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SYDNEY

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

APSRC, 5-7 Dec 2023, RMIT, Melbourne

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

Introduction



Financial incentives are the most significant motivators for consumers



Looking at the impact of tariff changes on

Household's energy bill for PV/battery energy storage (BES) systems

Payback period for PV/BES systems



To inspire more individuals to consider and invest in PV installations for long-term cost savings.

Data

- Residential **load** data from the Smart-Grid Smart-City (SGSC) customer trial, involving half-hourly load measurements from 235 NSW houses spanning from 1/7/2012 to 30/6/2013.
- Half hourly **PV generation** data from Ausgrid covering 300 systems.
- System and battery costs from July 2022 from Solar Choice.

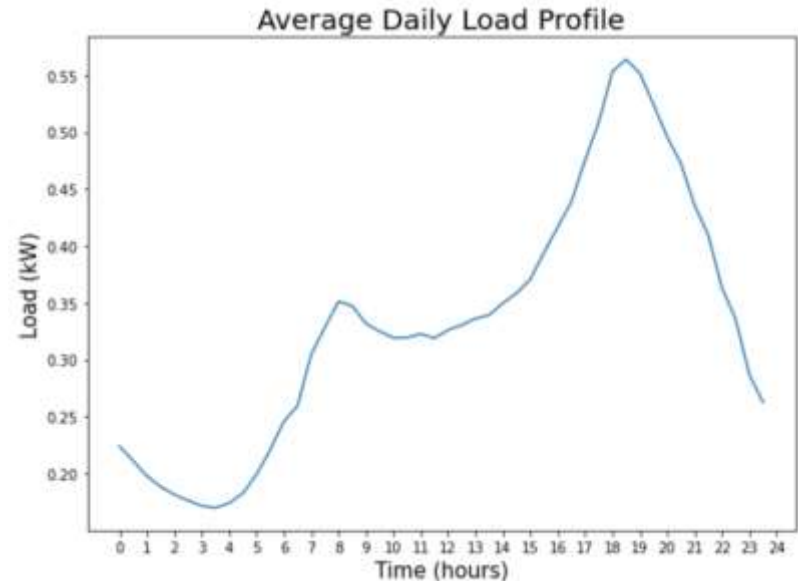


Figure 1: The average daily load profile of NSW households in the SGSC customer trial

2022

2022 Flat Rate Tariffs

Distributor	Daily Value(\$/day)	FiT Value(\$/kWh)	Flat Rate Value(\$/kWh)
Ausgrid	0.88125	0.062667	0.28968
Endeavour Energy	0.92648	0.0652	0.29588
Essential Energy	1.59685	0.071	0.31207

2022 ToU Tariffs

Distributor	Daily Value(\$/day)	FiT Value(\$/kWh)
Ausgrid	1.0466	0.075
Endeavour Energy	1.0599	0.0625
Essential Energy	1.6278	0.071

Ausgrid		
Time of Use	Time Intervals	Value
Off Peak Weekdays	22:00-07:00	0.1586
Off Peak Weekends	22:00-07:00	0.1586
Peak Weekdays	14:00-20:00	0.5337
Shoulder Weekdays	07:00-14:00, 20:00-22:00	0.2356
Shoulder Weekends	07:00-22:00	0.2356

Endeavour Energy		
Time of Use	Time Intervals	Value
Off Peak Weekdays	22:00-07:00	0.197725
Off Peak Weekends	00:00-00:00	0.197725
Peak Weekdays	13:00-20:00	0.397325
Shoulder Weekdays	07:00-13:00, 20:00-22:00	0.3307

Essential Energy		
Time of Use	Time Intervals	Value
Off Peak Weekdays	22:00-07:00	0.2376
Off Peak Weekends	00:00-00:00	0.2376
Peak Weekdays	07:00-09:00, 17:00-20:00	0.4152
Shoulder Weekdays	09:00-17:00, 20:00-22:00	0.3801

2023

2023 Flat Rate Tariffs

Distributor	Daily Value(\$/day)	FiT Value(\$/kWh)	Flat Rate Value(\$/kWh)
Ausgrid	0.957	0.0836	0.3776
Endeavour Energy	1.0747	0.077	0.3733
Essential Energy	1.6702	0.07	0.3769

2023 ToU Tariffs

Distributor	Daily Value(\$/day)	FiT Value(\$/kWh)
Ausgrid	1.0461	0.07
Endeavour Energy	1.1167	0.055
Essential Energy	1.7985	0.0836

