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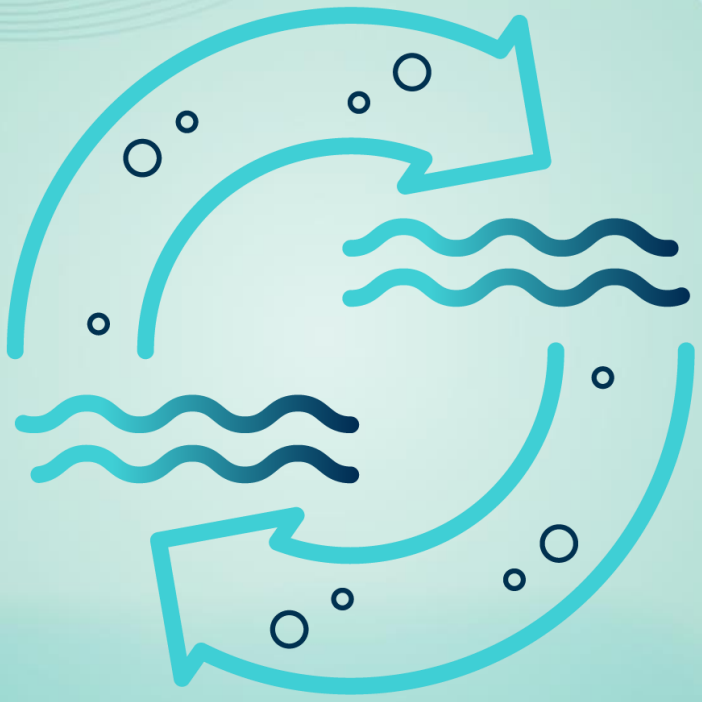

The case for deep storage

Why the NEM needs *Battery of the Nation*

April 2020

Prepared by Hydro Tasmania

This paper summarises key insights into the value of deep (long duration) storage derived from investigations supported by the Australian Renewable Energy Agency (ARENA). The underlying reports received funding from ARENA as part of ARENA's Advancing Renewables Program.

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Foreword

Australia's National Electricity Market (NEM) is undergoing a major transition from dependence on fossil fuel to predominantly using renewable energy. Accurately predicting what the future power system will look like is incredibly difficult, particularly in a time of rapid change over coming years. Yet, it is clear that the variable generation must be backed by sufficient flexible supply options (such as storage) to ensure the reliable electricity Australian customers expect.

The case for deep storage brings together key insights from a range of White Papers to show that energy storages with the ability to operate over many hours are an optimal, least-cost choice able to manage realistic uncertainty in the power system. Deep storage must play a critical role in efficiently supporting Australia's energy transformation.

Tasmania is well placed to support the transition of the NEM and has set a renewable energy target of producing 200% of its current needs by 2040.

Tasmania's naturally favourable topography and existing hydropower system provide an ideal opportunity to develop cost-effective deep storage pumped hydro that Australia needs to manage uncertainties and achieve a reliable future NEM.

