Repositioning hydro operations and electricity supply in a dynamic energy sector

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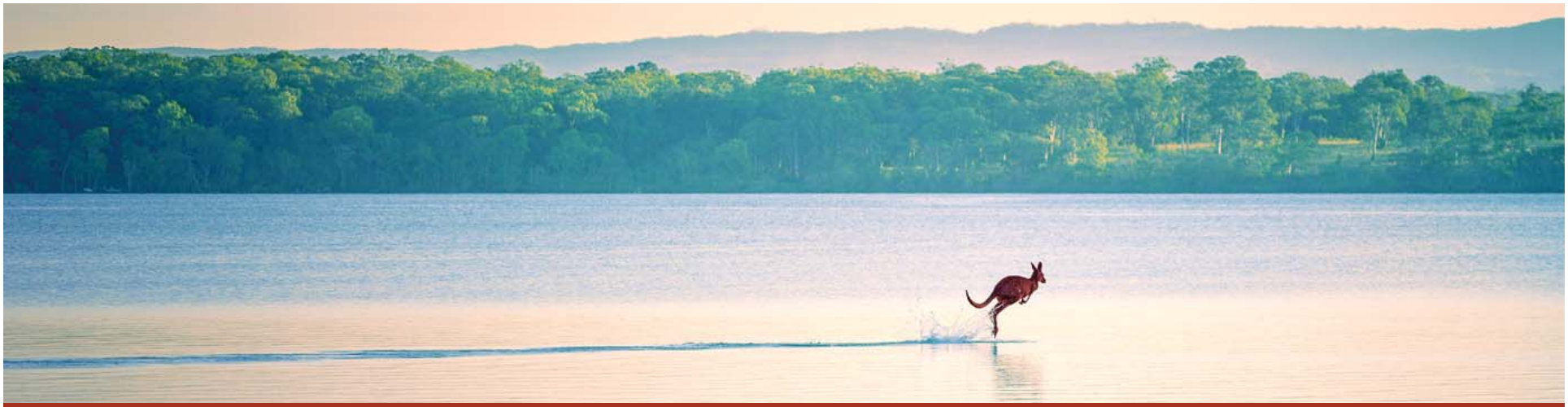


A global shift is occurring in hydropower

Traditionally, hydropower has been viewed as a stand-alone, established renewable technology.

With the rapid global increase of wind and solar power developments, hydropower needs to review its place, and its opportunities

But, as we know, the intermittency of these new renewable energy sources creates the need for some sort of storage to firm up the system.

Now we're seeing a much greater sense of integration with other renewable technologies as part of broader 'clean energy' systems.

Trends in the Australia's National Electricity Market

The NEM has a total electricity generating capacity (including rooftop solar PV of 6,700MW), of almost 54,421 MW

Increasing vertical and horizontal integration

Rapid growth of distributed generation

Soaring electricity price, due to grid costs

Absence of long tern policy on carbon emission reduction

Increasing share of intermittent renewable energy

Closing down of aging base-load thermal generation

The Contradiction of ‘Dispatchable Renewables’

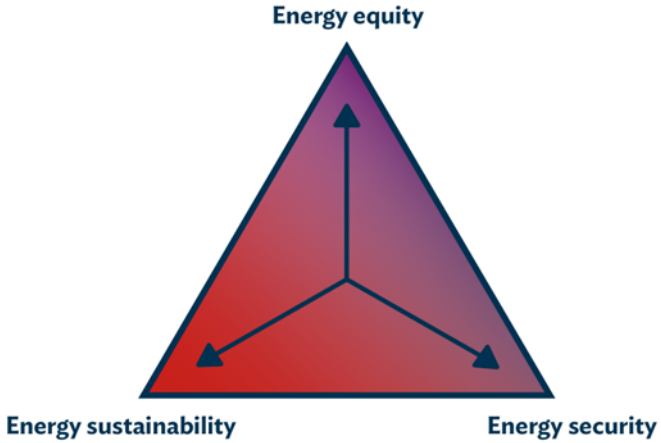
The role of renewables in achieving energy *affordability* and *sustainability* are clear.