Ausgrid		
Time of Use	Time Intervals	Value
Off Peak Weekdays	22:00-07:00	0.2556
Off Peak Weekends	00:00-00:00	0.2556
Peak Weekdays	13:00-20:00	0.4824
Shoulder Weekdays	07:00-13:00, 20:00-22:00	0.3854

Endeavour Energy		
Time of Use	Time Intervals	Value
Off Peak Weekdays	22:00-07:00	0.2742
Off Peak Weekends	00:00-00:00	0.2742
Peak Weekdays	13:00-20:00	0.5641
Shoulder Weekdays	07:00-13:00, 20:00-22:00	0.485

Essential Energy		
Time of Use	Time Intervals	Value
Off Peak Weekdays	22:00-07:00	0.3322
Off Peak Weekends	00:00-00:00	0.3322
Peak Weekdays	07:00-09:00, 17:00-20:00	0.5335
Shoulder Weekdays	09:00-17:00, 20:00-22:00	0.4581

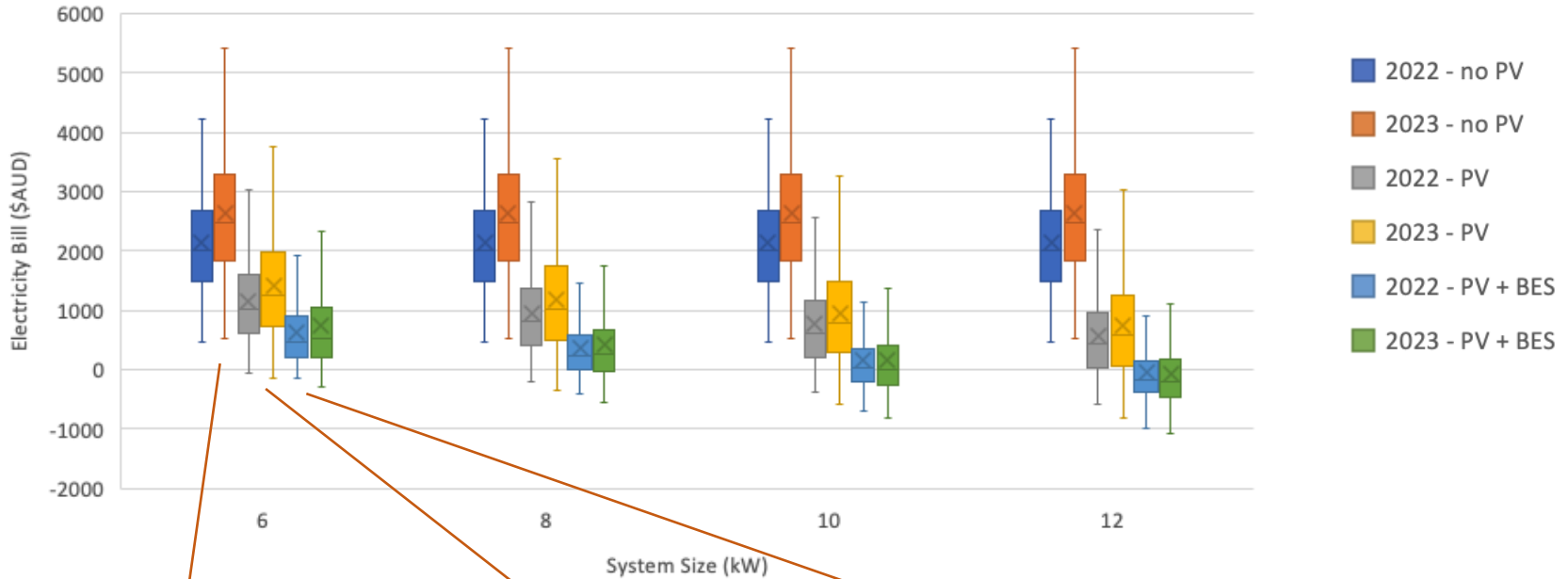


Method

- We take the NSW consumers load profiles and randomly assign them a PV generation profile
- Calculate the **electricity bill**, **annual savings** and **payback period** under the 2022 and 2023 tariffs
 - Using SunSPOT algorithms
 - 6,8,10,12 kW systems
 - 10kWh Battery
- Battery operation
 - TOU - minimise costs during peak-rate periods and maximise savings during off-peak periods
 - Flat Rate – charge with excess until full then discharge until empty