Steve Davy

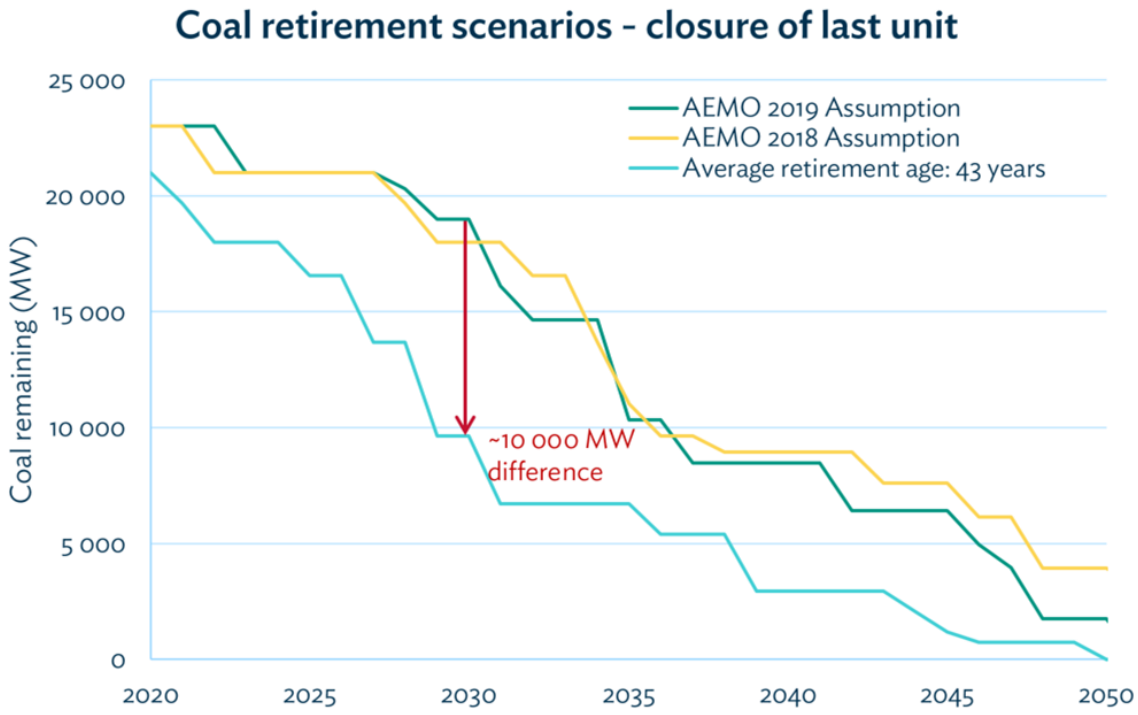
Hydro Tasmania Chief Executive Officer

April 2020

The future is uncertain and we need sound supply options for *all* futures

Key strategic decisions in coming years will shape the NEM for decades to come; and yet, the same factors that are prompting the critical infrastructure decisions are also the source of substantial uncertainty.

Challenges in modelling the transforming NEM[1] highlights that modelling is our best option to understand how the system might change, yet also cautions against too much faith in any single outcome. Recognising the uncertainty and accommodating broader strategic conversations will be critical to ensure a secure, reliable and affordable electricity system.



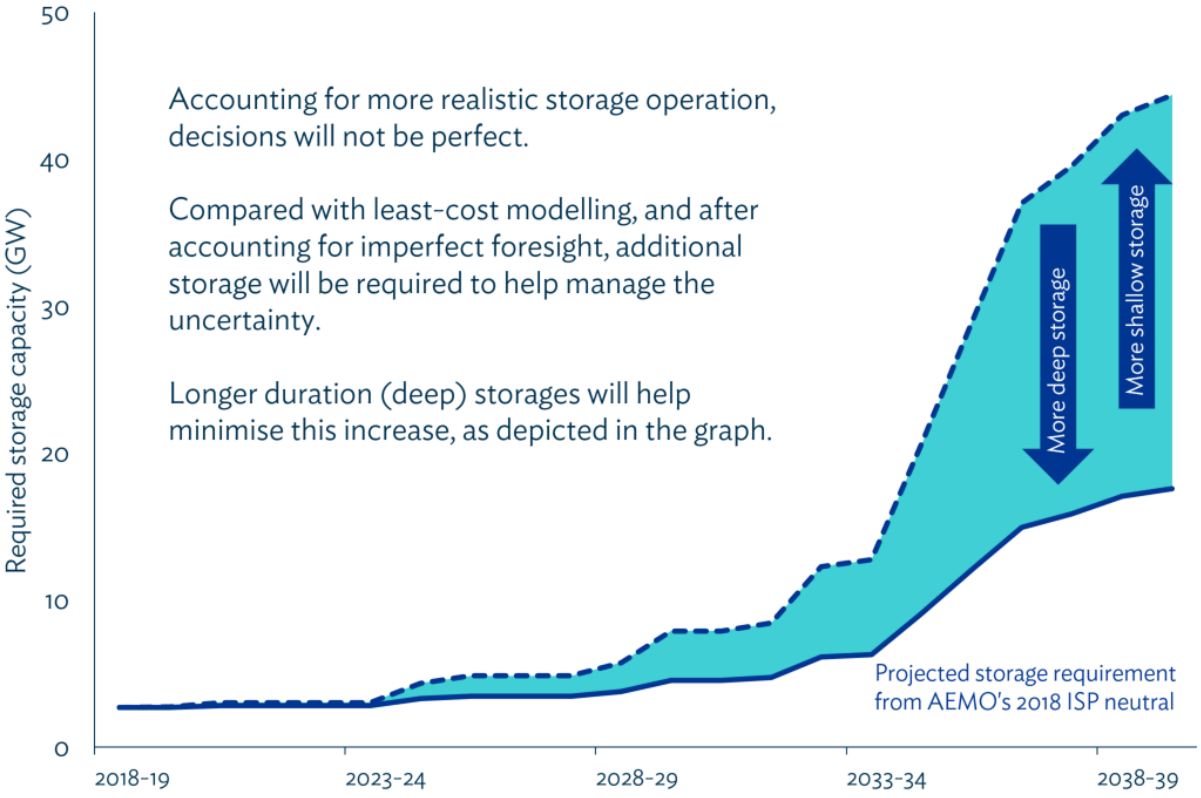
To ensure that consumers aren't left in the dark, dispatchable and flexible capacity must be made available before it is needed, not after.

