Balancing Flexibility Whilst Decarbonising Electricity on the NEM

ANLEC R&D Study[1] Contact: Noel Simento[2]

The current Australian grid has delivered reliable and secure energy for decades. With the majority of electricity provided by coal-fired power generation, this technology has also delivered the services required for grid stability such as inertia, frequency control, etc. Fossil-fuel technologies have, to date, underpinned the energy competitiveness of the Australian economy. However, with increasing penetration of renewable generation, it is becoming important to plan for and manage generation asset investment to track the least cost and highest reliability path to a low emissions future.

This ANLEC R&D commissioned study is an innovative modelling approach. It considers the grid system cost by recognising the importance of firm generation, the cost of balancing the system, and the required flexibility, while on the "pathway" to a lower emissions grid.

Key Points

- Including energy supply, each energy technology brings with it a different set of grid services such as – low emissions, inertia, frequency control, flexibility etc.
- The NEM is unique when compared with other international grid systems – it consists of 5 state based grids that are only weakly interconnected.
- The characteristics of this host NEM plays a significant role in determining the value of an additional asset placed on the system. Each state grid will have unique asset requirements and a material impact on the overall NEM system.

Results:

Approaches to meet short-term emissions targets (e.g: Paris 2030) can lock in higher costs and compromise Australian energy competitiveness in the long term.

The lowest cost energy supply technologies change as NEM decarbonisation proceeds. At high penetration renewables become increasingly expensive to the grid.

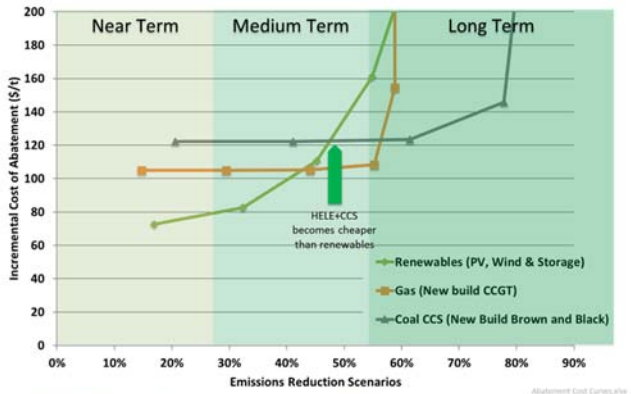

Figure 1 : Cost of abatement with increasing emissions reduction

In Figure 1 renewables costs increase due to intermittency and curtailment. Inflexions for other technologies occur when their emissions limits are reached.
At high decarbonisation levels, dispatchable power like HELE+CCS will be required to deliver the required resilience for grid stability. It can also deliver the deepest decarbonisation ambitions at lowest cost.

High penetrations of wind and solar PV will require companion low carbon technologies if they are to provide firm capacity, available "on-demand". See Figure 2.

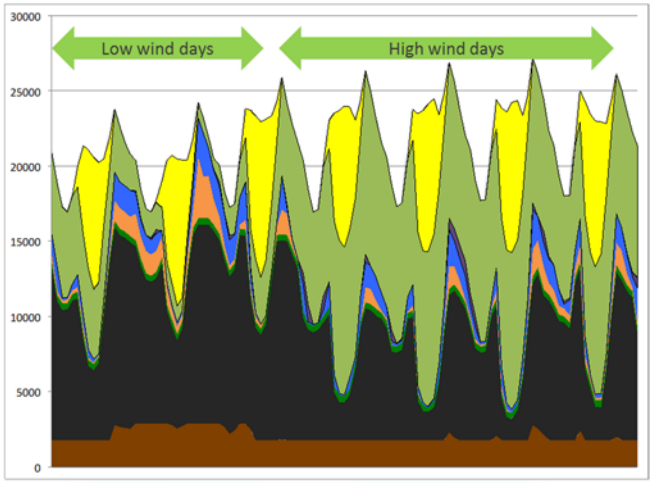

Figure 2: Modelled 7-day generation - high renewables scenario

In high renewables scenarios, the existing fossil-fuelled power plant (especially black coal) will have to become increasingly flexible on a daily basis.

This is a new operating paradigm for coal assets on the NEM. It requires either new build or investment to upgrade existing plant to ensure they have such flexibility.

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