Impact of 2023 Tariff Changes on Outcomes for Households with and without Solar and Battery Storage

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Introduction

Rising electricity prices and the climate crisis have prompted Australians to seek out affordable renewable energy options. The decreasing costs of solar photovoltaic (PV) and battery energy storage (BES) technologies, coupled with government incentives, are encouraging a greater adoption of residential solar systems (Clean Energy Council, 2023). To continue this trend into the future, PV solutions need to provide significant cost advantages over non-renewable energy resources. There is strong evidence that consumers are motivated to either adopt or forgo solar installation by the potential the economic impacts (Alipour et al., 2022), and that financial incentives are the most significant persuaders (Fauzi et al.,2023). In this analysis, the change in residential tariffs from 2022 to 2023 is investigated for how they impact the average household's energy bill as well as the change in payback period for PV/BES systems. This aims to provide clear evidence of the financial impacts of solar installations, as well as insights into potential changes in future electricity bills.

Motivation

This analysis aims to understand the financial value of PV and BES systems for households, and how this has been impacted by the recent tariff changes. It builds upon the established body of research by incorporating up-to-date tariff information and presenting the most recent effects on electricity bills. By offering a clear and quantifiable assessment of the current economic impacts of PV systems, this analysis seeks to inspire more individuals to consider and invest in PV installations for long-term cost savings.

Method

This study is done with residential load data from a Smart-Grid Smart-City (SGSC) customer trial which took half hourly measurements of load from NSW (New South Wales) houses for a year (specifically, 1/7/2012 -30/6/2013). 235 of these homes are used in this analysis each with a complete set of half-hourly data for the entire year. In Figure 1, you can see the average day in these load profiles. This study is limited as energy use will have changed since 2012, driven by increased appliance efficiency and electrification.

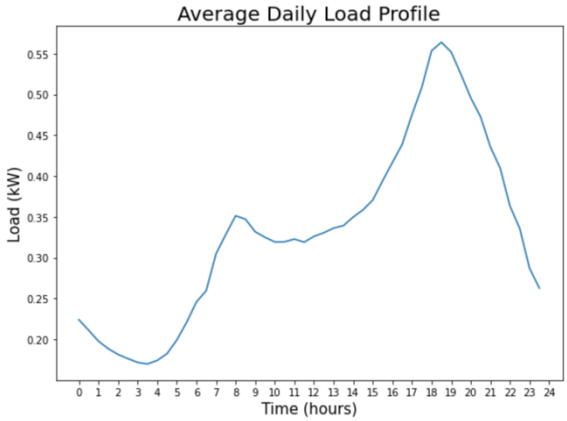

Figure 1: The average daily load profile of NSW households in the SGSC customer trial.

This analysis uses half hourly PV generation data from Ausgrid covering 300 systems over the same timeframe that the SGSC data covers.

The tariff values for NSW in 2022 and 2023 that are used in this analysis are the time of use (TOU) and flat rate (FR) tariffs for the three biggest retailers for each NSW distributed network service provider. Demand and seasonal time of use tariffs are removed for the simplicity of this analysis as they are not as common for residential homes and are more often associated with commercial and industrial consumers.

PV system costs and battery costs used in this analysis are the average standard system and average battery costs from July 2022 as reported by Solar Choice.

Data from the Australian PV Institute (APVI) shows that the current average system size installed is 9kW (APVI, 2023). Therefore, this analysis will compare PV system sizes of 6, 8, 10 and 12kW to reflect a range of recent installation sizes.

This analysis takes the load profiles of NSW consumers and estimates the electricity bill under the 2022 and 2023 tariffs. It examines these bills for households without PV, with PV systems of a range of sizes, and with PV and a 10kWh battery. A 10kWh battery was chosen as recommended by Solar Choice for a household with the average PV system size of 9kW and the average daily energy consumption of 16-20kWh.

With TOU tariffs, the battery calculation aims to optimize the use of the battery to minimize costs during peak-rate periods and maximize savings during off-peak periods. On the other hand, the FR battery operation simply, charges with excess until full then discharges until empty.

Results and Discussion

In general, the daily value, feed in tariff and both the flat rate and time of use tariffs (Appendix) have all increased. Thus, electricity bills have increased with and without solar (as seen in Figure 2). Electricity bills of households with a PV system have increased less and adding a battery to your system further reduces the bill increase.

