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Australian Energy Markets Operator
Forecasting and Planning
By email

***GenCost* 2023-24 Consultation draft**
SUBMISSION

This submission draws on over 30 years of experience on projects and assignments in the energy systems of some 30 countries around the world as a consultant to the electricity, energy and resources industries, banks, and governments; as an industry executive; as a university professor in engineering and teaching energy market economics and policy; and as a researcher. I make this submission in a personal professional capacity, not on behalf of any company, organisation, or institution.

Several problems and shortcomings with the *GenCost* process are reflected in the document itself. If those problems are not resolved, the underlying problems with the document will persist in future editions, as they have persisted now year after year, for the past five years or longer.

Therefore, rather than focusing on a long list of specific problems and details, as other submissions may, this submission focuses on three areas: **process**, **content** and scope, and **application**.

Process and institutional issues

The present annual series of reports known as *GenCost* is the successor to the *Australian Power Generation Technology Report* (APGT, 2015). That report is listed among the references in the GenCost 2023-24 Consultation Draft. Chaired by the then-CEO of the CO_2 Cooperative Research Centre (CRC), the report set a standard yet to be equalled by the *GenCost* series of reports.

The APGT report steering committee included CO2CRC, CSIRO, ARENA, the Department of Industry, Science and Resources (Office of the Chief Economist), and ANLEC R&D. The CSIRO and AEMO were members of the Reference Group for that report, among a total of 42 reference group members drawn from business, industry groups, government, academia and research, representing (more or less) all fuels and emission reduction technologies.

The online consultation process for the *GenCost* report allows for less depth and breadth than the process used in the APGT report, to the detriment of the rigour and quality of the result.

The predecessor APGT report drew upon inputs from 21 technical contributors, including very experienced power generation technology specialists from the US Electric Power Research Institute (EPRI). The four engineers from EPRI each had between 15 and over 25 years of experience at the time. At that time, CSIRO provided three of the technical contributors. None of the three are engineers. One is a physicist. One is an economist. One is trained in biology. Two of the three original CSIRO contributors to the earlier APGT report are now the lead authors on the *GenCost* report. Their work is supplemented by a consulting firm: 'The report encompasses updated current capital cost estimates commissioned by AEMO and delivered by Aurecon.'

The personnel and resources deployed for the production of the *GenCost* report (measured in terms of subject matter experience, industry experience, professional background and expertise) are a small fraction of those that were used in the predecessor work almost a decade earlier.

The roles of CSIRO and AEMO are briefly described on p.11 of the report as follows:

> AEMO and CSIRO jointly fund the GenCost project by combining their own resources. AEMO commissioned Aurecon to provide an update of current electricity generation and storage cost and performance characteristics (Aurecon, 2023a). This report focusses on capital costs, but the Aurecon report provides a wider variety of data such as operating and maintenance costs and energy efficiency. Some of these other data types are used in levelised cost of electricity calculations in Section 5.
>
> Project management, capital cost projections (presented in Section 4) and development of this report are primarily the responsibility of CSIRO.

From this description, the roles of the two organisations—AEMO and CSIRO—are somewhat ambiguous. Submissions on CSIRO's *GenCost* report are being received directly by AEMO, suggesting that AEMO is acting in the role of 'client' and CSIRO in a role not unlike a consultant/advisor, with Aurecon acting as subconsultant engaged by CSIRO. The respective accountability and responsibility of a taxpayer-funded statutory organisation (CSIRO) and a not-for-profit company whose remit is underpinned by statute (AEMO) is opaque under the current arrangements.

It is not clear whether the production and publication of the *GenCost* series of reports is even within the statutory remit of CSIRO. The *Science and Industry Research Act 1949*, No. 13, 1949 "An Act relating to the Commonwealth Scientific and Industrial Research Organisation" with the text of the law as amended and in force on 14 September 2022 (the *compilation date*)[1] states under '9 **Functions of the Organisation**' that (2) "The Organisation shall (a) treat the functions referred to in paragraphs (1)(a) and (b) as its primary functions; and (b) treat the other functions referred to in subsection (1) as its secondary functions." Those primary purposes are "(a) to carry out scientific research … [and] (b) to encourage or facilitate the application or utilization of the results of such research."

