



# An All-Technologies Available Approach

A Gamma Energy Technology P/L submission

*House Select Committee on Nuclear Energy -November 2024*



## A Simple Analogy:

Headlines often depict technologies as being in a race to deliver decarbonisation, but actually delivering a low emissions grid at minimum financial cost is analogous to building a successful sporting team. Every team has players (generation assets) with different roles, positions and strengths. The right selection and balance of these delivers the required success (net-zero emissions). Any missing or limited talent is paid for in the sporting team results, a team full of goal keepers is not that best option or optimum team. Similarly, any missing or limited technology appears as a cost penalty for the grid system and electricity consumer.

## Keeping the Lights on in a Decarbonised NEM<sup>1</sup>

Some important messages have emerged from our most recent study into the National Energy Market. These include some warnings on what may likely go wrong in the short term and what might be a more sensible scenario than those proposed by others.

- The lowest total system cost solutions always have a mix of nuclear, CCS, storage, biomass, renewables, and peaking plant. The solution gets more expensive and/or unreliable if a technology class is restricted or unavailable.
  - When considering long term storage capacity, it's important to consider the whole year and a range of weather scenarios to ensure there's enough capacity and depth of storage.
  - Changing the input Capex assumptions, and in particular the relativities between technologies, has a significant impact on the future generation capacity profile.
  - The total system cost is not significantly impacted by gas price increases in a system where gas is used as peaking / backup plant.
  - Peaking plant is a 'class of technologies' which is currently dominated by open cycle gas turbines. Coal plants could be upgraded to also perform peaking duties, as it does in the UK, without a significant impact on cost or emissions. Diesel or biofuel-based plant are also capable of performing peaking duties.
- We are now running a risk that the lights will go out if the system follows AEMO's Step Change ISP scenario, closing all coal and building only wind, solar, storage and interconnectors. There will be a detrimental impact on grid security as early as 2025<sup>2</sup>.

Engineering judgement should ALWAYS be applied to modelling outcomes to ensure the results are able to be delivered in the real world. An achievable, net zero, future scenario that passes the giggle test is one which has some nuclear, some CCS, some biomass, a lot of storage, and even more wind and solar.

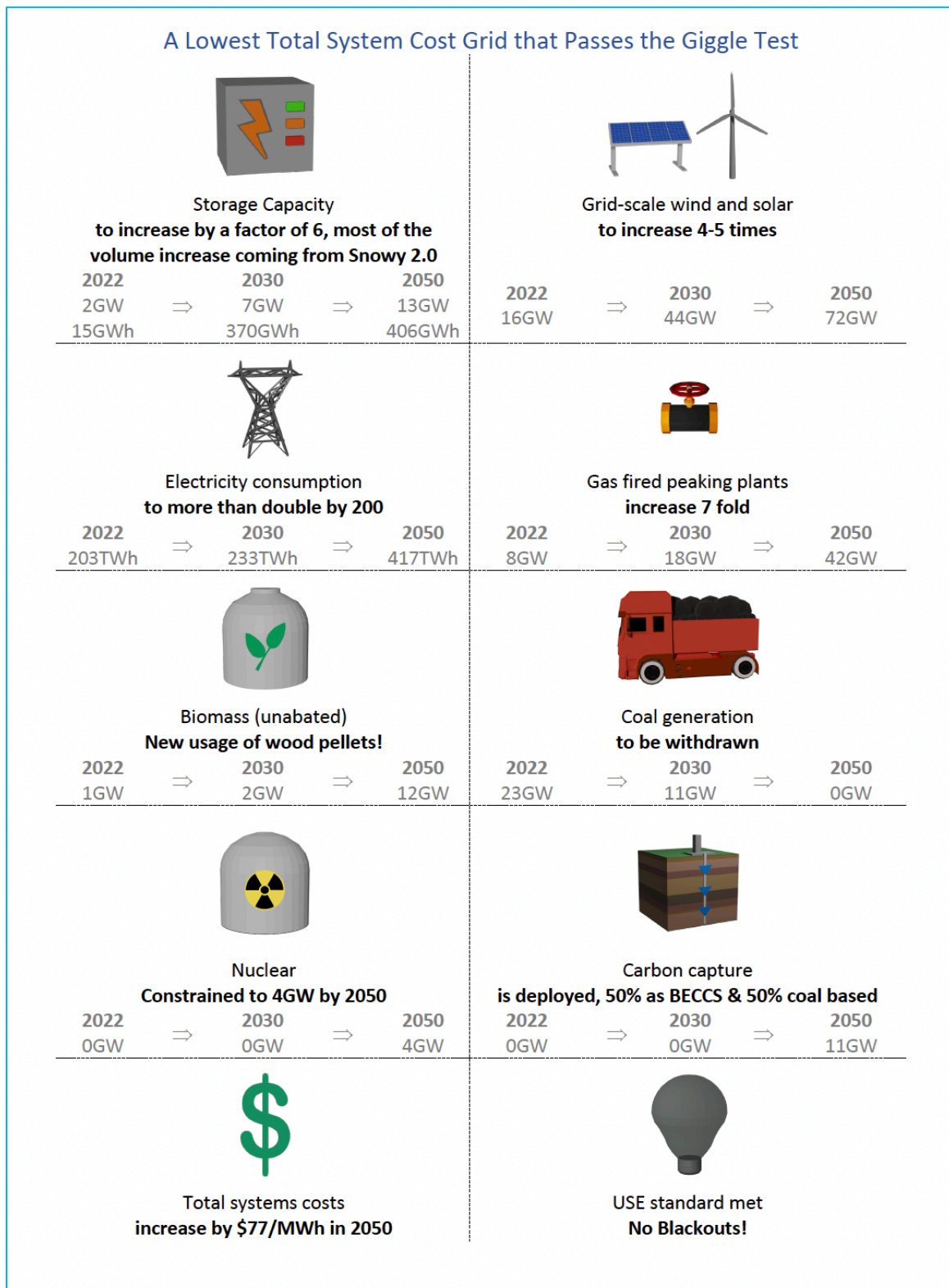
- To achieve such a system will require action to facilitate nuclear power deployment in the 2040's.
- Action will also need to be taken so that sequestration sites be identified in order to facilitate planning and deployment of CCS.