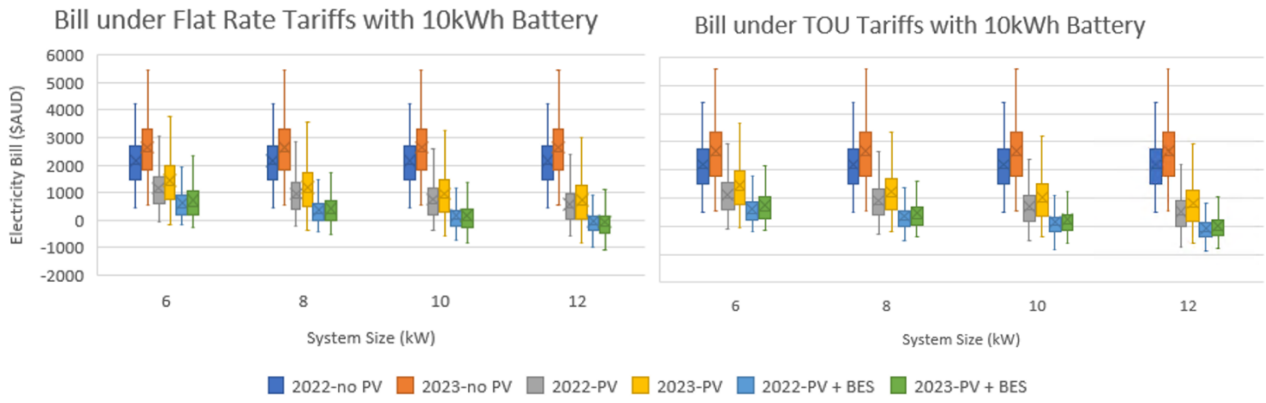

Figure 2: Electricity bills for households without PV, with PV and with PV and a battery for 2022 and 2023.

It is noted that the bill is negative for larger systems with a 10kWh battery. This is a credit from the electricity company that can be a credit straight into your bank account or is rolled over into future billing periods, depending on the individual retailer.

The most significant benefit that solar provides with this tariff change is it increases the difference between the bill with solar and the bill without solar, thus increasing the savings that solar provides. Average households with a 10kW system are saving $265 more than last year under flat rate tariffs and $279 more under time of use tariffs. Adding a battery further increases the savings, as can be seen in Figure 3.

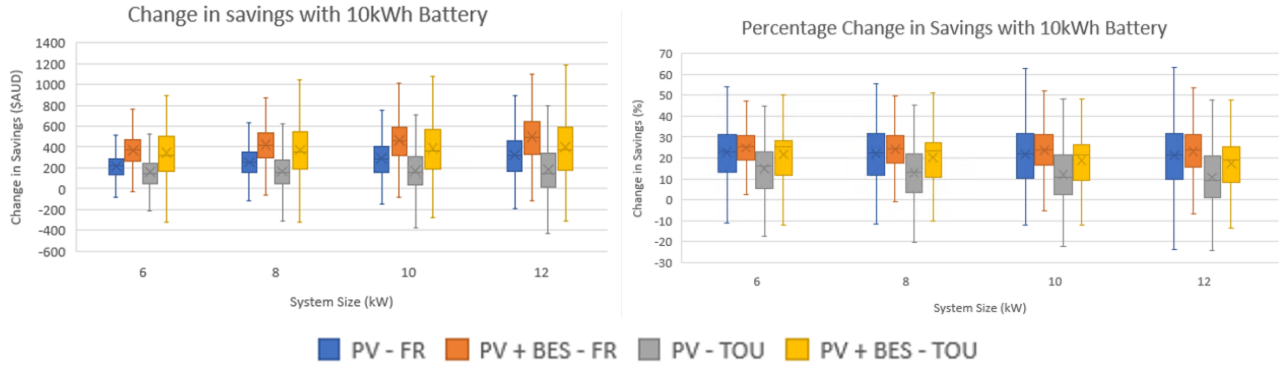

Figure 3: Absolute and percentage change in the savings that PV provides between 2022 and 2023 at different system sizes for households with solar and with solar and a battery.

Customers are saving more in 2023 with a PV system, with and without a battery. This increase in savings allows a PV system to recover its cost faster. This is shown on Figure 4 representing the number of years it would take for the cumulated savings from a PV system to equal the cost of the system (and battery if applicable). The change in tariffs from 2022 to 2023 reduces the payback period for systems with and without BES, with the 2023 tariffs resulting in an average payback period for a PV+BES of around 8 years. This is shorter than what is generally expected for the lifespan of most batteries. As an illustration, the Tesla Powerwall, comes with a 10-year warranty.