The research involved in *GenCost* is not scientific research. It is a form of economic and engineering research more like management consulting. The strongest case for *GenCost* being within the statutory remit of CSIRO is that it falls under the last two listed of CSIRO's secondary functions, namely:

> (h) to collect, interpret and disseminate information relating to scientific and technical matters; and
>
> (j) to publish scientific and technical reports, periodicals and papers.

The basis for CSIRO having statutory responsibility for this field of work is tenuous and weak at best.

Content, method and scope

The core content of the *GenCost* report is a set of estimates of capital and operating costs for various types of electricity generation plants. **The problem with the Levelised Cost of Energy** (LCOE) metric is acknowledged in the *GenCost* report in Section 5.1 "Purpose and limitations of LCOE." The report nonetheless continues to present LCOE numbers, and those numbers continue to be cited and used by third parties in ways that mislead the public and governments alike.

The 2020 edition of the IEA and OECD NEA report also acknowledges issues with LCOE, which it summarises as follows:

> Low-carbon electricity systems are characterised by increasingly complex interactions of different technologies with different functions in order to ensure reliable supply at all times. The 2020 edition of Projected Costs of Generating Electricity thus puts into context the plain metric for plant-level cost, the levelised cost of electricity (LCOE). System effects and system costs are identified with the help of the broader value-adjusted LCOE, or VALCOE metric. Extensive sensitivity analyses and five essays treating broader issues that are crucial in electricity markets round out the complementary information required to make informed decisions. A key insight is the importance of the role the electricity sector plays in decarbonising the wider energy sector through electrification and sector coupling.[2]

The nuances and depths of thought in the IEA-NEA 2020 report are not reflected in the *GenCost 2023-24 Consultation Draft*. This may be because the 2020 edition was not considered. The reference list for the GenCost 2023-24 Consultation Draft contains document that appear not to be the latest available versions. Failure to reference or consider the latest available information was also a problem in earlier *GenCost* editions. The reference cited is:

> International Energy Agency (IEA) 2015, *Projected costs of Generating Electricity*. Paris, France: OECD.

A more recent edition of that report, is the 2020 edition cited above, available online. The description provided by the publisher about the 2020 IEA and OECD NEA report includes this statement:

> This joint report by the International Energy Agency and the OECD Nuclear Energy Agency is the ninth in a series of studies on electricity generating costs. As countries work towards ensuring an electricity supply that is reliable, affordable and increasingly low carbon, it is crucial that policymakers, modellers and experts have at their disposal reliable information on the cost of generation. This report includes cost data on power generation from natural gas, coal, nuclear, and a broad range of renewable technologies. For the first time, information on the costs of storage technologies, the long-term operation of nuclear power plants and fuel cells is also included. The detailed plant-level cost data for 243 power plants in 24 countries, both OECD and non-OECD, is based on the contributions of participating governments and has been treated according to a common methodology in order to provide transparent and comparable results.

It would be helpful if the quality of data and analysis in the *GenCost* report was raised to the level of the IEA-NEA report. If that is not be possible with the resources available to AEMO and the CSIRO, or if it is acknowledged that this work is not actually within the statutory remit of the CSIRO, as questioned above, then that would be an issue for the government to resolve through the department.

A report on which I am the lead author is cited in the *GenCost 2023-24 Consultation Draft*.[3]

Unfortunately, the information cited is selectively and misleadingly represented in *GenCost* as a single point estimate. My original report makes clear in some depth and throughout the report, most notably in the chapters on project delivery, and on financing, that there are uncertainty ranges around cost estimates for projects to deploy power generation technologies. For any given project those estimates begin very wide, and are narrowed as the project development process approaches financial close. The uncertainty ranges are wider for less mature technologies, and narrower for more mature technologies. Those concepts are all central to the information that CSIRO purports to present in *GenCost*, yet none of that is clear in executive summary Figure 3 of the *GenCost 2023-24 Consultation Draft*.

