Australian Resources Development Pty Ltd

Submission regarding GenCost 2023-24 Consultation draft

9 February 2024

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Agenda

Recommendations

Based on the analysis described in this Submissions, the following recommendations are made to CSIRO regarding the development of GenCost24 Final:

- CSIRO needs to explain why it has restricted integration costs only to storage and transmission costs sponsored or approved by governments or regulators. This restriction is a significant change from the methodology adopted in GenCost23 Final and serves to exclude significant pre-2030 integration costs. Particular omissions are various government subsidies and peaking plants
- CSIRO needs to address the following very serious issues relating to the wind capacity factor (**CFs**) assumption:
  - The assumed increasing CF assumptions which lower the projected LCOEs of integrated wind.
  - The relationship between increases in the assumed CFs and the real unit cost of wind.
  - The use of much lower CFs for modelling than used to calculate LCOEs.

  CSIRO also needs to provide evidence of the technological advancements that are increasing the wind CFs.
- The GenCost methodology for setting the CFs for baseload plant assumes that these plants will be unable to operate at their technical capability due to the preferences and subsidies given to VRE generators. Under this methodology, the proposition that integrated VRE is the lowest cost, new generation technology is impossible to disprove – effectively unfalsifiable - so that the consequent GenCost results are of little value to policy makers and stakeholders.

  Thus, GenCost24 Final needs to apply the CFs for fossil-fuel and nuclear SMR baseload technologies based on the technical capabilities of new-build plant and leave it to policy makers and other stakeholders to determine the desired policy settings.
- CSIRO has been badly caught out breaching the GenCost data standards in its attempt to demonstrate that nuclear SMR technology is too expensive. In GenCost24 Final, CSIRO should seek experienced, nuclear, technical advice to develop realistic estimates for the cost of SMR technology using the standards it applies to other technologies.

Recommendations (cont.)

- In GenCost24 Final, CSIRO should include the following major costs omitted from GenCost24:
  - connection costs;
  - marginal loss factors; and
  - retail distribution costs.
- When Draft GenCost24's estimated LCOEs are corrected for several major errors and omissions, this Submission demonstrates that the estimated LCOEs of VRE technologies are significantly higher than the estimated LCOEs of black coal and gas CCGT in 2023 and 2030.

  This is not to say that the transition to a low carbon energy sector is not important and worthwhile. However, this conclusion highlights the importance of Australian policy makers and stakeholders being better and more reliably informed of the likely future costs of making the transition to a low carbon generation sector.

  Prior to the release of GenCost24 Final, CSIRO should commission an urgent, independent, in-depth review of the Draft GenCost24 methodology and findings.

Introduction

This submission (**Submission**) sets out a review of the "GenCost 2023-24 Consultation draft" (**Draft GenCost24**) that will be submitted to the "2024 Inputs Assumptions and Scenarios Consultation" governed by the Australian Energy Regulator's (**AER**) Forecasting Best Practice Guidelines.The Submission makes reference to the following documents:

- GenCost 2018 - Report released in December 2018 (**GenCost18**), GenCost 2019-20 - Final Report released in May 2020 (**GenCost20 Final**), GenCost 2020-21 - Final Report released in July 2021 (**GenCost21 Final**), GenCost 2021-22 - Final Report released in July 2022 (**GenCost22 Final**), Draft GenCost 2022-23 Consultation draft released in December 2022 (**Draft GenCost23**) and GenCost 2022-23 Final Report released in July 2023 (**GenCost23 Final**).
- Energy Policy Institute of Australia paper 3/2022 "Future Australian Electricity Generation Costs - A Review of CSIRO's GenCost 2021-22 Report" published in September 2022 (**EPIA Paper**).
- CSIRO paper "Response to Energy Policy Institute of Australia paper" published in November 2022 (**CSIRO Response**).
- This Company's submission on Draft GenCost23 "ARDL Submission on Consultation Draft GenCost 2022-23 - ISSUE 1 - 16 February 2023" (**Draft GenCost23 Submission**).
- A subsequent submission regarding GenCost 2022-23 on 23 August 2023 to AEMO at forecasting.planning@aemo.com.au website "230823 - Submission regarding GenCost 2022-23 Appendix D.2.3 - FINAL ISSUE 1.0. (**Appendix D.2.3 Submission**).
- AEMO Draft 2024 Integrated System Plan, 15 December 2023 (**Draft ISP24**).

