

5th April 2017

Mr Noel Ryan

PUOSubmissions@treasury.wa.gov.au

Dear Noel,

RE: CONSTRAINED ACCESS CONSULTATION

Emergent Energy welcomes the opportunity to make a submission to the Public Utilities Office regarding the constrained access consultation papers.

This submission is brief, outlining some high level concepts which might be considered by the PUO while progressing its current course of action.

The discussion papers deal with very significant reforms – such as allocating capacity credits, as well as the notion of legislating away property rights enshrined in network access agreements. Both have the potential to impact the revenues of existing generators, with the latter item a course of action that no government should ever contemplate lightly... if at all. It is disappointing that the PUO, prior to releasing the discussion papers, did not release any relevant data or modelling information which frames the rationale for progressing these reforms. While the rationale may be apparent to the PUO, it is not immediately so to many stakeholders. The concern is that the solutions identified in the discussion papers are for problems that are poorly identified, may be fleeting, or may be trivial compared to other issues faced by the sector. Additionally, they may introduce larger unintended consequences than the issues they seek to address, where such consequences are simply unnecessary in the first place.

Given its uncertainty as to the nature of the issues, Emergent Energy does not think it appropriate at this stage of the process to comment on the detailed questions posed in the discussion papers.

The following discussion is around high level concepts which seek to identify what the future issues of the WEM may be prior to identifying a set of reform objectives.

Regards,

Shane Cremin.



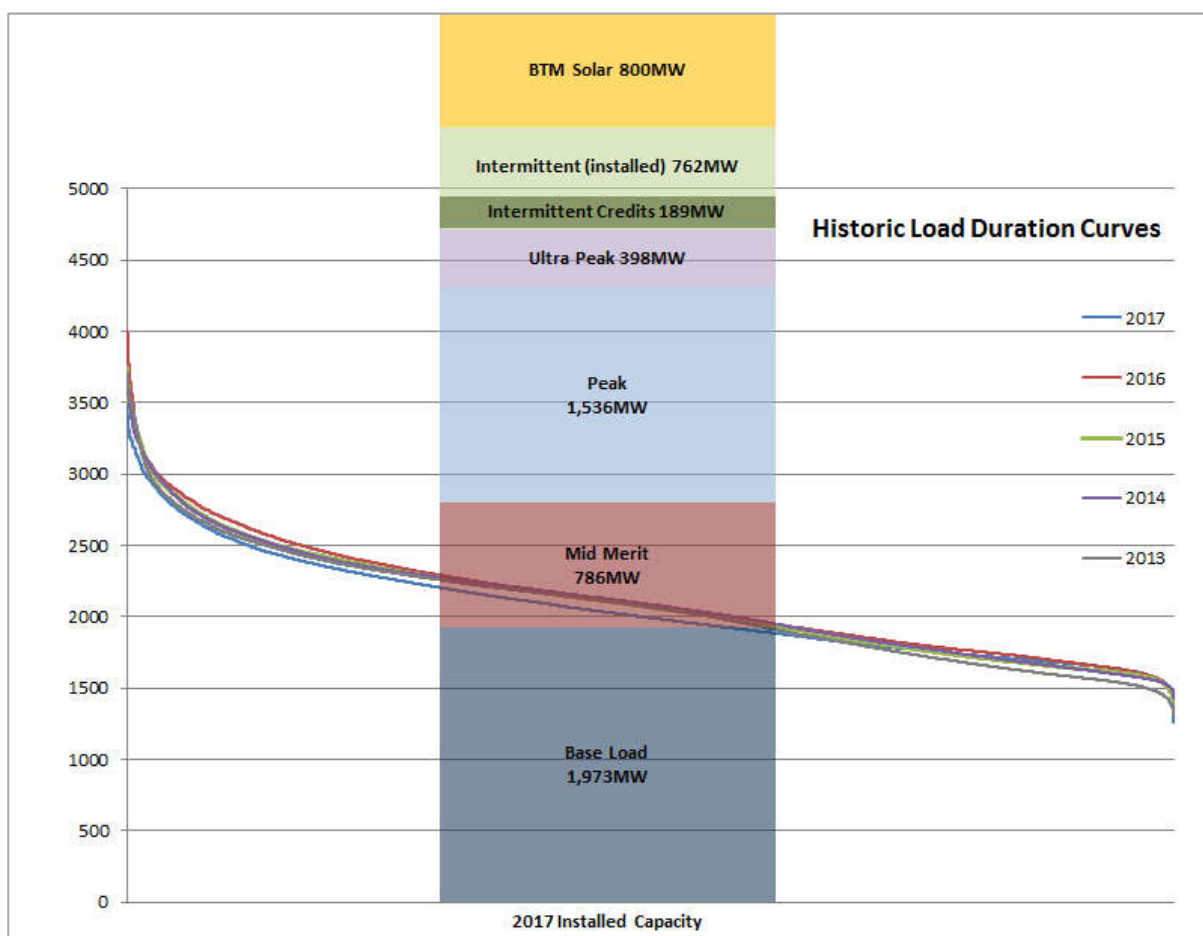
WHAT MIGHT THE WEM LOOK LIKE IN 10 YEARS?

