Why Finkel is wrong on storage

One of the surprising recommendations of the Finkel review is the Generator Reliability Obligation.

> *In regions where dispatchable capacity approaches the determined minimum acceptable level, new generation projects should be obliged to also bring forward new (i.e. not contracting existing) dispatchable capacity to that region. This obligation should be expressed in terms of a percentage of the new VRE generator's nameplate capacity, able to be dispatched for a required time period. The new capacity should not need to be located onsite, and could utilise economies of scale. Multiple VRE projects could pair with one new large-scale battery or gas-fired generation project, for example.*

In reality this would mean that potential investors in a renewable energy project (wind or solar) would need to factor storage into their business plan. Notwithstanding the practical difficulty of determining the likely amount of storage required in the "region" over the life of any particular investment, it is economically sub-optimal to "pair" energy storage with individual generators. This can be illustrated by the following simple model.

Assume a network with a similar load profile to the Western Australian SWIS that consumes 18,000 MWh per annum, and is serviced by solar, wind and wave generators. Each generator is required to dispatch 6,000 MWh, roughly mimicking an extreme version of the Finkel obligation. The approximate power generated by each source during a typical 24 hour period in each month of the year is shown in Figure 1.

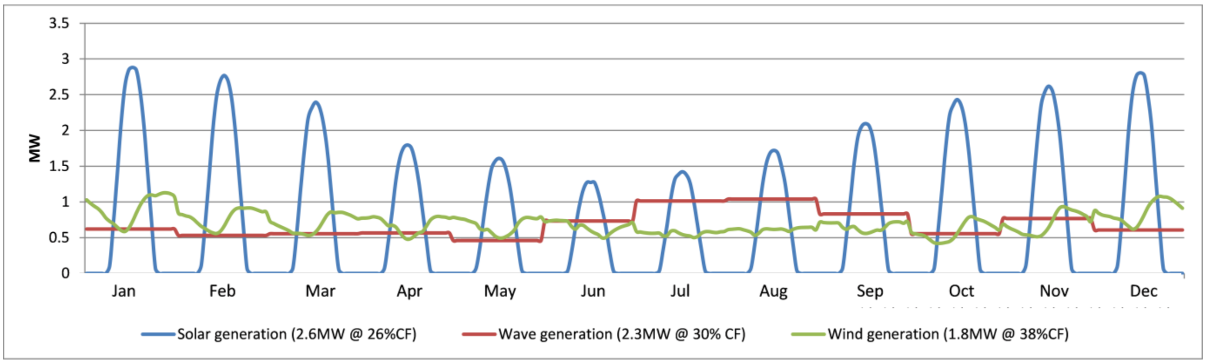

Figure 1 Generation

To meet its obligations, each generator installs sufficient storage to meet the requirement. As both the capacity factor and the generation profile of each energy source is quite different, the proportions of demand met a) directly from generation or b) through storage discharges, varies significantly. Figures 2-4 illustrate how demand is met from each generator, and the state of storage during a typical 24 hour period in each month of the year.