The GenCost methodology uses levelised costs of electricity (**LCOEs**) to summarise the relative competitiveness of new-build generation technologies, including the cost of integrating variable renewable energy (**VRE)** sources such as wind and solar (excluding hydro, rooftop solar and associated resources). All references to wind generation technology in this Submission refer to onshore wind only.

As background, the next slide presents a summary of the Draft GenCost24 results. Based on these results, CSIRO claims that:

"The LCOE cost range for variable renewables with integration costs is the lowest of all new-build technologies in 2023 and 2030. The cost range overlaps slightly with the lower end of the cost range for coal and gas generation." (Page ix).

The GenCost 2023-24 final report is referred to as **GenCost24 Final**. Reference to years is to financial years and all monetary figures are expressed in 2023 dollars.

Draft GenCost24 Results

The Draft GenCost24 LCOE estimates published in Appendix Table B.10 (page 80) for the low assumptions in 2023 and 2030 are reproduced in the following Table for selected baseload and VRE technologies except that the integration costs for 60% and 90% VRE shares of total generation (**VRE Shares**) that Draft GenCost24 (page 60) applies to the standalone LCOEs of combined wind and large-scale solar PV (**LS Solar PV**) are applied individually to the standalone wind and LS Solar PV LCOEs.

Technology	**2023 - Low**	**2030 - Low**
Black coal	$110	$86
Gas CCGT	$138	$91
Standalone		
LS Solar PV	$47	$36
Wind	$66	$44
Integrated		
LS Solar PV - 60% VRE Share	$88	$61
Wind - 60% VRE Share	$107	$69
LS Solar PV - 90% VRE Share	$81	$70
Wind - 90% VRE Share	$100	$78

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Feedback misinterpreted

The first major issue raised in this Company's Draft GenCost23 Submission under the heading "**GenCost integration results of little relevance and poorly explained"** (slide 3) was as follows:

*"The GenCost methodology only applies to the cost of integrating additional VRE capacity in FY2030 ABOVE the 54% VRE generation share (**VRE Share**) projected in the business as usual (**BAU**) case in FY2030. That is, the methodology DOES NOT measure the cost of integrating additional VRE capacity above the current level of approximately 20% in FY2022 to approach 54% in FY2030."*

"Thus, the GenCost results are of little relevance to the major issue TODAY - what is the integration cost to maintain a reliable system while increasing the VRE Share from the current level to 54% by FY2030?"

Thus, the feedback was to include ALL the pre-2030 integration costs.

Draft GenCost24 states:

"Feedback from the 2022-23 GenCost report requested that integration costs be presented that account for storage and transmission projects that will be delivered before 2030 since they have been sponsored by government or approved by the relevant regulator on the basis that they will be needed to support variable renewables. To accommodate that request, we present variable renewable integration costs for 2023 which include committed and under construction pre-2030 storage and transmission projects." (Page viii).

Thus, GenCost24 misinterprets the feedback by restricting integration costs only to storage and transmission costs sponsored or approved by governments or regulators.

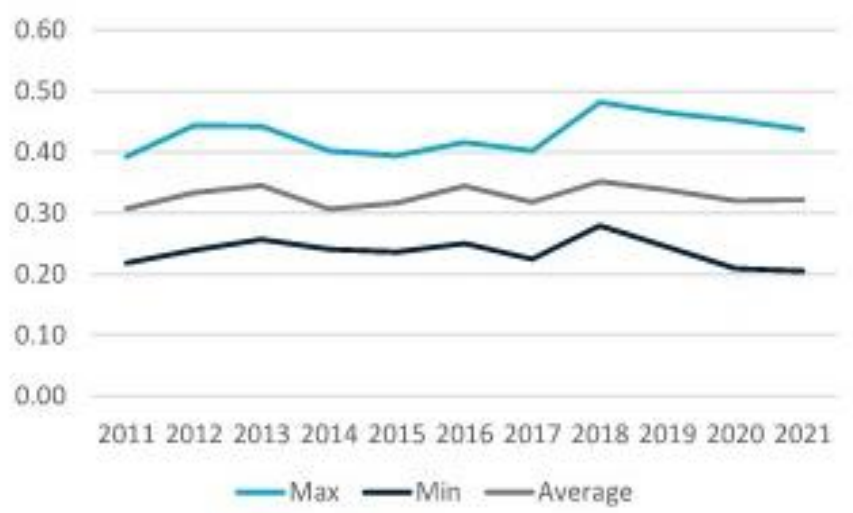
This restriction is a significant change from the methodology adopted in GenCost23 Final and serves to exclude significant pre-2030 integration costs. The impact of imposing this restriction is examined in slides 12 to 17.

