

Summary of Recommendations.**Document Scope**

The final GenCost report should adhere strictly to the scope and role expressed in Section 1 of the report. In summary, the provision of capital and operating cost estimates for electricity generation. To that end all extraneous comment not supporting nor substantiating only generation plant capital and operating costs should be removed from the body of the document to avoid misinterpretation. It is the role of the Australian Energy Market Operator (AEMO) to assess the technical viability of development options for the National Electricity Market and present final system costs for those options.

Cost Presentation

The report should be reformatted to show current capital costs of all generation technologies currently under substantial development along with associated fixed and variable operating costs upfront in the body of the report for each option not in an appendix.

Future Costs

All plant capital cost reduction projections need careful review and full explanation defining the basis for some large cost reductions shown in the draft document. Reference to external out of date historical documents is not appropriate.

Nuclear Energy Review

The GenCost authors have an ethical if not legal obligation to review, all costs and comments on nuclear energy with the Australian Nuclear Science and Technology Organisation (ANSTO). That organisation is Australia's nuclear centre of excellence. It has a mandated role to advise the Australian Government on all nuclear and science technology matters. It is not the role of potentially conflicted and/or inexperienced GenCost authors and stakeholders to assess complex nuclear engineering detail.

Nuclear Energy Costing

The section on nuclear energy should provide capital and operating costs for all committed or currently under construction nuclear power plant types and not preclude any on the basis of potential application in Australia. It is the AEMO ISP mandate and the responsibility of each State to undertake review of possible applications utilising the GenCost information.

Recommendation Context

Document Scope

Section 1 of the GenCost document clearly defines the rationale and role for the production of the report. It states:

"GenCost is a collaboration between CSIRO and AEMO to deliver an annual process of updating the costs of electricity generation, energy storage and hydrogen production with a strong emphasis on stakeholder engagement. GenCost represents Australia's most comprehensive electricity generation cost projection report. It uses the best available information each cycle to provide an objective annual benchmark on cost projections and updates forecasts accordingly to guide decision making, given electricity costs change significantly each year. This is the sixth update following the inaugural report in 2018." and

"The purpose of GenCost is to provide key input data, primarily capital costs, to the electricity modelling community so that they can investigate complex questions about the electricity sector up to the year 2055."

The yearly CSIRO GenCost document is widely referenced particularly by politicians to support concepts or actions for the potential advancement of the Australian electricity sector. As a consequence the importance of the document cannot be underestimated and every effort must be made to ensure accuracy, leaving no chance of criticism by experienced persons in the electricity sector.

The GenCost report does not set out to be the final document providing a strategic plan for the development of the Australian electricity sector, as many seem to believe. It is, as defined above, a collation of information and data that can be utilised by AEMO to *"guide decision making"* for the development of the annual Integrated System Plan (ISP) as well as for others who may wish to provide informed comment to the Australian community using common costing data.

The misunderstandings of the context and role of the GenCost document through scope extension are played out day by day in the misinformation and misinterpretation circulating within the Australian community. The stated scope and intended use of the GenCost document must be much more clearly followed in development and articulated throughout the document where appropriate, and in any wider promotion or commentary, to counter this problem. It may be appropriate to engage an experienced technical report editor to ensure this outcome is achieved in line with the stated scope of the work.

The document is currently written from an investor point of view, using marginal investment analysis. It can be used as the foundation of work by others to analyse the cost of electricity for consumers as a result of repaying the combination of investment options required together with associated system operating costs for a viable electricity supply sector. It is the mandate of the AEMO ISP to develop whole of the system costs for a range of realistically achievable options with others

such as the authors of the Net Zero Australia 2023 Report currently providing more comprehensive analysis outcomes.

The final GenCost report should adhere strictly to the scope and role expressed in Section 1 of the report, the provision of generation cost projections. To that end all extraneous comment not supporting or substantiating generation plant capital and operating costs only, should be removed from the body of the document and, if felt necessary, collated as a separate appendix. Actioning this recommendation would go some way to lessening the widespread confusion previous versions of the GenCost report have generated through mission creep and stepping beyond the defined scope of work.

