 3-4000) and only slightly higher in the new builds in Korea and Japan.

4. The Commission's assumption that nuclear costs will remain the same is at odds with the expectations of the major vendors, Westinghouse, Korea Hydro and Nuclear Power and Hitachi, as well as ignoring the costs to the system of operating intermittent renewables, in the absence of cost efficient storage. In further support of this statement, the introduction of Generation III nuclear plants, while to be welcomed for the enhancement of safety and operational efficiency, has created many first-of-a-kind costs, which would be expected to reduce over the next 10 years. This outcome would be consistent with the experiences in Japan, Korea and China, where designs were standardised and learning effects seen. As yet, we have not seen the first EPR or AP1000 in operation, so learning is currently limited. On the other hand, in Japan, where ABWRs have been built, the costs and the 4 year construction timeframes have been repeatable. The same outcomes are occurring for the construction of the Korean APR1400 in the UAE.
5. As the Commission noted, the most suitable course for South Australia would not be with large nuclear reactors, given the small grid size. Small Modular Reactors are a more suitable technology in many ways and, if the modularity construction process is confirmed, then the costs of these reactors should continue to decline. By the time Australia is in a position to consider nuclear deployment, there is expected to be considerable experience with these reactors. Hence **I recommend that the Commission conclude that Small Modular Reactors offer considerable promise of enhanced safety, greater flexibility (including load following), factory construction and easier financing, and should be a major focus for Australia over the next 10 years.** Should this promise be fulfilled and storage costs for intermittent renewables remain high, then they could offer a low-carbon, stable and long-term reliable source of electricity. Relevant organisations, such as ANSTO, should be encouraged to be part of the evolution of such development, so that Australia would be in a position to benefit.
6. Turning now to the second part of Finding A, it is agreed that the nature of the current liberalised electricity markets in Australia and the small size of the South Australian grid, make the construction of a large nuclear plant currently not the appropriate decision and also difficult to accommodate within the current grid architecture. It is widely accepted that the short horizons (up to 5 years) of liberalised markets, even with capacity payments, are not sufficient to make construction of nuclear power plants attractive to investors. Put another way, the structure of the market inevitably determines the technologies that will be successful or unsuccessful within them and this currently prevents nuclear competing. The same conclusion was arrived at recently by the International Energy Agency (2016)², who noted that "a new consistent market

² OECD/IEA, Repowering Markets, Electricity Market Series, 2016

framework” is needed, which includes carbon pricing and support for low-carbon investments, including nuclear.

7. As evidence of this difficulty, I note that, apart from one reactor each in France and Finland (the former financed by a State-backed utility, EDF and the latter from a particular financing structure (the Mankela Model)), no developed country is constructing a nuclear power plant under a liberalised electricity market structure. This is because such markets cannot give the price certainty necessary to allow the necessary returns on investment.
8. In the US, Westinghouse are constructing two nuclear power plants at Vogtle and Summer in a regulated market (with cost pass through to the consumer) and the UK has decided to, effectively, re-regulate the market through the use of a strike price and contracts for difference. Other new build reactors are being constructed in centrally planned economies (e.g. China, Russia, UAE), in regulated markets (e.g. Korea) or using financing schemes provided by the vendor (Russian builds in Turkey and also proposed for Bangladesh and Egypt).
9. Hence I fully support the findings that nuclear generation is not viable “under the existing electricity market structure”. Whether that structure is sufficient or appropriate to deliver the investment in infrastructure that is needed, not just to replace old power plants, but also for evolving the type of grid that is needed for the future, is questionable.

Tentative Finding B

10. However, it would be wrong to stop at the point of noting the deficiencies of the current market for large energy infrastructure. I fully support the Commission’s finding that the challenge of providing security of supply with low-carbon electricity remains and Australia needs to take that seriously as part of a global response. Given that renewable energies attract subsidies and grid priority (in many countries), the Commission should consider a recommendation that an appropriate electricity market structure, suitable for all low-carbon, high capital intensive technologies should be actively examined. Nuclear power, as a low carbon dispatchable technology, not suffering from intermittency, would be included under such a framework. There seems no reason to exclude nuclear if we are serious about climate change mitigation. This would be one part of a more detailed process to take forward the Commission’s second finding “It would be wise to plan now to ensure that nuclear power would be available, should it be required”. Otherwise such a general finding is not likely to lead to any concrete action.
11. The Commission could give a valuable lead on the issue of how nuclear might be made available in the future. To that end, it should indicate what no-regret steps can be taken over the next 5-10 years that would allow nuclear to be in a better position to be implemented in South Australia. These measures could include:

- a. Monitoring the economics and financing of nuclear as the new build process continues.
- b. Promoting involvement of Australian research organisations in Generation IV technologies, to ensure that we can be intelligent buyers.
- c. Setting up a group between government and relevant scientific organisations to interact with the small modular reactor developments, so that Australia would be in a position to adopt the technology in 5-10 years time, if the promises of such development are fulfilled.
- d. Investigating, with ARPANSA and ASNO, what steps would be needed to ensure a regulatory system could be in place, should nuclear be an appropriate choice for Australia.