Assumed VRE capacity factors significantly exceed current observations

There are several major issues with assumed wind capacity factors (**CFs**).

First, Draft GenCost23 Submission criticised the assumed CF range for wind in 2030 of 35% - 46%[1] as not related to market reality given even the minimum assumptions exceed the CFs currently being achieved. Thus, it was difficult to accept that such assumptions are "plausible". The assumed CF range for wind in 2022 was 35% - 44%.

The GenCost23 Final response to the criticism was to change the 2022 and 2030 ranges to 29% - 48% - a 9% increase in the high range, thus moving further away from market reality. CSIRO justified its changes to the wind CFs as follows: "*The capacity factor range assigned to new build technologies are designed to be higher than the historical range. This is based on the view that new build technologies* ***may*** *include some technical advancements on their historical predecessors which mean they do not enter at the low range. Consequently, their low range capacity factor assumption is closer to the average capacity factor rather than the worst case. Specifically, we assume the low range value is 5% below the average. The high range assumption is that it equals the historical high range.*" (Page 51, emphasis added).



The preceding chart is reproduced from GenCost23 Final, Apx Figure D.1, Historical maximum, minimum and average capacity factors for existing NEM wind generation (page 80).

1: The 2030 wind CF range had been 35% - 46% for GenCost18 and 46% for GenCost20 Final and GenCost21 Final.

Assumed VRE capacity factors significantly exceed current observations (cont.)

From the preceding chart, GenCost23 acknowledged that the *"… capacity factor for wind has been relative (sic) steady …"* (Page 80).

Thus, CSIRO's historical wind data shows that no such "technical advancements" have occurred.

Secondly, the low range CF assumption is set at 5% below the historical average of $33/MWh while the high range assumption is set at the historical high range.

- The historical high range CF for wind is 48% which occurred in 2018 and has declined ever since.

If the approach of linking the CF range to the historical average is to be applied, it should be applied even-handedly which would result in the the high range CF assumption being set at 5% above the historical average, yielding a 38% high range wind CF.

Thirdly, the increases in the high range CF assumption has a material impact on the projected LCOE for integrated wind. For example, the impact of these assumptions on the projected 2023 cost of integrated wind for the high range assumption is as follows:

High Range CF Assumption	**33%**	**38%**	**44%**	**48%**
	Average	**Average +5%**	**2018-22**	**Draft GenCost24**
Standalone	$96	$83	$69	$66
60% VRE Share	$137	$124	$110	$107
90% VRE Share	$130	$117	$103	$100

The results show that the assumed increases in the high range CF have served to lower the projected wind LCOEs materially.

As an important point of reference, the projected 2023 LCOE for black coal is $110/MWh.

Assumed VRE capacity factors significantly exceed current observations (cont.)

Fourth, the following Table shows that increases in the assumed wind CF have coincided with increases in the projected, assumed CFs and the assumed, low range, real unit wind capital cost.

GenCost Report	Year	Low Capex 2023$/kW	High CF	Year	Low Capex 2023$/kW	High CF
GenCost22 Final	2021	$2,115	44%	2030	$1,763	46%
GenCost23 Draft	2022	$2,689	44%	2030	$1,788	46%
GenCost23 Final	2022	$2,689	48%	2030	$1,947	48%
GenCost24 Draft	2023	$3,038	48%	2030	$1,944	48%

Finally, Draft GenCost24 notes that the assumed wind CFs are not used in modelling the VRE integration costs. Rather, AEMO data is used. (Page 57). Consequently, the installed VRE capacity is modelled to produce significantly less electricity than reflected in the LCOE calculations. Thus, there is an obvious reason for CSIRO to use the AEMO data in both its modelling and LCOE calculations. It is noted that the 2023 CFs for the National Electricity Market (**NEM**) were 36% for wind.