Forecasting a specific outcome will almost always give you the wrong answer. However, creating realistic scenarios via credible modelling is a useful tool for thinking about the issues of moving from a known state to an unknown one. The data below is derived from observed trends in electricity supply and demand both in the WEM and in other jurisdictions. Emergent Energy believes it is one of a number of credible scenarios of what a future WEM may look like in 2027 and beyond.

One of the fundamental premises of these scenarios is that the cost of new renewable generation technologies is decreasing to the point where they will eventually displace conventional technologies. This is irrespective of climate policies – though the rationally accepted premise that pro-climate policies will continue into the future will only reduce the competitiveness of fossil fuel plant. The only question now is how long this will take?

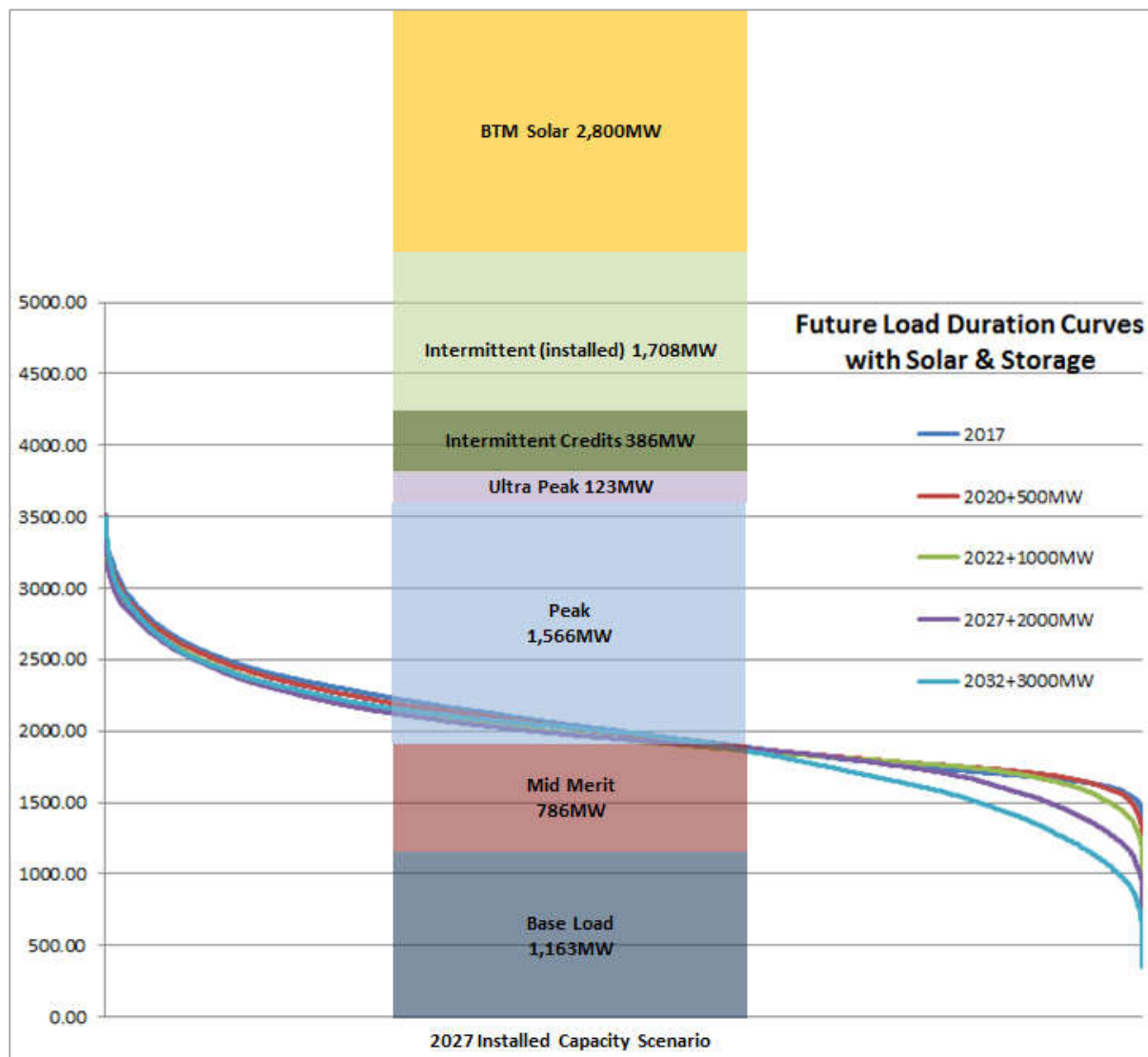
Figure 1 below shows the current generation fleet and load duration curves in the WEM. Figure 2 shows a 2027 fleet scenario and future load duration curves.

