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Economic Analysis of Residential Photovoltaic Systems in Australia

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Australia has likely the highest penetration of distributed photovoltaic (PV) system capacity in the world with more than 2.1 million distributed PV systems (mostly residential) representing around half of the 12GW PV capacity installed in the country [1]. It is expected that the number and capacity of distributed PV systems will continue to increase over the next few decades. The combination of ever-declining PV system prices and high electricity prices are two key reasons for the high PV uptake in Australia. The benefit to consumers of installing PV systems has been analysed in previous studies, showing a clear financial benefit in many countries including Australia [2]. While previous studies show that installing PV has an excellent payback period for the average household, the outcome for an individual household will depend on the PV system's performance, the user's consumption pattern, and the retail tariff, and could significantly vary across different households. In this paper, using a large number of actual load and PV profiles from the greater Sydney area, a detailed analysis of the distribution of PV self-consumption, bill reduction, and pay-back period outcomes is presented. The analysis is performed using CEEM's open-source Tariff Design and Analysis (TDA) tool [3] under six different retail tariffs. To investigate the inter-annual variability, three years' worth of load and PV data have been used. Moreover, to evaluate the impact of PV size, the output data of PV systems is scaled to reflect different PV system capacities. Finally, a sensitivity analysis of the PV system's capital cost is performed.

The preliminary results show a significant variability in the financial benefits of PV for different households. The difference in PV-load correlation among households leads to a different fraction of exported energy. Since feed in tariffs for this exported energy are substantially lower than consumption tariffs, different export percentages lead to significantly different savings and hence payback periods. As shown in figure 1, a huge range from almost zero to 80% of energy exported is seen across households, even when a very small PV system capacity is modelled. With larger PV systems, the differences are still evident, but since much of the energy is exported for most households, there is a smaller range. The payback period also varies across different households and with PV system size, ranging from less than four years to more than 19 years for a system between 2 and 3kW. The economic benefit tends to be higher for larger systems up to 5kW, but declines for systems larger than 5kW. The results highlight the importance of detailed and tailored economic analysis for a range of customers with varied PV system operational conditions and even more unique load profiles.

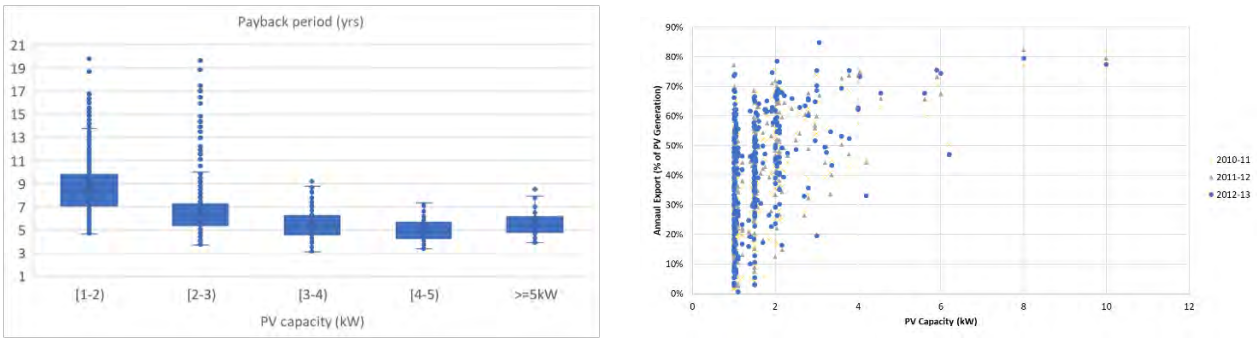

Figure 1 Payback period and % of PV export in different PV sizes

References

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