In GenCost24 Final, CSIRO needs to address the following very serious issues:

- The provision of evidence of the technological advancements that lower wind CFs.
- An explanation of the lack of balance between the setting of the low and high range CF assumptions.
- An explanation of the relationship observed between the assumed increasing CF assumptions and assumed decreasing real, unit wind capital costs.
- The use of much lower CFs for modelling than used to calculate LCOEs.

Capital Costs underlying the 2023 Integration Projects

Draft GenCost24 notes that: *"The integration costs fall with increasing variable renewable share in the 2023 results. This is because the cost of the committed storage and transmission infrastructure can be spread over more of the additional renewable generation the greater the required variable renewable share."* (Page 59). *"Integration costs to support renewables are estimated at $34/MWh to $41/MWh in 2023".* (Page 60).

These statements are interpreted to mean that the $41/MWh relates to a 60% VRE Share in 2023 and the $34/MWh relates to a 90% VRE Share. This is borne out by a visual inspection of Figure 5-3.

Draft GenCost 24 analysis of the 2023 costs assumes that the following projects (**DG24 2023 Projects**) are completed and so, their costs are included in the 2023 integration costs (Page 58):

1. **Snowy 2.0** and battery of the nation (**BON**) pumped hydro projects sourced either directly from the projects or AEMO.
2. The various transmission expansion projects (**TREX Projects**) already flagged by the AEMO June 2022 ISP process to be necessary before 2030.
3. The NSW target for an additional 2GW of at least 8 hours duration storage **(NSW2GW**).

All the DG24 2023 Projects are in the NEM and so, only support the integration of VRE in the NEM.

In 2023 the NEM VRE Share was approximately 20% (excluding Rooftop PV and associated resources). The additional VRE generation to take the VRE Share to 60% in 2023 multiplied by the $41/MWh integration cost to support renewables yields an annual cost that supports a capital value of approximately $39 billion.

This $39 billion capital sum funds the estimated capital cost of the DG24 2023 Projects.

The Inclusion of 2023 Costs

There has been widespread criticism that previous GenCost Reports omitted (i.e., "sunk") pre-2030 cost of the capital equipment required to deliver the business-as-usual (**BAU**) case on the argument that it is *"… already installed and paid for by 2030."* (CSIRO Response, page 12).

- The misinterpretation of this Company's Draft GenCost23 Submission is discussed in slide 7.

In response to the criticism, Draft GenCost24 included 2023 variable renewables LCOEs for the VRE technologies with integration costs by estimating the *"… total unit cost an investor must recover to deliver a project that provides reliable electricity supply in 2023 from a combination of variable renewable generation, transmission, storage and other resources, including the cost of currently committed or under construction projects …"* (Page 56).

- Draft GenCost24 defines the 2023 year as follows: *"The year 2023 … is aligned to the middle of that calendar year or the beginning of the 2023-24 financial year."* (Page 69).

As noted, to achieve this, the 2023 analysis assumes that the DG24 2023 Projects are all completed in 2023 and so, their costs are included in the 2023 integration costs.

There are several major errors and omissions with this revised methodology.

2023 Costs significantly understated

As noted on slide 11, the estimated cost of the DG24 2023 Projects is $39 billion.

The capital cost estimates for the DG24 2023 Projects are:

Project	**$ billion**	**Source of estimate**
Snowy 2.0 (incl transmission)	12.0	Snowy Hydro media release, December 2023
Tasmanian BON	3.6	Federal Government media release, December 2023
TREX Projects	25.0	Various sources
NSW additional 2GW storage (8 hours storage)	8.3	Draft Gencost24, Table B8, 8hr battery 2023
Total	**48.9**	

These estimates indicate that Draft GenCost24 underestimates the cost of the DG24 2023 Projects by approximately $10 billion or 25%.