Figure 1 – 2017 generation fleet (capacity) and load duration curve



BTM = Behind the Meter

Figure 2 – 2027 generation fleet (capacity) and load duration curve scenario



Each year after 2017 uses the 2017 interval data (an average demand year) increased by 1.25% annual load growth. Added to this is the indicated quantity of BTM solar (additive to the existing 2017 BTM solar), roughly equal to 200MW of additional BTM solar per year. The BTM solar uses PVsyst hourly interval output, so includes days of both low and high solar irradiance providing a realistic output.

Figure 3 shows the generation by type and Figure 4 looks at the capacity credit allocation vs installed capacity – based on the current capacity mechanisms settings.

Figure 3 – 2017 and 2027 generation (energy produced) by type

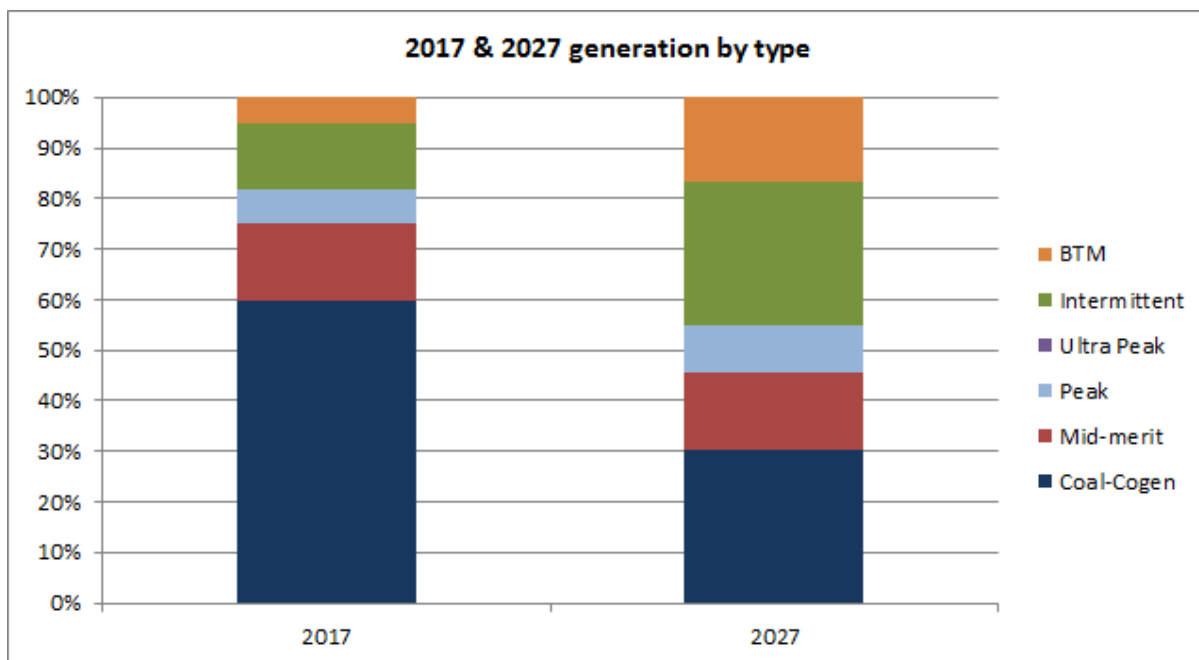
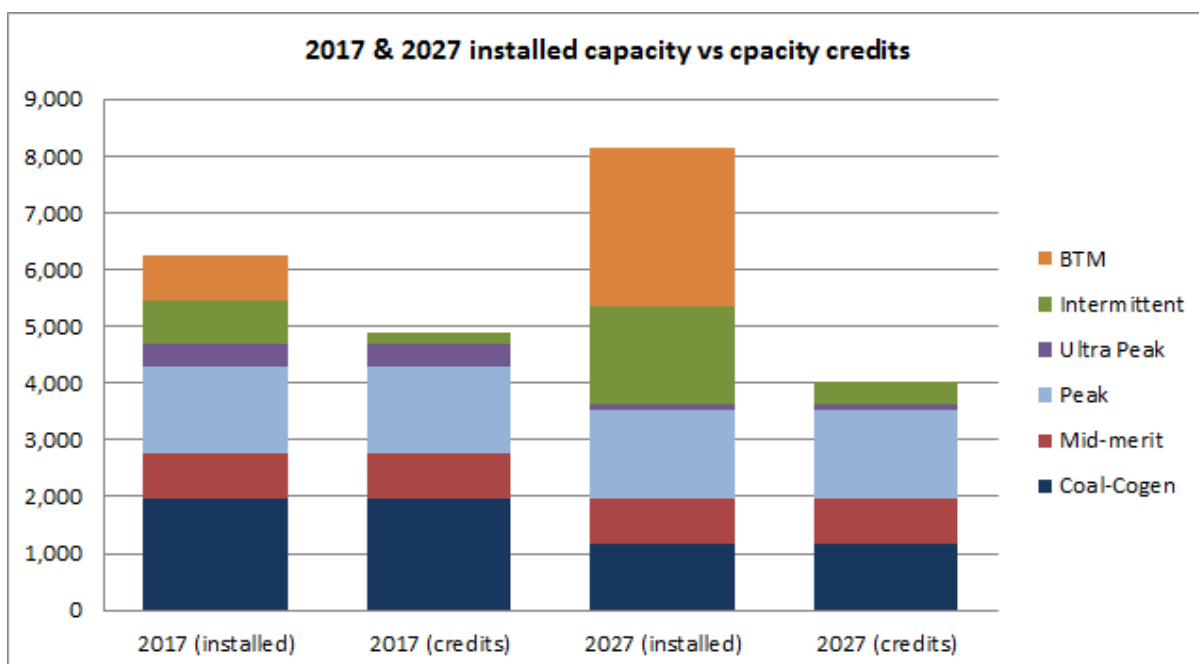


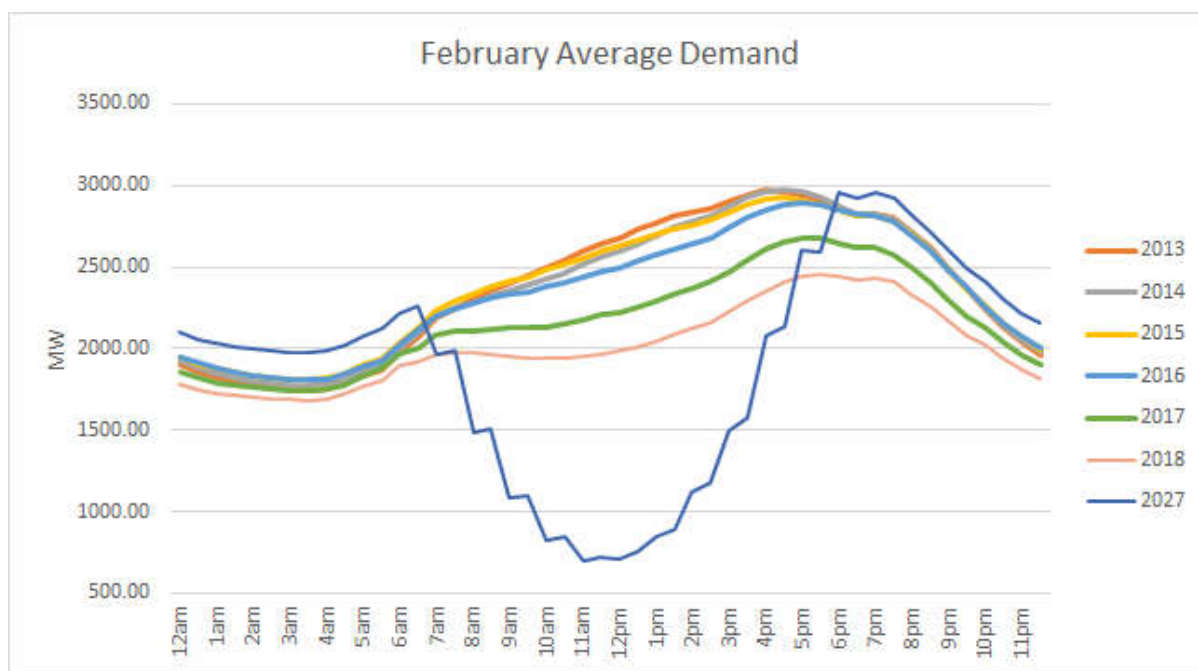
Figure 4 – 2017 and 2027 installed capacity vs capacity credits