Results

Bill under Flat Rate Tariffs with 10kWh Battery



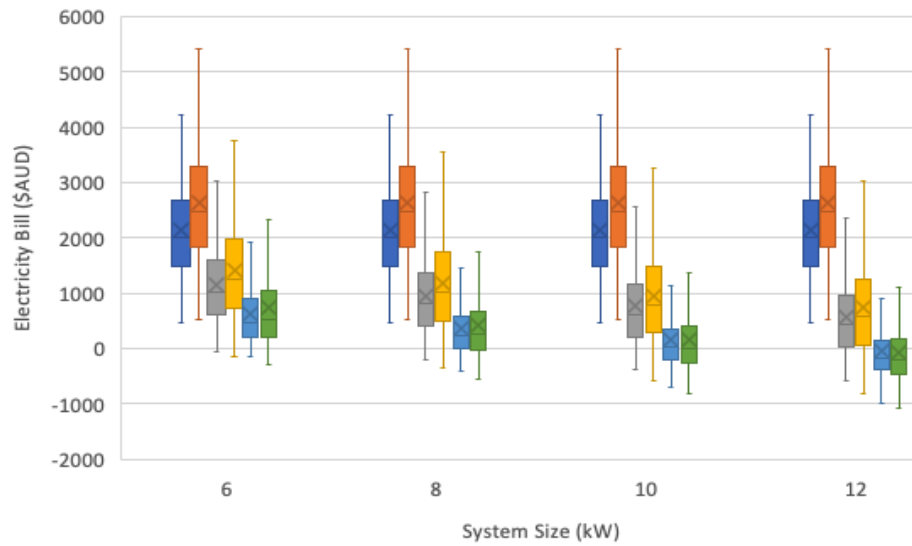
With no PV
\$500 increase

With 6kW system
\$300 increase

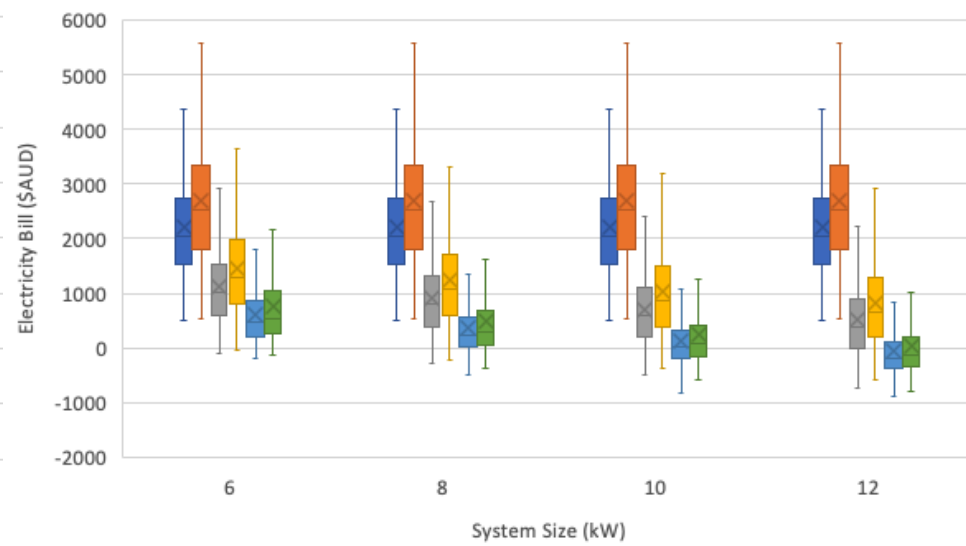
With 6kW
system and
10kWh Battery
\$100 increase