Omission of BAU Costs identified in GenCost23 Final

The major cost elements in the GenCost23 Final BAU case (**23BAU Costs**) are described in GenCost23 (pages 51 to 52) as follows:

1. Existing "state renewable targets".
2. Snowy 2.0 and battery of the nation pumped hydro projects are assumed to be constructed before 2030.
3. Various transmission expansion projects already flagged by the ISP process to be necessary before 2030.
4. NSW gas-peaking plants at Kurri Kurri and Illawarra are assumed to have been constructed.
5. The NSW target for an additional 2GW of at least 8 hours duration storage is assumed to be met by 2030.

Draft GenCost24 omits the first and fourth cost elements.

The first cost element covers Federal and State Government-funded schemes. These government subsidies (**BAU Subsidies**) either reduce the cost structure or increase the revenues of VRE projects. They are a direct transfer to VRE project developers from electricity consumers and taxpayers.

- The positive impact of these schemes on the cost structure of VRE projects is confirmed by Draft GenCost24: *"Rooftop solar PV costs are before subsidies from the Small-scale Renewable Energy Scheme."* (Page 14).

The fourth cost element covers two, large NSW peaking plants that were clearly included in GenCost23 because they were needed to project a stable system in 2030. This omission of these plants (**Omitted NSW Peaking Plants**) is justified as follows:

"Two gas-fired power plants were also due to be added to capacity this summer in NSW and are therefore treated as existing capacity in both 2023 and 2030 LCOE calculations given that is their likely status for the final version of this report which will be released in mid-2024. As projects become operational, they are transformed from committed into existing capacity." (Page 58).

Omission of BAU Costs identified in GenCost23 Final (cont.)

The Draft GenCost24 methodology states:

"To calculate the integration cost of variable renewables we therefore start by allowing them free access to any ***existing*** *flexible capacity (that has not retired)."* (Page 55, emphasis added).

Further, *"… in the same way that anything built pre-2023 is free existing capacity for 2023 investors".* (Page 59).

It is noted that the 2023 year began in July 2023 under the Draft GenCost24 definition. Thus, CSIRO treats the Omitted NSW Peaking Plants that were demonstrably NOT built pre-2023 as built in 2023. Moreover, pursuant to CSIRO's methodology set out above, even if reality is suspended and it is assumed that these plants were built in 2023, it is only **pre-2023** capacity that is free in 2023.

This is an obvious breach of CSIRO's methodology.

Consequently, the cost of the Omitted NSW Peaking Plants needs to be included in the 2023 integration costs as they are required to support the rapidly rising VRE generation share from 60% to 90% in 2023.

It is worth noting that, under the methodology of GenCost23 Final, the five costs elements could have no effect on the 2030 integration costs since all pre-2030 costs were sunk. Presumably, this is why the 2030 integration costs only included REZ Transmission, Other Transmission, Synchronous condensers and Storage. (see Table 5-2, page 53).

However, to give effect of CSIRO's recognition of the need to include the 2023 integration costs, it clearly needs to include all the 2023BAU Costs in GenCost24 Final.

2023 cost of the Omitted BAU Subsidies

The following major government programmes subsidised large-scale VRE projects:

- Cost of the funds awarded to VRE projects under the existing government renewable targets (**Government Targets**).
- Large-scale Renewable Energy Target (**LRET**).
- Cost of the funds awarded to VRE projects by the Australian Renewable Energy Agency (**ARENA**).
- Cost incurred by the Clean Energy Regulator (**CER**) to administer the Renewable Energy Target.
- Managing electricity system security due to the growing VRE penetration.

The estimated BAU Subsidies in 2023 are as follows:

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Subsidy	**$ billions**
Government Targets	1.6
LRET	1.8
ARENA	0.2
CER	0.3
System security	0.4
Total	**4.3**

The amended results presented later correct for the exclusion of the BAU Subsidies in 2023.