SO WHAT DOES THIS MEAN?

There are a few items that are immediately apparent in looking at these charts. Energy supply shifts from baseload fossil fuels to variable renewable energy and BTM solar. Baseload generators cannot survive this shift in capacity factors, or the shift in operating duty, where they must cycle up and down (or on and off) as lower SRMC renewables displace them in the merit order. While the load duration curves tell us some of the story, the real narrative is in the daily load profiles (Figure 5).

Figure 5 – Daily load profiles (February average daily demand profile)



Actual demand up to February 2018 has been extrapolated out to 2027, based on current BTM solar installation rates. These are averages only, meaning there will be even greater variation between individual days. Baseload generation is not capable of responding to this variation, so the marginal base load units will likely retire early. Mid-merit and peaking (dispatchable) generation must respond by producing more energy to firm up the variable renewable energy. The majority of peaking plant in the WEM is not particularly flexible or well suited for this role.

The next major item of interest is the difference between the installed capacity in 2027 and the quantity of capacity credits allocated (based on the current methodology). Given there are no capacity credits allocated to BTM solar (or storage); and that intermittent generation receives significantly lower capacity credits than the thermal generation it replaces, then there is a likelihood that there will not be enough capacity credits to reconcile the current IRCR mechanism. And if investors were incentivised to defer plant retirement in order for there to be sufficient capacity to meet the reserve capacity target, then with up to 20% of energy consumed behind the meter in 2027, the cost of the additional capacity would be substantially higher, with less variable energy over which to amortise the fixed costs.

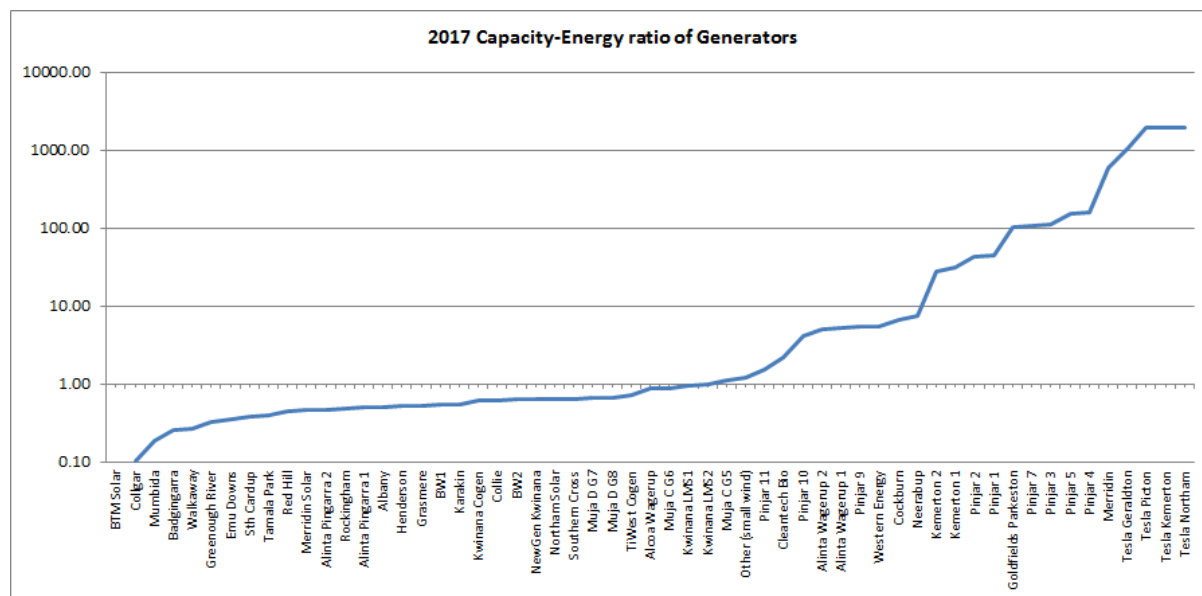
So rather than ask a set of questions relating to how the current capacity allocation methodology should be adapted under a constrained access regime, the question that needs to be asked is:

