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PV and CSP price sensitivity in a 100% renewable electricity scenario

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Several recent studies have demonstrated the technical viability of high penetration renewable energy scenarios for the Australian electricity market, with the studies producing a variety of combinations of technologies depending on the input assumptions (Blakers et al, 2017, Jeppesen et al., 2016, Elliston et al., 2014). In this study we investigate the impact of different assumptions of the future costs of photovoltaics and concentrating solar thermal power using the Melbourne/Monash Renewable Energy Integration Lab (MUREIL) modelling framework. This model finds the least cost combination of generation technologies (both renewable and conventional) and transmission network augmentations to meet a given demand profile and emission abatement target. The model solves for the transition from today's generation capacity mix to 2050 in 5-year increments, using hourly demand and energy generation potential data. Using cost projections from the BREE AETA (BREE, 2013) study as the reference case we then run the simulation with increasingly optimistic projections for PV and CSP as shown in the graph. In each scenario the costs of other technologies (wind, hydro, transmission lines upgrades, coal and gas, storage systems and demand response) are kept the same as the reference case.

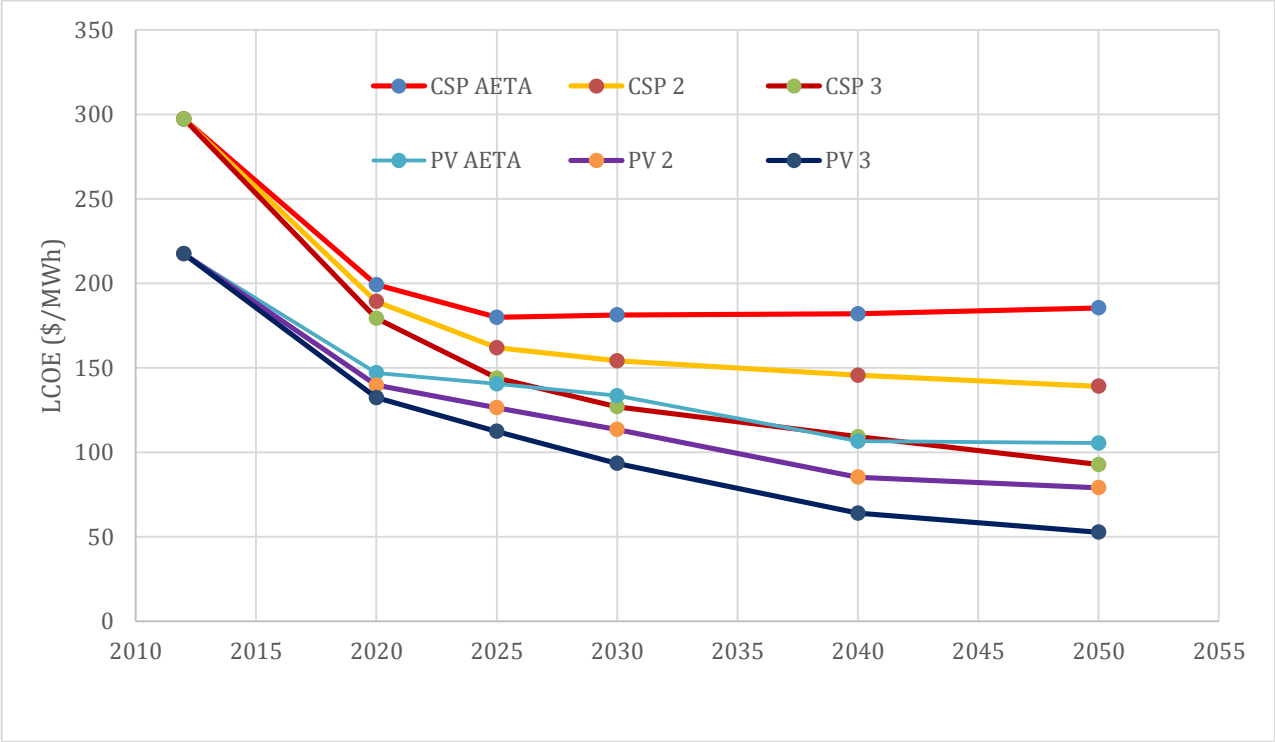

Figure 1. AETA BREE cost projections and additional projections considered in this study.

Results will show that the optimal generation mix in each scenario is highly dependent on the cost assumptions. At certain points, when a technology becomes cheap enough, it is rapidly taken up in the model. That tipping point however is determined in part by the costs of the alternate technologies in the mix. PV, being relatively cheap in terms of LCOE compared to CSP sees significant uptake as long as storage technologies are available and cost effective (i.e. pumped hydro energy storage). Concentrating solar thermal is expensive at the start of the simulations, but under optimistic price scenarios it dominates over photovoltaics as it is able to provide dispatchable electricity and system inertia onto the grid without the need for additional storage.

This study gives an indication of the cost targets that solar technologies should be aiming for to remain (or to become) competitive in future markets. Our model assumes that the market will work perfectly efficiently, but in the real world there will of course be other competing factors such as regulatory frameworks that may favour certain technologies or market distortions such as feed-in-tariffs that are only available for distributed technologies.

References

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