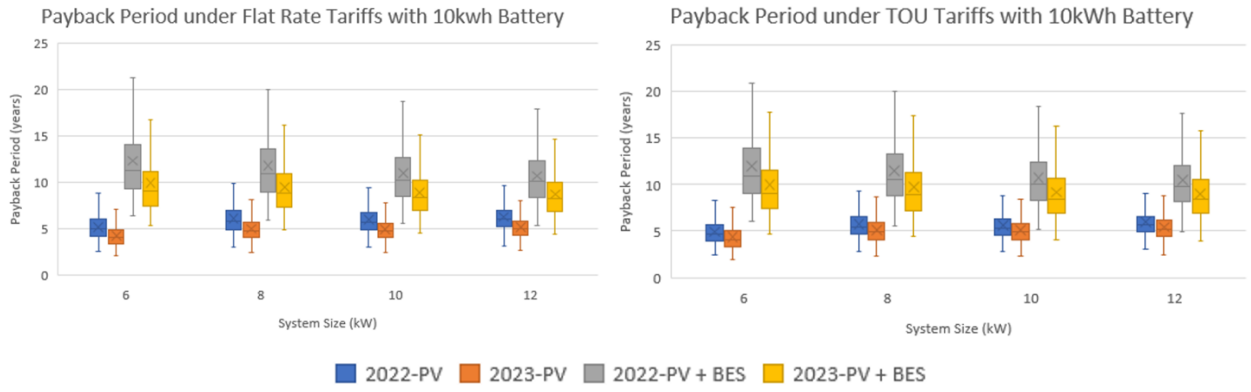

Figure 4: Payback period with a 10kWh battery.

Payback for systems with batteries is much longer due to capital cost of the battery and installation. The payback period for battery alone is the time in which the extra savings that the battery provides equals the cost of the battery, not considering any savings from just the PV system. Figure 5 displays that, for a 10kWh battery, payback has decreased quite significantly in 2023, roughly 5 years under flat rate tariffs and 7 years under time of use tariffs.

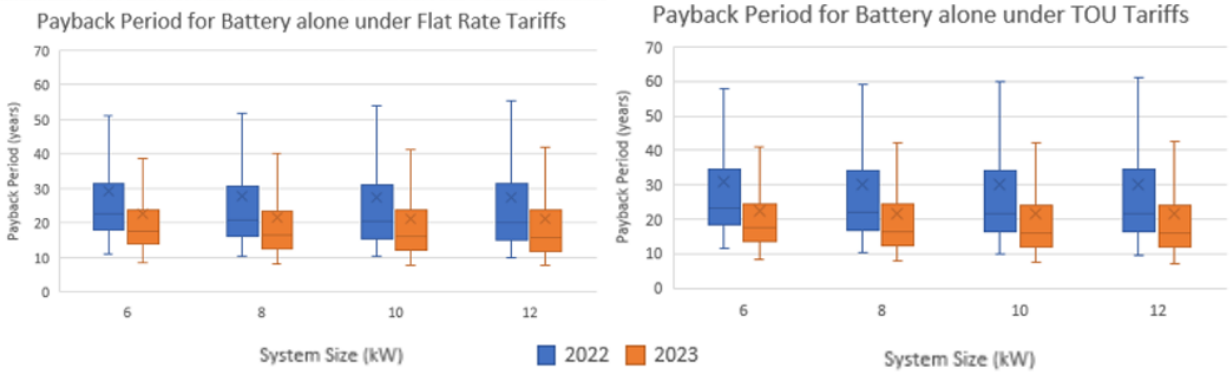

Figure 5: Payback period of 10kWh battery alone.

Conclusion

This initial analysis only compares 2022 and 2023 tariffs for NSW, further analysis will include the other states as well as systems with different battery sizes.

These findings emphasize the financial benefits of adopting PV and BES technology, not only to offset rising electricity costs but also to expedite the return on investment. As electricity prices continue to rise, transitioning to PV and BES solutions can be expected to become increasingly popular, offering tangible economic advantages and thus, encouraging wider adoption.

The work is supported by the Australian Centre for Advanced Photovoltaics (ACAP) and received funding from the Australian Renewable Energy Agency (ARENA).

This work was completed with the support of the Australian Research Council Project ID ***ARC IH180100020***

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