Is the current capacity mechanism, designed nearly 15 years ago to address a specific set of issues pertinent to the WEM at the time, appropriate in the future... or indeed now?

This has potentially large implications for addressing the issues outlined in the discussion papers.

Figure 6 shows the current generation fleet and the value of capacity payments relative to the proportion of energy produced:

Figure 6 – Capacity-Energy ratio by facility (Note: LHS is logarithmic scale)



Capacity-Energy ratio is the ratio of the facility capacity cost divided by the total capacity cost: to the facility's energy output divided by the total energy supply over the past 12 months.

Figure 6 shows that while there is some 'peaking capacity' in the WEM that is used very little relative to its capacity cost (e.g. the Tesla diesel units cost of capacity per MWh delivered over the last 12 months was around \$63,000/MWh), the wind farms and solar farms have very low costs of capacity relative to the energy they supply (e.g. Collgar and Mumbia, the two newest wind farms in the WEM, at \$3.60/MWh and \$6.50/MWh respectively¹).

The WEM operates a capacity and energy market. The LRMC of generation for individual facilities is met by revenues from multiple streams. In the case of wind and solar, these include energy; capacity and LGCs. Roughly, over the last decade, energy prices have averaged around \$50-60/MWh and LGC prices around the same. With capacity prices around \$10/MWh or lower, this would account for the approximately \$100-120/MWh LRMC for wind farms constructed in the past. And it is clear that the value of capacity credits was the lowest priority for these investments.

Based on recent reports and projects in the NEM, the LRMC of wind has fallen to somewhere around the \$55-70/MWh range, and solar to \$65-80/MWh range. Projections see these costs likely falling to \$45-55/MWh for wind and \$50-60/MWh for solar in the next 5 to 10 years². Based on these

¹ Of course, the quantity of capacity credits is based on coincidence with peak demand (or LSG demand) which impacts the ratios

² Projections for LGC prices similarly drop away quickly post 2022



assumptions... do wind and solar farms require capacity credits at all? At least in the form of the current capacity mechanism, where credits for all facilities are measured as a contribution to ultra-peak demand (and where ultra-peak facilities are costing \$63,000/MWh in an average year). And does this then impact the rationale for implementing a WEM-wide constrained access regime (impacting the property rights of all existing generators), when some form of nodal constraint might be able to manage the issue, localised to the prospective new wind and solar regions³.

THE VALUE OF MODELLING – WHAT ARE THE CONSTRAINTS FOR WIND FARMS?

Highlighting the value of having access to data; is not having a clear understanding of the nature of the constraint issues in these areas. For example: new wind farms will produce significant quantities of energy, having high capacity factors approaching 50%. How much of this is curtailed? The wind resource in the North Country Region is reasonably correlated, so most wind facilities will be producing at the same time. It is the same with solar (though solar and wind are not generally coincident). But how closely do these correlate with times of network congestion (especially with the growth of BTM solar and lower future demand), where existing methodologies allocate low quantities of capacity credits based on low correlation to peak demand. And is the peak demand of the future the same as it is now (see below).

If new wind and solar facilities are not required to contribute to 1-in-10 year ultra-peak demand, does this change the nature of the network solution?

If new wind and solar facilities are able to produce energy at significant discounts to existing generation – but this is curtailed in large enough quantities, does the existing Western Power NFI enable economically efficient network expansion to remedy the situation? (perhaps coupled with some nodal constraint for the region).

IS THE CAPACITY MECHANISM PERFORMING ITS ROLE?