Results

Bill under Flat Rate Tariffs with 10kWh Battery



Bill under TOU Tariffs with 10kWh Battery

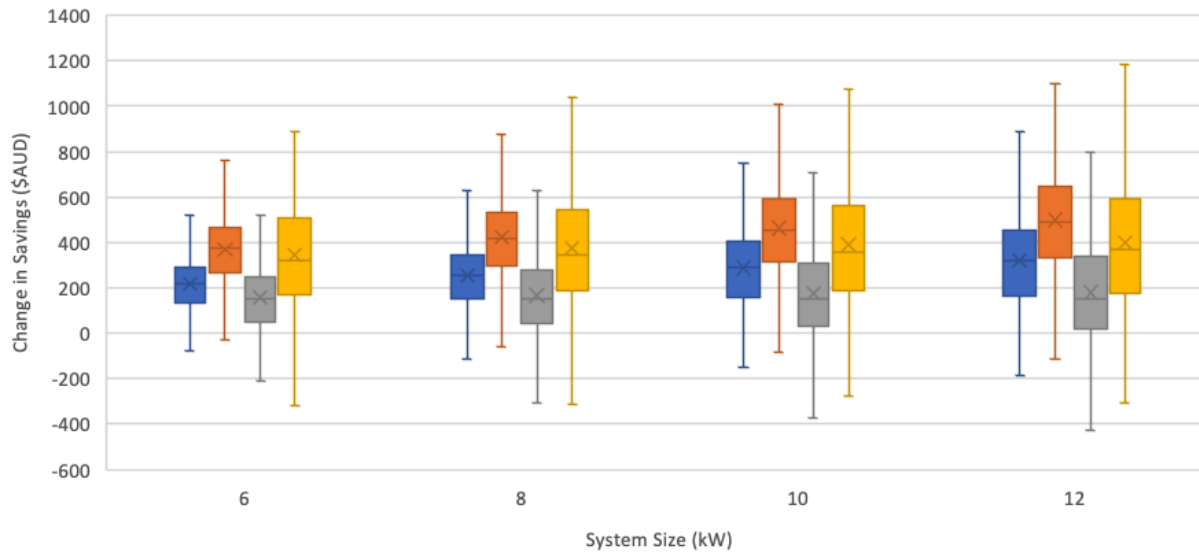


■ 2022 - no PV ■ 2023 - no PV ■ 2022 - PV ■ 2023 - PV ■ 2022 - PV + BES ■ 2023 - PV + BES



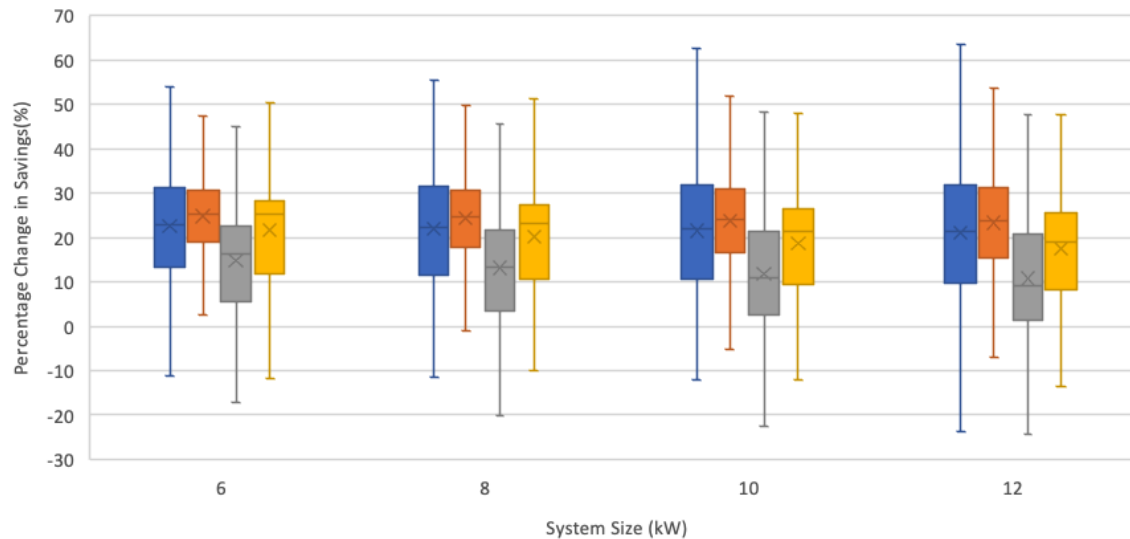
Results

Change in Savings with 10 kWh Battery



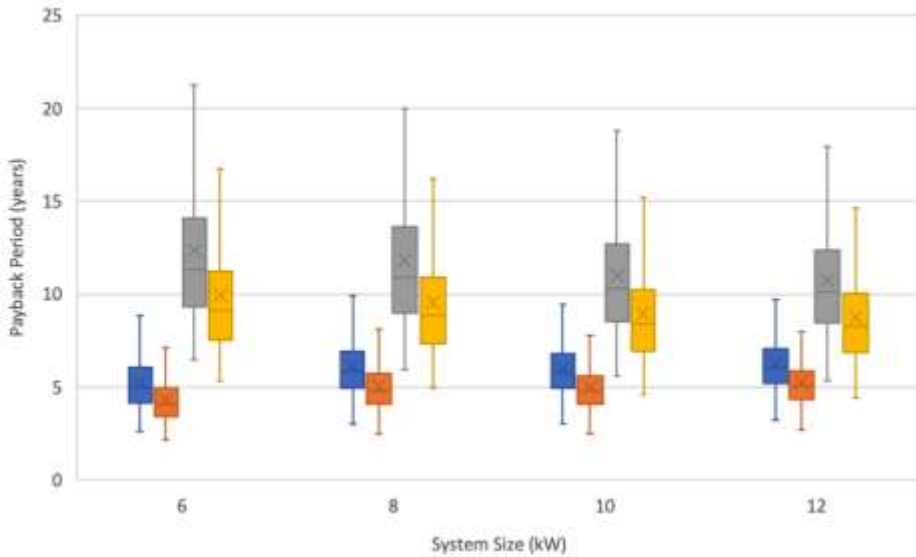
- PV - FR
- PV + BES - FR
- PV - TOU
- PV + BES - TOU