2023 cost of the Omitted NSW Peaking Plants

The capital cost estimates for the two omitted NSW peaking plants:

Project	$ billions	Source of estimate
Kurri Kurri plant	0.95	Snowy Hydro 2024-2028 Corporate Plan, September 2023.
Illawarra plant	0.40	Draft 2024 ISP Inputs and Assumptions workbook, Step Change, New Entrant Data Summary, NSW Large OCGT, 2022-23 NSW Medium cost.
Total	**1.35**	

2030 cost of the Omitted Subsidies

Draft GenCost24 states: "*In 2030, we project forward including all existing state renewable energy targets …*" (Page 57). However, as with the 2023 costs, the 2030 costs omit the costs (**2030 Subsidies**) of the major government programmes that subsidise large-scale VRE projects.

In addition to the existing programmes relevant to 2023 set out on slide 16, there is the additional cost of the expansion to Capacity Investment Scheme (**CIS**) announced by of the Federal Government in November 2023 to target 23GW of renewable capacity ($52 billion) and an additional 7.9GW ($13 billion). There has been much speculation about the subsidy component of the CIS ranging from zero to 100%. This Submission applies a 50% subsidy to the annual amortisation of the cost of the CIS.

The cost of the LRET has also been increased to reflect a higher certificate price in 2030.

The estimated BAU Subsidies in 2030 are as follows:

Subsidy	**$ billions**
Government Targets	1.6
LRET	2.5
CIS	2.6
ARENA	0.4
CER	0.3
System security	0.4
Total	7.8

The amended results presented later correct for the exclusion of the 2030 Subsidies.

Amended 2023 and 2030 Integration Costs

This submission has identified three major errors and omissions from the 2023 integration costs provided in Draft GenCost24 as follows:

1. understatement of the capital cost of the DG24 2023 Projects by approximately $6 billion;
2. omission of the BAU Subsidies estimated at approximately $4.5 billion in 2023; and
3. omission of the two NSW gas peaking plants with an approximate capital cost of $1.2 billion.

The Submission has also identified the omission of the 2030 Subsidies.

When the 2023 and 2030 integration costs provided in Draft GenCost24 are admended for these factors, the following estimates result:

Integration Costs - $/MWh	**2023**		**2030**	
VRE Share	**60%**	**90%**	**60%**	**90%**
Draft GenCost24	$41	$34	$25	$34
Understated and omitted 23BAU Costs	$12	$7	$0	$0
Omitted BAU Subsidies	$35	$23	$51	$34
Total	**$88**	**$64**	**$76**	**$68**

These adjusted integration costs are used later in the presentation to re-calculate the Draft GenCost24 LCOEs.

Assumed baseload capacity factors significantly less than technical capability

Draft GenCost24 assumes a 53% - 89% CF range for fossil-fuel and nuclear SMR[1] baseload plants based on the CFs achieved recently by coal plants in the NEM that are significantly lower than the technical capabilities of new-build plant. This has the effect of significantly increasing the estimated LCOEs above those achievable when operating those plants at their technical capabilities.

The CSIRO Response justified the use of recent market history as follows: *"The capacity factor GenCost assigns to baseload plant are generous considering the realised capacity factors are low and getting lower. There would be no benefit to the reader in assigning a "technically achievable capacity factor". There is very little prospect that any plant will be able to operate at high capacity factors due to the existing and likely increasing share of low cost variable renewable generation."* (Pages 3-4).

However, the main reason for the recent CFs being lower than the plants' technical capabilities is the constrained dispatch of those plants due to the preference in dispatch given to VRE supported by significant subsidies.

Thus, according to CSIRO's use of recent market history, as subsidised solar and wind generation increases, the CFs of baseload technologies reduce which makes them relatively more expensive, thus justifying the even greater use of solar and wind, putting aside the cost of the additional support for this capacity.

For example, Draft GenCost24 estimates the 2023 LCOE of a black coal unit at $110/MWh at an 89% CF. If the CF is forced down to 53%, the LCOE increases to $185/MWh.

On this basis, one could understand CSIRO's comment above.

The GenCost methodology for setting the CFs for baseload plant assumes that these plants will be unable to operate at their technical capability due to the preferences and subsidies given to VRE generators. Under this methodology, the proposition that integrated VRE is the lowest cost, new generation technology is impossible to disprove – effectively unfalsifiable - so that the consequent GenCost results are of little value to policy makers and stakeholders.

This is a flawed method of developing the LCOEs for baseload plant.