The capacity mechanism is integral to how the WEM is structured and, as the nature of supply and demand changes, will play a vital role in whether or not the WEM operates efficiently into the future.

Take the case of storage. Storage has not been considered so far in these high-level observations⁴, but it is probably the most important component of the new supply/demand paradigm of the future.

Figure 7 shows the same load duration curve as Figure 2, but without the storage. And Figure 8 shows the same average (February) daily load profiles in Figure 5, but with the addition of storage⁵.

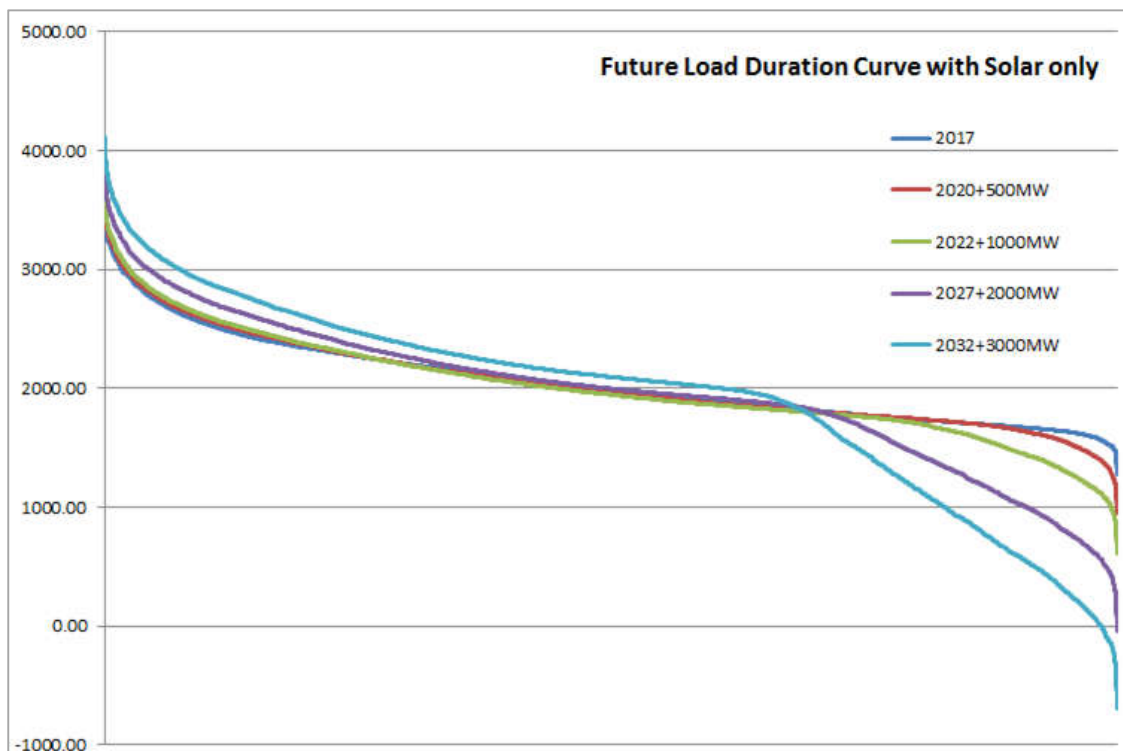
The implications for ensuring the mass adoption of storage in the WEM are obvious.

³ And given that the majority of scheduled generators (with firm access rights) are located in regions unlikely to experience network congestion as more plant retires than is constructed.

⁴ Although it is implicit in the Load Duration Curve in Figure 2.