An initial review indicates that the majority of Section 3 should be removed. All comment in Section 5 on generation units Levelised Cost of Operation should be removed. This is beyond the scope of the document and can only be partly analysed after the AEMO ISP process defines plant utilisation levels for particular development options.

The document states that; *“LCOE data can only answer a narrow range of questions. It is provided for the purpose of giving stakeholders who may not have access to modelling resources an indication of the relative cost of different technologies on a common basis.”*

It is actually not possible to provide any *“common basis”* which might provide an indication of the relative costs of different technologies or answer any rational questions. Even LCOE comparison within dispatchable and non-dispatchable categories after system utilisation has been defined, has little use. Simply providing derived LCOE ranges combining these contexts is an equivocation providing no benefit whatsoever, and can only be defined as *“apple and lemon”* comparisons, prone to misunderstanding, and not appropriate for a document of this importance.

Nuclear Energy

On the assessment of the cost of nuclear energy the GenCost document notes that the authors have;

“been advised by stakeholders that small modular reactors are the appropriate size nuclear technology for Australia. Australia’s state electricity grids are relatively small compared to the rest of the world and planned maintenance or unplanned outages of large scale nuclear generation would create a large contingent event of a gigawatt or more that other plant would find challenging to address. In the present system, it would take two or more generation units to provide that role. As such, large-scale nuclear plants which are currently lower cost than nuclear SMR, may not be an option for Australia, unless rolled out as a fleet that supports each other - which represents a much larger investment proposition.

The second issue is that observations of low cost nuclear overseas may in some cases be referring to projects which were either originally funded by governments

or whose capital costs have already been recovered. Either of these circumstances could mean that those existing nuclear plants are charging lower than the electricity price that would be required to recover the costs of new commercial nuclear deployment. Such prices will not be available to countries that do not have existing nuclear generation such as Australia.

In summary, given overseas nuclear electricity costs may be referring to technology that is not appropriate for Australia, or assets that are not seeking to recover costs equivalent to a commercial new-build nuclear plant, there may be no meaningful comparison that can be made to Australia's circumstances which is the focus of GenCost."

The information needed to appropriately assess the costing information for nuclear generation units should be pursued with the same level of rigour, integrity, and honesty evident throughout the rest of the document. It is not appropriate to dismiss the preparation of a thorough costing analysis of any large or small existing nuclear energy generation units using the assumptions quoted above from the GenCost draft document. Resort to vague "may not" and "may be" terminology reflects very poor research integrity and is wholly inappropriate in a Australian government agency reference document of this importance.

It is not the defined role of the GenCost authors to question the engineering viability of an option which is so widely utilised around the world nor the level of investment that may be finally appropriate for Australia. That exercise is best left to final analysis by AEMO as noted above, hopefully using appropriately qualified engineers. CSIRO should only provide the range of basic costs of existing and potential installations as it has done in the rest of the GenCost draft report, leaving final system analysis for others. For example, the emerging failure of the international offshore wind industry provides no excuse to exclude costing information for that option so as to ensure that decision makers understand the implications of considering that option.

It is also not appropriate to fail to fully assess costs simply because some of the analysis work appears difficult or is beyond the existing capability of the organisation or else requires government to government liaison which is a common requirement in the nuclear sector. It seems that CSIRO does not have the resources to do this other than reference "stakeholders" who appear not to have relevant experience or may be conflicted. In other cases requiring support CSIRO has turned to external engineering consultants. For this section the organisation should turn to the Australian Nuclear Science and Technology Organisation for support. The charter of that organisation notes;

"ANSTO is Australia's nuclear centre of excellence. It has a mandated role to advise the Australian Government on all nuclear and science technology matters.

In the event it were needed, ANSTO has the foundational elements on which to build and sustain nuclear technologies in Australia.

Nuclear stewardship is the responsible planning, operation, application, management, and leadership of nuclear facilities and technologies to ensure that

the highest levels of safety, security, safeguards and sustainability are achieved to maximise utilisation, benefit, and assurance for the people of Australia.”