Thus, the CSIRO's GenCost24 Final needs to apply the CFs for fossil-fuel and nuclear SMR baseload technologies based on the technical capabilities of new-build plant and leave it to policy makers and other stakeholders to determine the desired policy settings.

1:Small modular nuclear reactor.

Assumed capital costs of small nuclear modular reactors (SMRs)

Draft GenCost24 lists the cost of the nuclear SMR technology in 2023 at $31,138/kW in all cases and in 2030 as $7,938/kW (low case) and $7,952/kW (high case).

In previous GenCost Reports, the high case assumption was based on the 2018 GHD nuclear cost review for CSIRO which simply doubled the cost of a large reactor to $16,000/kW and only applied to 2030.

Unfortunately, Draft GenCost24 has based its 2023 estimate on the failed UAMPS projects.

CSIRO has been widely and justifiability criticised for using an obviously failed project as the basis for a serious assessment of Australian-based SMR projects. This Submission feels no need to add to this criticism.

However, what this Submission does highlight is the double standard exhibited by the SMR assessment in Draft GenCost24 in abandoning its methodology of using expert advice from Aurecon on this one, particular generation technology.

The CSIRO Response heavily criticised this Company's EPIA Paper for using vendor information. Significant examples are:

- *"The author also does not consider differences in data quality between estimates provided by a technology vendor and other sources".* (Page 3). CSIRO did not consider such differences in relation to the failed UAMPS project.
- *"The author also does not consider differences in data quality between estimates provided by a technology vendor and other sources. Nor do they consider that there is any other transformation required other than an exchange rate in converting overseas cost estimates to an Australian build cost."* (Page 4). CSIRO simply converted the UAMPS estimate to Australian dollars.
- *"The lack of hard data and technical rigour in this approach (use of vendor information) underlines the reason the GenCost project was first commenced."* (Page 10). CSIRO's development of the nuclear SMR capital costs failed these standards.

Thus, CSIRO has been badly caught out breaching the GenCost data standards in its attempt to demonstrate that nuclear SMR technology is too expensive.

CSIRO should seek experienced, nuclear, technical advice to develop current, realistic cost assumptions for SMRs in GenCost24 Final.

Failure to take account of other issues

Failure to take account of connection costs and marginal loss factors

Draft GenCost24 fails to take account of the assumed connection costs and MLFs for the various technologies.

Baseload technologies can be located near large load centres and associated fuel supply and transmission infrastructure which leads to relatively low connection costs and MLFs.

In contrast, VRE technologies are generally located in areas remote to the grid and load centres which leads to relatively high connection costs and MLFs.

GenCost23 Final acknowledges this negative impact on LS Solar PV as follows: *"… there is a notable decline in the capacity factor for LS Solar PV. This could represent several factors including curtailment due to transmission congestion …"* (Page 80).

The inclusion of connection costs and MLFs increases the unit costs and lowers the effective CFs of VRE generation technologies relative to baseload technologies.

Failure to take account of retail distribution costs

Draft GenCost24 states:

"Virtual Power Plants (VPPS) and electric vehicles are negligible in 2023. However, in 2030, a portion of customer-owned battery resources are assumed to be available to support the wholesale generation sector consistent with the approach taken in the AEMO ISP." (Page 57).

These technologies require significant upgrades to the distribution network to be effective in supporting the increasing VRE Share.

The regulated asset base of the Australian low-voltage distribution network is over three time the RAB of the high-voltage transmission network. Thus, there will be a significant cost to be borne by retail customers through their regulated access charges to fund upgrades.

CSIRO needs to take account of these three significant cost factors in GenCost24 Final.

Amended estimated LCOEs

In addition to the amendments to the integration cost estimates, the following CF assumptions were made to amend the LCOE estimates:

- Black coal and Gas CCGT CF adjusted from 89% to 93% based on the technical capability data set out in the ISP 22 (black coal new entrant data not provided in Draft ISP24).
- LS Solar PV CF adjusted from 32% to 26% based on the Draft ISP24 average.
- Wind CF adjusted from 48% to 36% based on the Draft ISP24 average.

No adjustments were made for marginal loss factor or connection costs which are significantly higher for VRE technologies.

The estimated LCOEs for the low assumptions for 2023 and 2030 are as follows.