[1] Hydro Tasmania, *Challenges in modelling the transforming NEM*, September 2019, https://www.hydro.com.au/clean-energy/battery-of-the-nation/future-state

Deep storages will be better placed to manage the uncertain decisions in the real-world electricity market

Operation of storages without perfect foresight[2] analyses the importance of forecast accuracy in determining the performance of energy storages in the NEM. Imperfect foresight affects both supply and store decisions. Unlike fuel-driven generation, storages are energy-constrained and all decisions are driven by opportunity-cost.

Analysis of a conceptual storage operation over the last 4-5 years shows that short duration storages perform much worse in reality compared with deep storages of 12+ hours. Longer duration storages will help manage the risk of future scarcity and limit the need for duplication.



Realistic operations will likely result in a need for storages 2-3 times longer in duration to achieve similar outcomes with the same capacity.

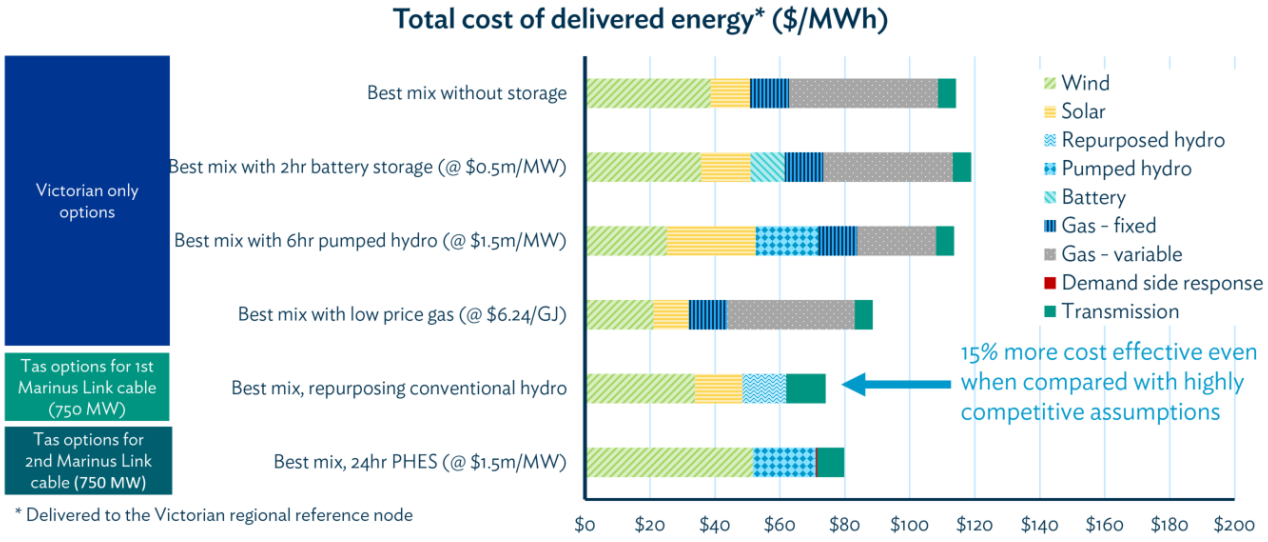
[2] Hydro Tasmania, *Operation of storages without perfect foresight*, September 2019, https://www.hydro.com.au/clean-energy/battery-of-the-nation/future-state

Tasmanian supply can cost-effectively support electricity reliability in an uncertain future

Increasing levels of low-cost wind and solar will result in increased need for flexible supply, such as storage, to maintain reliability.

