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Revenue Sufficiency for Flexible Resources in the Australian NEM With High Renewable Energy Penetrations

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Abstract

In order to assist international efforts in mitigating the severity of anthropogenic climate change, the incorporation of higher penetrations of variable renewable energy (VRE) resources such as wind and photovoltaics into Australia's National Electricity Market (NEM) seems necessary. However, implications for wholesale electricity prices may be problematic market-wide. VRE generators have very low short-run marginal costs and tend to bid low offers into the NEM's wholesale market in order to ensure dispatch, thereby reducing the market clearing price for that dispatch interval. Lower wholesale prices at times of high instantaneous VRE penetration may result in revenue insufficiency for various types of electricity generators (Özdemir et al., 2013) and creates a disincentive for market entry, particularly for VRE resources, which may slow deployment and prevent the realisation of ambitious emissions reductions goals (Wilkie, 2015; Samocha, 2017). Furthermore, the combination of high penetration VRE and the NEM's ageing fossil fuel fleet gradually exiting the market may necessitate the uptake of dispatchable flexible resources (e.g. biomass generators, batteries, pumped hydro) in order to complement VRE resource dispatch and provide synchronous or emulated system inertia and dynamic response to manage increasingly variable grid conditions. Hence flexible resources may be instrumental in achieving both system reliability and security while satisfying future sustainability requirements. However, to reward the invaluable services they can provide to the grid and enable capital cost recovery in light of falling wholesale prices, changes to the market rules may be necessary.

In this paper, Energy Exemplar's PLEXOS simulation software will be used to assess the effectiveness of a capacity remuneration mechanism (CRM) to drive flexible resource deployment and VRE integration. Generator revenues and market impacts will be modelled in VRE penetration scenarios from 40-100% of annual total energy consumption for the year 2040. A requirement for minimum instantaneous penetration of flexible resources between 0-40% will also be modelled and assessed.

References

Özdemir, Ö. et al., 2013, 'Generation Capacity Investments and High Levels of Renewables - The Impact of a German Capacity Market on Northwest Europe', *Energy Research Centre of the Netherlands*, p3-12.

Samocha, S., 2017, 'Generator Revenue in the Australian National Electricity Market with High Renewables and a Synchronous Generation Constraint', *University of New South Wales*, Asia-Pacific Solar Research Conference, p11.

Wilkie, O., 2015), 'Revenue Sufficiency in the Australian National Electricity Market with High Penetrations of Renewable Energy', *University of New South Wales*, Asia-Pacific Solar Research Conference, p10.