Technology	**2023 - Low**		**2030 - Low**	
Technology	**Draft GenCost24 Results**	**Amended Results**	**Draft GenCost24 Results**	**Amended Results**
Black coal	$110	$105	$86	$82
Gas CCGT	$138	$132	$91	$87
LS Solar PV	$47	$58	$36	$44
Wind	$66	$87	$44	$58
LS Solar PV - 60% VRE Share	$88	$145	$61	$120
Wind - 60% VRE Share	$107	$175	$69	$134
LS Solar PV - 90% VRE Share	$81	$122	$70	$112
Wind - 90% VRE Share	$100	$151	$78	$126

Amended estimated LCOEs (cont.)

When Draft GenCost24's estimated LCOEs are corrected for several major errors and omissions, the resultant amended LCOEs of VRE technologies are significantly higher than the estimated LCOEs of black coal and gas CCGT in 2023 and 2030.

These results clearly refute CSIRO's claim: "*The LCOE cost range for variable renewables with integration costs is the lowest of all new-build technologies in 2023 and 2030.*" (See slide 5).

This is not to say that the transition to a low carbon energy sector is not important and worthwhile. However, this conclusion highlights the importance of Australian policy makers and stakeholders being better and more reliably informed of the likely future costs of making the transition to a low carbon generation sector.

Prior to the release of GenCost24 Final, CSIRO should commission an urgent, independent, in-depth review of the Draft GenCost24 methodology and findings.

Glossary

Abbreviation	Meaning
2030 Subsidies	Cost of Government Targets included in 2030
23 BAU Costs	The major cost elements in the GenCost23 Final BAU case
AER	Australian Energy Regulator
AEMO	Australian Energy Market Operator
Appendix D.2.3 Submission	230823 - Submission regarding GenCost 2022-23 Appendix D.2.3 - FINAL ISSUE 1.0
ARENA	Australian Renewable Energy Agency
BAU	Business as usual
BAU Subsidies	Cost of Government Targets included in the 2023 BAU case
BON	Battery of the nation pumped hydro project
CER	Clean Energy Regulator
CFs	Capacity factors, the proportion of the year that a generating unit is generating
CIS	Capacity Investment Scheme announced by of the Federal Government in November 2023
CSIRO Response	The CSIRO paper "Response to Energy Policy Institute of Australia paper", November 2022
DG24 2023 Projects	Snowy 2.0, BON, TREX Projects and NSW2GW
Draft GenCost23	GenCost 2022-23 Consultation draft, December 2022
Draft GenCost23 Submission	ARDL Submission on Consultation Draft GenCost 2022-23 - ISSUE 1 - 16 February 2023
GenCost18	GenCost 2018 report released in December 2018
Draft GenCost24	GenCost 2023-24 Consultation draft, December 2023
Draft ISP24	AEMO Draft 2024 Integrated System Plan, 15 December 2023

Glossary (cont.)

Abbreviation	Meaning
EPIA Paper	Energy Policy Institute of Australia paper 3/2022 "Future Australian Electricity Generation Costs - A Review of CSIRO's GenCost 2021-22 Report" published in September 2022
GenCost20 Final	GenCost 2019-20 final report released in May 2020
GenCost21 Final	GenCost 2020-21 final report released in July 2021
GenCost22 Final	GenCost 2022-23 final report released in July 2022
GenCost24 Final	GenCost 2023-24 final report
Government Targets	Federal and State Government-funded schemes supporting the development of VRE projects
LCOE	Levelised cost of electricity
LRET	Large-scale Renewable Energy Target
LS Solar PV	Large-scale Solar PV
MLF	Marginal loss factor
NEM	National Electricity Market
NSW2GW	NSW target for an additional 2GW of at least 8 hours duration storage
Omitted NSW Peaking Plants	Kurri Kurri and Illawarra peaking plants
SMR	Small modular nuclear reactor
Snowy 2.0	2200 MW expansion of the Snowy Mountains Hydroelectric Scheme
TREX Projects	The various transmission expansion projects already flagged by the AEMO June 2022 ISP process to be necessary before 2030.
VRE	Variable renewable energy
VRE Share	VRE generation share

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