---

<sup>1</sup> Bongers, G., Boston, A., & Bongers, N. Keeping the Lights on in a Decarbonised NEM: Examining the options for a lowest cost pathway. Gamma Energy Technology P/L, Brisbane, Australia, Dec 2022. <https://www.powerfactbook.com/downloads/energy-reports>

<sup>2</sup> AEMO. May update to the 2023 ESOO. May 2024. [https://aemo.com.au/-/media/files/electricity/nem/planning\\_and\\_forecasting/nem\\_esoo/2023/may-2024-update-to-the-2023-electricity-statement-of-opportunities.pdf](https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/nem_esoo/2023/may-2024-update-to-the-2023-electricity-statement-of-opportunities.pdf)

A summary of our analysis from our latest report which is an ALL TECHNOLOGIES IN solution is given in the figure below.



Bongers, G., Boston, A., & Bongers, N.  
Keeping the Lights on in a Decarbonised NEM: Examining the options for a lowest cost pathway.  
Gamma Energy Technology P/L, Brisbane, Australia, Dec 2022  
<https://www.powerfactbook.com/downloads/energy-reports>

## Background

In Australia, historically there has been a lack of open transparent assessments to understand the emissions reduction from the electricity sector "at lowest cost" to the system and users. If you do not support a renewables only decarbonisation pathway, you are typically cast as a climate denier or fossil fuel / nuclear power advocate. As Australia is comparatively in the early stages of its decarbonisation journey, some total system cost assessments have been undertaken<sup>3</sup> with a "clean slate" - unencumbered by constraining aspirations, goals and technology agendas.

When examining the impact of the constrained access to a technology, or suite of technologies on the lowest total system cost it has again and again been demonstrated that reducing the carbon emissions from the NEM comes at an increased cost. Despite the 'learn by doing' gains associated with a large-scale deployment of generation technologies<sup>4</sup>, transformation of the NEM to a lower emissions grid will always result in an increase of the total system cost.

If Australia is to remain competitive in a low carbon world, it will need to reduce emissions at the lowest possible cost. The electricity sector will likely have to bear a disproportionate load of any emissions reduction strategy.

Transforming the entire NEM, currently underpinned by unabated fossil fuel technologies, with a range of variable renewable, energy storage and other low-emissions technologies has wide ranging implications. For the grid, considerations such as grid stability, energy diversity, grid connections, available grid services, reserve sufficiency, impact of changing weather due to climate change and other such factors must be taken into account.

## Impact of Constraining Technologies

To understand some of the issues facing this transformation, understanding the impact constraining a particular technology on the total system cost is very important. Constraining technologies increases the total system cost at deep decarbonisation levels. As highlighted previously, decarbonisation of the NEM will require access to all available technologies to build the optimum portfolio.

If no low emissions, firm generation such as CCS and nuclear, are available, very deep decarbonisation will become a significant system cost issue. Without BECCS or fossil CCS, nuclear power is required for deep decarbonisation, will be more than necessary. Constraints to the deployment of technologies, when applied, limit the possible 2050 decarbonisation transformation options, will result in a less than optimum total system cost.<sup>5</sup>

While some constraints may be physical, and some policy driven – it is clear that these constraints need to be minimised where possible to ensure we have the best chance of delivering low carbon electricity to NEM customers.

---

<sup>3</sup> Refer to the work done by Gamma Energy Technology in conjunction with Red Vector, our key reports are listed in the Recommended Supporting Material section.

<sup>4</sup> Graham, P., Hayward, J. and Foster J. 2024, GenCost 2023-24: Final report, CSIRO, Australia.

<sup>5</sup> Boston, A., Bongers, G., Byrom, S. and Bongers, N., (2020). The Lowest Total System Cost NEM – the impact of constraints. Gamma Energy Technology P/L, Brisbane Australia. <https://www.powerfactbook.com/downloads/energy-reports>

## Recommended Supporting Material

- Boston, A., Bongers, G., Byrom, S. and Bongers, N., (2020). The Lowest Total System Cost NEM – the impact of constraints. Gamma Energy Technology P/L, Brisbane Australia.  
<https://www.powerfactbook.com/downloads/energy-reports>
- Bongers, G., Boston, A., & Bongers, N. Keeping the Lights on in a Decarbonised NEM: Examining the options for a lowest cost pathway. Gamma Energy Technology P/L, Brisbane, Australia, Dec 2022. <https://www.powerfactbook.com/downloads/energy-reports>