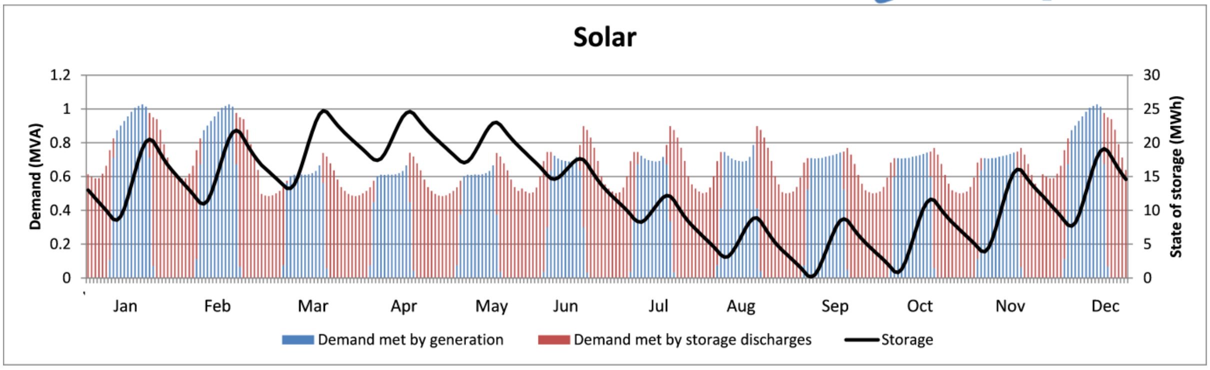

Figure 2 Solar generation and energy storage

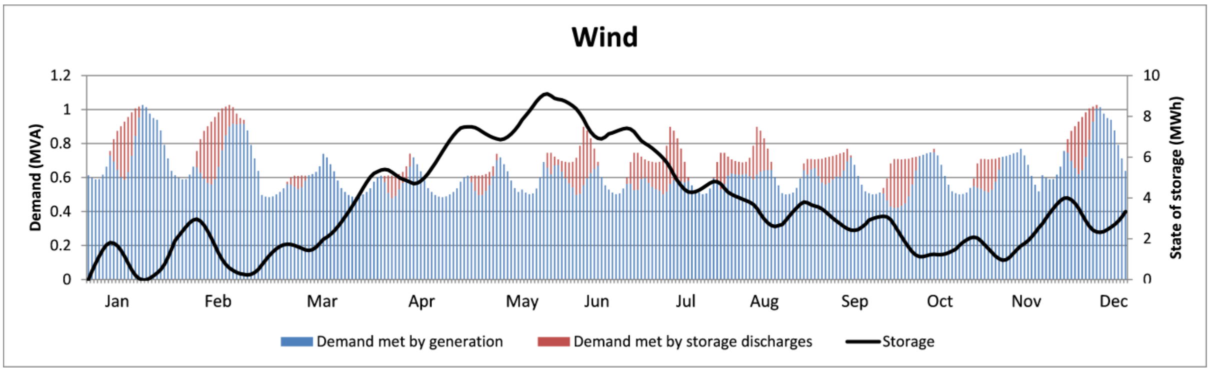

Figure 3 Wind generation and energy storage

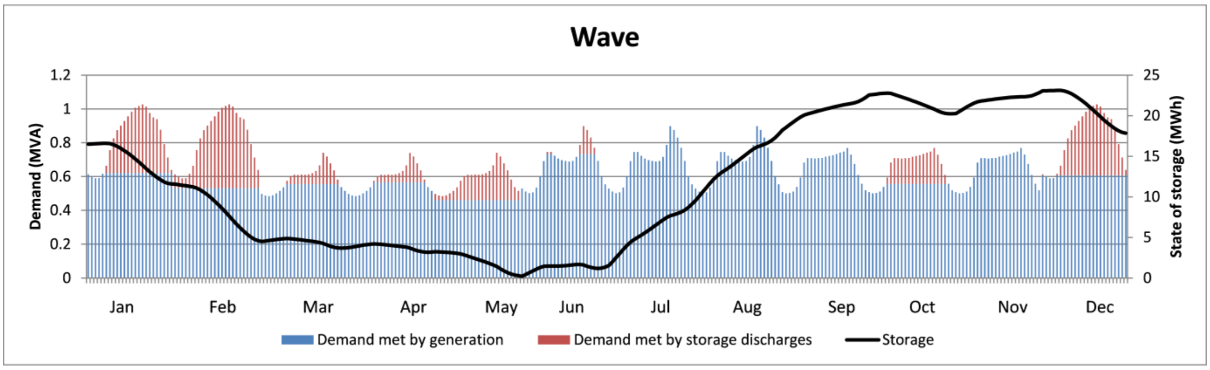

Figure 4 Wave generation and energy storage

The storage requirement is driven by how well generation matches demand. In the solar generation situation, the storage capacity is determined by the weaker winter generation[1]. The solar generator requires some 25 MWh of storage capacity to meet its requirement to deliver its required energy, while the wind generator (with much less diurnal intermittence and strong summer / autumn generation) requires less than 10 MWh. The wave energy generator (strongest in winter) requires around 23 MWh of storage to meet autumn demands. If we assume the storage is through batteries and costs around $1,000 per kWh the total storage required is around 60 MWh and the capital cost is around $60m.

Consider now the situation where the storage is aggregated at the network scale. Exactly the same demand is met by exactly the same generation sources, i.e. solar, wind and wave. However because

[1] Losses and minimum discharge levels are ignored in this simple example

the generation sources are diversified, more demand can be met directly from generation rather than relying on storage discharges. Figure 4 illustrates the situation.

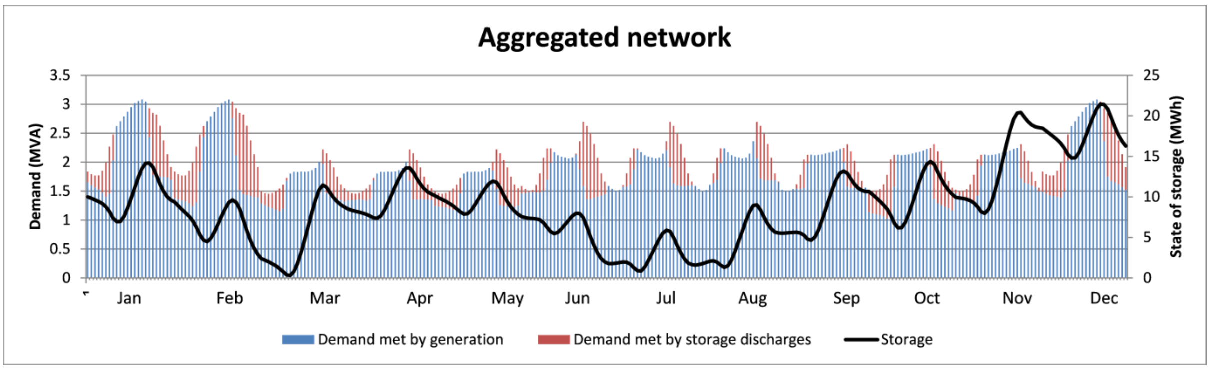

Figure 4 Combined generation and aggregated storage

Albeit an extreme case, it can be seen that the aggregation of storage at the network scale requires only 20 MWh storage compared to the nearly 60 MWh if each generator is required to store their own energy, thus saving some $40m in capital costs alone. The same logic also applies to household storage. It will be economically much cheaper for the excess energy from household systems to be a) used by others or b) stored at network scale rather than in backyards (as I have shown elsewhere), even if economies of scale are ignored.

This illustrates why energy storage should be the responsibility of the network operator and not individual generators, who have no control over the commercial decisions of others (including consumers) that in reality determine the optimal aggregate storage requirements of the network. Placing such an obligation on generators is merely another impediment to the introduction of large scale renewables.

Finkel is trying to retain aspects of the existing arrangements by making renewable energy fit into the system we have, rather than meet the challenge of the wholesale revamp that is needed. The future role of the network will be to absorb energy from a variety of sources (including much more behind the meter than Finkel assumes) and dispatch it on demand. This requires energy storage to be either within the network itself (or for multiple storages to be controlled in aggregate) for the system to operate most efficiently and cost effectively.

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