The severe capital cost escalation, which closely coincides with the pandemic era, is labelled as a generic "Global inflation event" in the *GenCost 2023-24 Consultation Draft*. In the discipline of project cost estimation, it is important to distinguish between general consumer price inflation (CPI) or producer price inflation (PPI) or economy-wide nominal to real currency deflators on the one hand, and project input cost escalation on the other hand. These distinctions are not noted in the *GenCost 2023-24 Consultation Draft*.

There is some discussion of the drivers of changes in cost estimates for the UAMPS Carbon Free Power Project in the US (which as noted, was abandoned) on a slide headed "Class 3 [Project Cost Estimate] Increased – Why?

> The cost increase is primarily influenced by external impacts, not by the project's development
>
> There have been price increases due to inflationary pressures on the energy supply chain that have not
>
> been seen for more than 40 years. In the past two years:
>
> Producer Price Index for Fabricated Steel Plate increased 54%
>
> Producer Price Index for Carbon Steel Piping increased 106%
>
> Producer Price Index for Electrical Equipment increased 25%
>
> Producer Price Index for Fabricated Structural Steel increased 70%
>
> Producer Price Index for Copper Wire and Cable increased 32%
>
> Producer Price Index for All Commodities increased 45%
>
> In addition, the referenced interest rate used for the project's cost modeling has increased approximately 200 basis points since July 2020

The failure of the UAMPS project in the United States is mentioned in the *GenCost 2023-24 Consultation Draft*, but unfortunately in a very superficial and dismissive way without any real depth of insight, and without drawing out lessons of any kind that may be useful for Australia in the future.

A number of the factors noted above as driving are not specific to nuclear energy or any other power generation technology class, but are common to a range of generation technologies. This is a reminder that relative costs are what really matter, rather than nominal estimates (and highly uncertain forward projections) at a moment in time. Given that the numbers provided by *GenCost* is being used for very long horizon assessment and modelling, the work would stronger and more useful if more attention was given to providing insights into underlying fundamentals of relative costs.

Application

The report gives considerable attention to the question of the cost of integration of renewable energy. That is a system level issue. Attempting to deal with that issue in *GenCost* is fraught with problems and compromises. Presenting capital and operating cost numbers via the LCOE metric opens up the integration cost debate. The IEA-NEA report arguably handles the issue more elegantly than *GenCost*, and in their 2020 report includes thoughtful discussion on the decline in the value of electricity generated by intermittent sources as the share of that generation increases in various systems.

Given that CSIRO and AEMO are joined at the hip in the publication of *GenCost* and the Integrated System Plan (ISP), respectively, it would be better not to present LCOE numbers at all, and to leave the system level analysis to the ISP. Attempting to overcome the limitations of LCOE within *GenCost* only serve to increase the likelihood of public confusion and mislead decision-makers.

Estimating the future costs of capital-intensive electricity generation technologies is a question of project management and programme delivery as much (or arguably even more than) a question of technology-level costs. Programme-level issues are clearly now beginning adversely to affect large-scale wind and solar technology deployment system-wide in Australia and around the world.

Programme-level issues will likely be a critical factor for success or failure of other technologies (including but not limited to nuclear energy) in Australia and around the world. That much is clear from even the most cursory familiarity with the energy sector in the past decade.

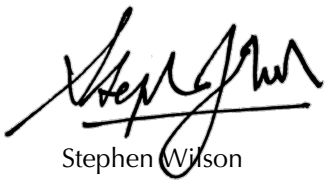
This key issue is mentioned very briefly in passing, *GenCost 2023-24 Consultation Draft:*

> 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.

Project delivery within a fleet-wide programme, and the full set of supply chain, system-level, and socio-economic implications, are so significant as to overwhelm completely narrow technical-level estimations and projections of plant-level unit costs. That applies with even greater importance when one is considering what amounts to the replacement of almost the entire existing generation fleet, particularly forced within a very short period of time.

I would be pleased to respond to any questions AEMO may have with respect to this submission.

Sincerely,



Stephen Wilson

References

[1] https://www.legislation.gov.au/C1949A00013/latest/downloads

[2] https://www.iea.org/reports/projected-costs-of-generating-electricity-2020

[3] Wilson, S. 2021, *What would be required for nuclear energy plants to be operating in Australia from the 2030s*, University of Queensland.