Other local organisations with expertise in the nuclear engineering field, such as the Australian National University and the Engineers Australia Nuclear Engineering Panel would also be able to provide appropriate nuclear power costing information. However it would appear that as an Australian government entity CSIRO does have an obligation to first consult with ANSTO and to accept the advice given for incorporation in the GenCost report.

ANSTO expert support, and acceptance of the advice provided, would ensure that the integrity of nuclear power costing information matches that provided across the rest of the GenCost document. Experienced support would also eliminate the need for vaguely qualified speculative comments on this subject, and turn most of the widespread negative comments, now evident, to a more positive appreciation of CSIRO work. CSIRO has already engaged other engineering consultants for a range of costing work for the GenCost report.

Any timing comments for potential nuclear installations suggested in the GenCost report are beyond the scope and intent of the report and should be removed. This is a matter for more thorough analysis through the AEMO ISP process for any assessment of this option. The highly pessimistic timing suggested in the report puts Australia in an ineffectual government bureaucracy league many years behind Bangladesh and the United Arab Emirates. Experience with the ANSTO Opal reactor indicates a maximum period from the initiation of a detailed feasibility study to full load operation of nuclear power plant at about 10 years maximum, similar to that achieved in far more difficult circumstances by the United Arab Emirates. ANSTO is the best placed organisation in Australia to contribute more realistic schedule information to the AEMO ISP exercise.

Nuclear Energy Costing

Using a single first of a kind small modular reactor example still under development as the cost basis defining the benchmark for a major international electricity generation sector is a unique concept. It is obviously not appropriate when so much information on so many other existing examples utilising already well proven technology is available from so many sources including ANSTO. The Snowy 2 project provides many management and risk warnings but is not the only analysis benchmark to frame all renewable energy considerations.

Costs of nuclear power units under construction or recently completed are widely available although some detailed work is required to translate this information into an Australian context. The civil engineering cost component can be up to double that found overseas, reflecting higher hourly costs for labour, and lower productivity. It is relatively straightforward to establish current capital cost estimates for Australian applications ranging from \$7500 per kilowatt for 2x 1000 MWe units to \$8000 per kilowatt for 4x 300MWe units, all using technology proven over the past 75 years and fully accepted by regulators. These cost estimates are

well above simple cost comparisons using only currency exchange rates, and are significantly below \$32,000 per kilowatt proposed in the draft GenCost report.

Preliminary engineering assessments have already indicated that a fleet of 1000 MWe nuclear power stations can progressively be installed in the Victorian and New South Wales electricity grids and with appropriate upgraded interconnection, most likely into southern Queensland and eastern South Australia.

If nuclear energy proves to be the best electricity source after AEMO ISP option studies and full feasibility study, larger units followed by smaller units can be progressively rolled out as a fleet. Given that new large scale plants providing baseload electricity currently have a track record of near zero unplanned outages, maintenance and refuelling outages can be easily managed.

A larger risk is more likely found in the existing transmission system which may require some additions. An appropriate feasibility study would quickly establish a minimum risk proposal for the step by step integration of large unit nuclear power plants and transmission augmentation for a progressive replacement of the existing electricity generation infrastructure. Preliminary engineering studies by Australian consultants indicate that the optimum low emission and minimum cost electricity supply for consumers is provided by around 70% nuclear 30% renewable energy. This finding is in line with analysis of similar grid systems overseas as well as general studies published by the International Energy Agency.

Conclusion

The final version of the GenCost report must reflect *“an evangelical pursuit of the truth”* to quote one senior government minister on a subject of similar economic scale and security importance for Australia.

The GenCost document must emphasise and follow what it states it is more directly and avoid mission creep into what it is not. In particular it must not overstep its defined role of providing costing information and err by delving into the realm of technical speculation and dubious derivations not relevant to the clearly defined scope of work.

Ongoing review of the Integrated System Plan development process indicates that a future separate GenCost document is probably not required. Given the level of engineering knowledge required all costing and analysis work should be directly managed and presented by the Australian Energy Market Operator after coordinating support as needed from other Australian government agencies and external consultants.

Submission Author

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