Renewable sources of energy are now the most cost-effective options for new energy generation.

Replacing thermal generators with wind and PV is not a like-for-like swap.

Resource availability from renewable sources makes matching supply with demand a challenge.

For large scale centralised grids
Australia needs ‘dispatchable renewables’ to address the elements of the energy trilemma.



The energy ‘Trilemma’

How can Renewables be made Dispatchable?

Studies of generation across the NEM have shown that wind and solar are not highly correlated, due in part to sufficient geographic spread, which enables these variable technologies to firm each other to a degree.

To assist geographical spread, interconnection between regions is critical.

In a low carbon energy market, storage is critical to provide flexibility to store excess or low value energy for times when it is needed.

When renewables generation patterns are highly correlated, storage is needed.

A forgotten Technology

Hydropower provides both baseload and peaking capacity.

Now it also has the opportunity to provide storage and the firming capacity required to help stabilise grids as they integrate increasing levels of intermittent renewables.

Pumped storage enables energy to be shifted from low demand times to high demand times (i.e. pump water up when the demand and price is low, generate when the demand is high and help keep prices lower)

Pumped storage hydropower may be particularly useful in this context.

Case Study – Tasmania the Battery of the Nation

Tasmanian Pumped Hydro Options Assessment

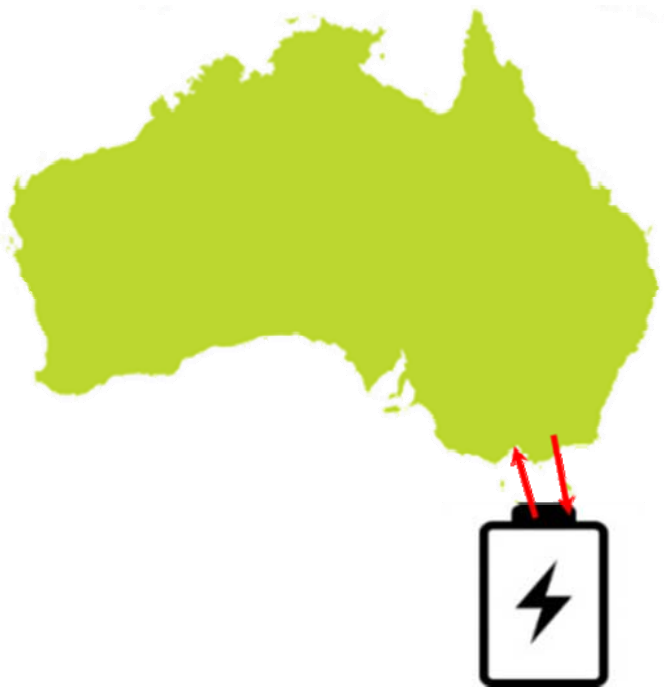
The original objective was 2,500 MW of Tasmanian Pumped Hydro development opportunity.

Key results of first stage of assessment:

- Substantial pumped hydro development potential in Tasmania
- more than is needed
- with very attractive “cost to construct” estimates.

Options include:

- Converting existing hydropower stations
- Linking existing reservoirs together
- Utilising existing reservoirs and linking to a new off-stream reservoir



What does the future hold?

As the percentage of energy from wind asn solar increases ther will be a time when there will be a need for ‘dispatchable renewables’ that will inevitably lead to a diversity of storage and supply solutions. The range of these solutions will depend on the resources of particular regions and locations.

There is room for both batteries and pumped hydro which will likely complement each other.

For now, batteries are more cost-effective at delivering small amounts of stored energy over a short time at high power levels.

For now, pumped storage is more cost-effective at storing and releasing larger amounts of stored energy.

Achieving the optimum storage solution will depend on careful planning and finding the best fit for the particular circumstances.

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