ASIA-PACIFIC
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Review of voltage management approaches and network regulation: who pays and how?

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Australia has the highest penetration of rooftop solar photovoltaics (PV) worldwide, comparable only with Hawaii as shown in Figure 1 (International Energy Agency 2016), and it is widely accepted that over voltage is a key concern for integration of PV into distribution networks (Passey, Spooner et al. 2011, International Energy Agency 2017). However, the approach to maintaining voltage within its required envelope can vary widely, including both 'network' and 'non-network' solutions. For instance, installing voltage regulators and curtailing PV generation can both resolve over voltage issues. Clearly these different approaches to maintaining voltage can have significant financial implications for electricity consumers and may exacerbate concerns regarding cross subsidisation as customers without PV are required to contribute to network costs, without benefitting from self generation and thereby reduced power bills.

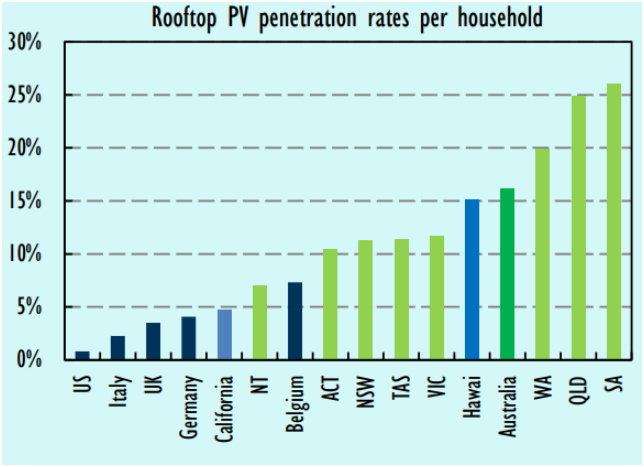

Figure 1. International rooftop PV penetration rates per household (International Energy Agency 2016)

This paper presents a review of approaches to voltage management given the existing culture and network regulation incentives. Preliminary analysis of Australian PV curtailment due to over voltage conditions is examined, with this supporting analysis utilising a unique data set kindly provided by Solar Analytics. This study summarises the different approaches to voltage management, with particular attention to how costs are shared amongst consumers.

Previous work has shown that the low voltage network in Australia is generally run high (Stringer, Bruce et al. 2017) and that this is likely the cause of reported power quality issues (Miller, Liu et al. 2018). The data set examined in this study is unique in that it includes a significant number of sites

across South Australia. The data set contains 30 second data for ~170 individual premises. Preliminary findings on the volume of curtailed PV generation and resultant financial impacts are presented and implications for different voltage management approaches are discussed.

'Who pays' for maintenance of voltage and other grid congestion management may determine the feasibility of a high PV penetration grid over the coming years as public support is likely to be critical through the period of transition to a more decentralised and decarbonised electricity system. As result, findings are likely to be of relevance to a number of ongoing industry consultation processes within Australia, including the join AEMO and Energy Networks Australia project 'Open Energy Networks'.

References

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