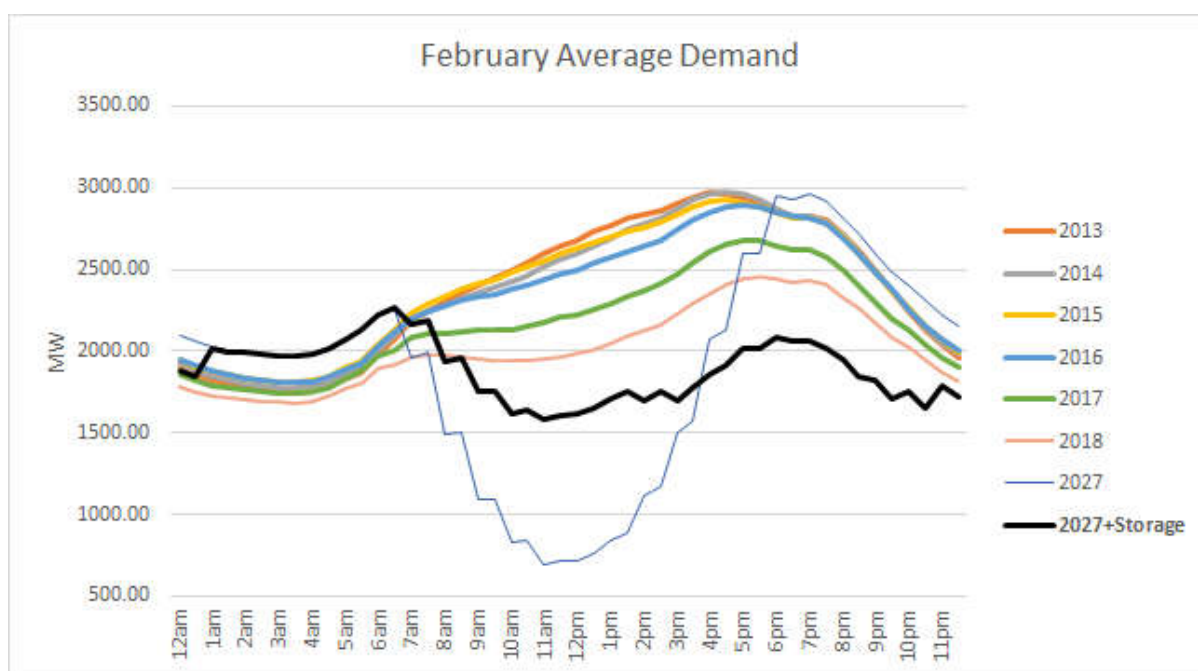
⁵ In Figure 8, the assumption is that 50% of all BTM generation is stored and time-shifted 8 hours.

Figure 7 – Future load duration curves including BTM solar with no storage



Each year after 2017 uses the 2017 interval data (an average demand year) increased by 1.25% annual load growth. Added to this is the indicated quantity of BTM solar (additive to the existing 2017 BTM solar), roughly equal to 200MW of additional BTM solar per year. The BTM solar uses PVsyst hourly interval output, so includes days of both low and high solar irradiance providing a realistic output.

Figure 8 – Daily load profiles (February average daily demand profile) with storage





The most immediate observation from Figure 7 is the number of low-demand intervals and their relative value, including some negative demand. This is a result of the large impact of BTM solar during the middle of the day. This is not the case in Figure 2 where the impact of time-shifting from storage moves the daytime BTM production into the evening.

The time shifting is more evident in Figure 8, where the average daily load profile of the curve with storage is significantly flatter. Absent the storage (but with significant solar uptake), the peaks are roughly the same as the current (2017) load profile, though a little later in the evening. While an average daily profile means there will be daily variance in real time, the benefits of flattening the load profile in this manner would be enormous.

The next observation is that the system peak in the solar-only load duration curve is around 400MW higher than in the curve with storage. Additionally, the system only peaks above 3,000MW for around 50 hours in the storage curve, but for around 150 hours in the non-storage solar-only curve. Again, the implications for meeting peak demand are important.

And finally, storage has the impact of shifting the peak demand intervals out of summer and (mostly) into winter... a very significant difference from the current capacity design philosophy.

However, the current capacity mechanism does not even contemplate storage... let alone incentivise it, just as it begins to reach an economic case for adoption at scale.

CONCLUSIONS

It is evident that under a different supply/demand scenario – which is inevitable in the near future, many current market mechanisms will struggle to produce efficient market outcomes. This is not unexpected as they were designed for very different circumstances. But the size of the inefficiencies should be more broadly understood before further significant reform of the nature proposed in the PUO discussion papers is embarked upon. It may well be the case that the reforms contemplated are the right course of action. But it may also be the case that a set of different solutions to a set of far more substantial issues may be more appropriate... or at the least, be understood and integrated into the solutions proposed the PUO.

It is hoped that the detailed modelling will shed further light as to the true nature of the issues that lie ahead. It is also hoped that the PUO expedites the capacity mechanism reform program to more seamlessly integrate with constrained network reform. Trying to figure out how to adapt the current capacity design into a constrained access model to accommodate a future supply/demand scenario for which it was not devised for does not seem to make a lot of sense.