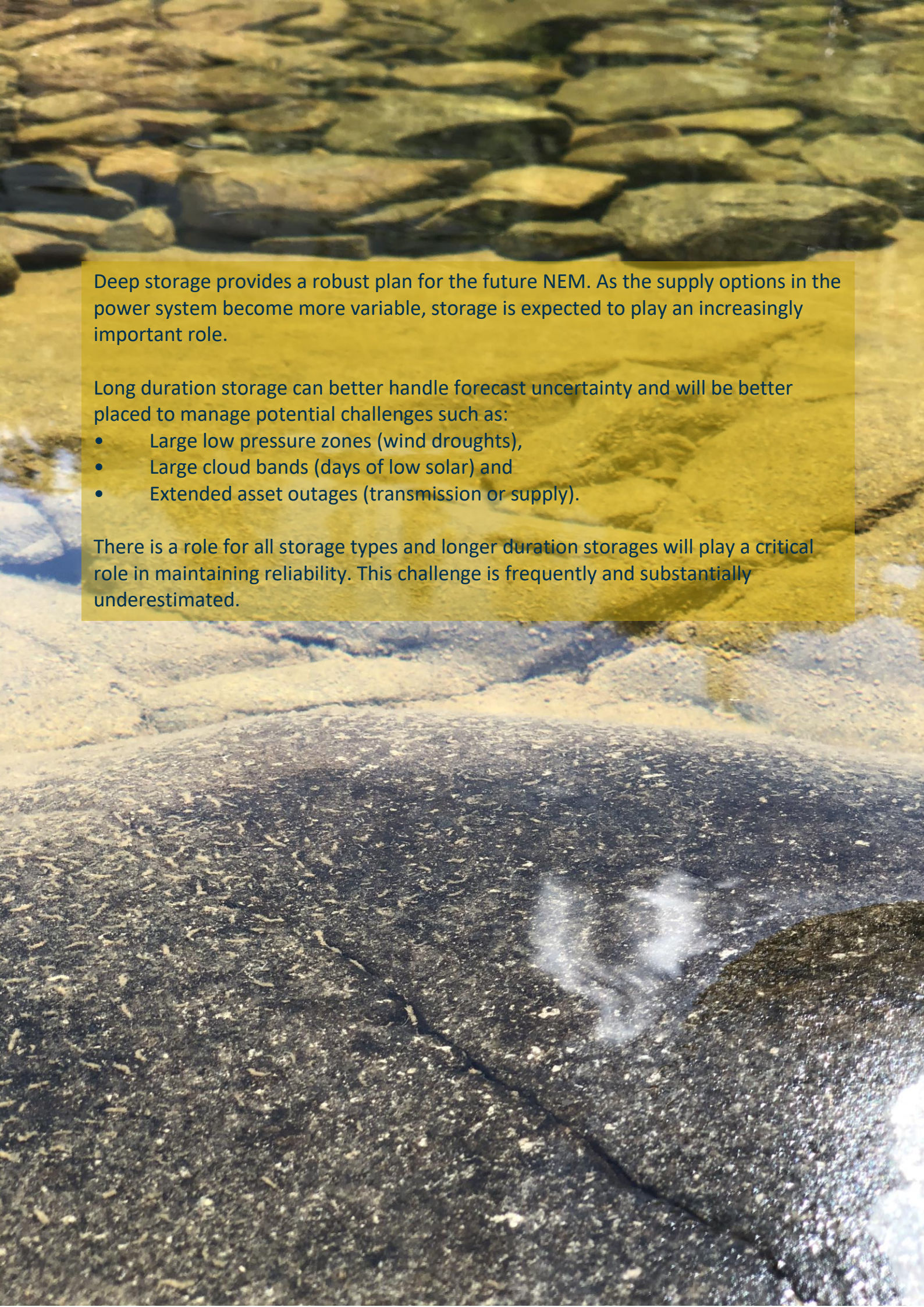
For over 100 years, Hydro Tasmania has managed the challenges of ensuring reliability in a power system dependent on weather-driven renewable energy. This provides a strong understanding of how longer storage duration supports more flexible operating choices.

Unlocking investment in storage for a reliable future NEM[3] discusses how capacity-focussed investments can be challenging in the NEM. The same paper also demonstrates that Tasmania's existing hydropower portfolio could provide highly competitive firming, as shown in the graphic below.



Tasmania could cost-effectively provide an additional 1500 MW of firm supply by extending our existing hydropower system with deep storage pumped hydro.

[3] Hydro Tasmania, *Unlocking investment in storage for a reliable future NEM*, November 2019, https://www.hydro.com.au/clean-energy/battery-of-the-nation/future-state



Deep storage provides a robust plan for the future NEM. As the supply options in the power system become more variable, storage is expected to play an increasingly important role.

Long duration storage can better handle forecast uncertainty and will be better placed to manage potential challenges such as:

- Large low pressure zones (wind droughts),
- Large cloud bands (days of low solar) and
- Extended asset outages (transmission or supply).

There is a role for all storage types and longer duration storages will play a critical role in maintaining reliability. This challenge is frequently and substantially underestimated.