Percentage Change in Savings with 10kWh Battery

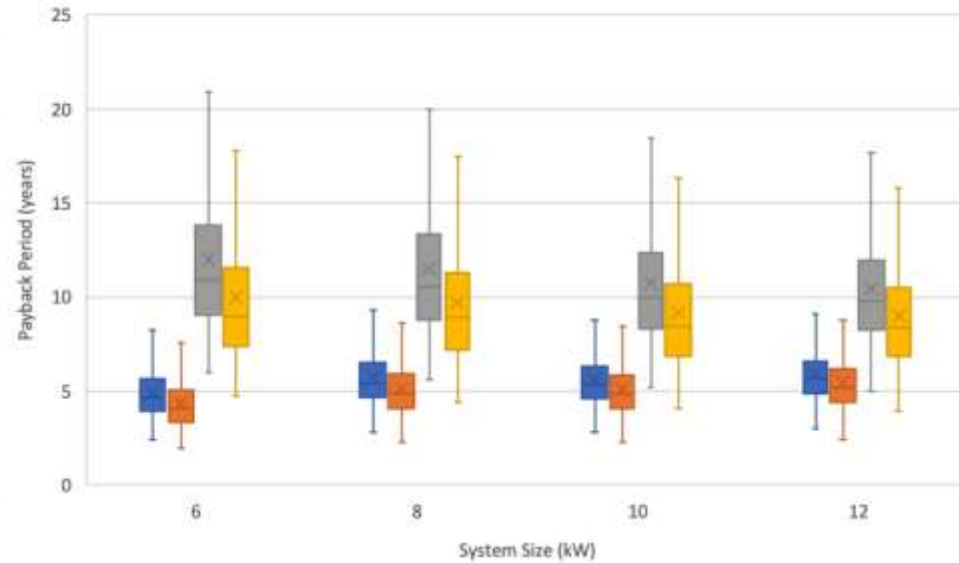


Results

Payback Period under Flat Rate Tariffs with 10kWh Battery



Payback Period under TOU Tariffs with 10kWh Battery

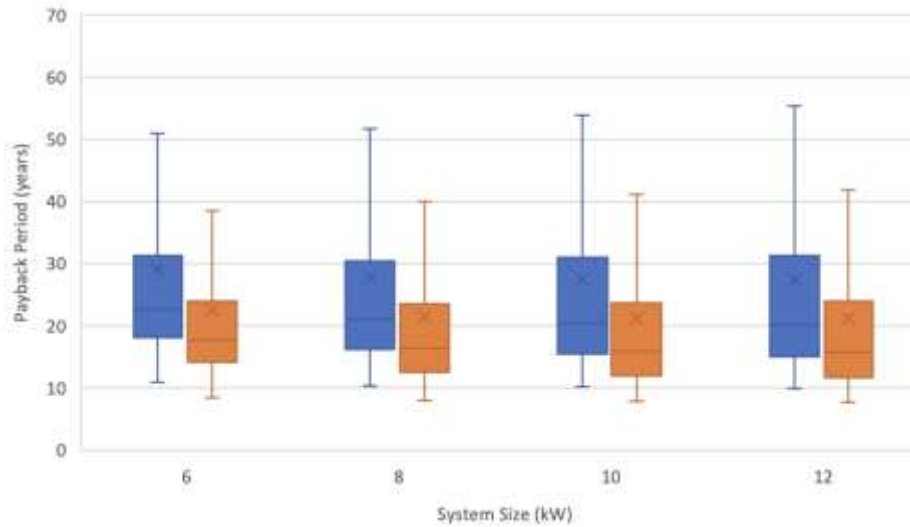


■ 2022 - PV ■ 2023 - PV ■ 2022 - BES + PV ■ 2023 - BES + PV

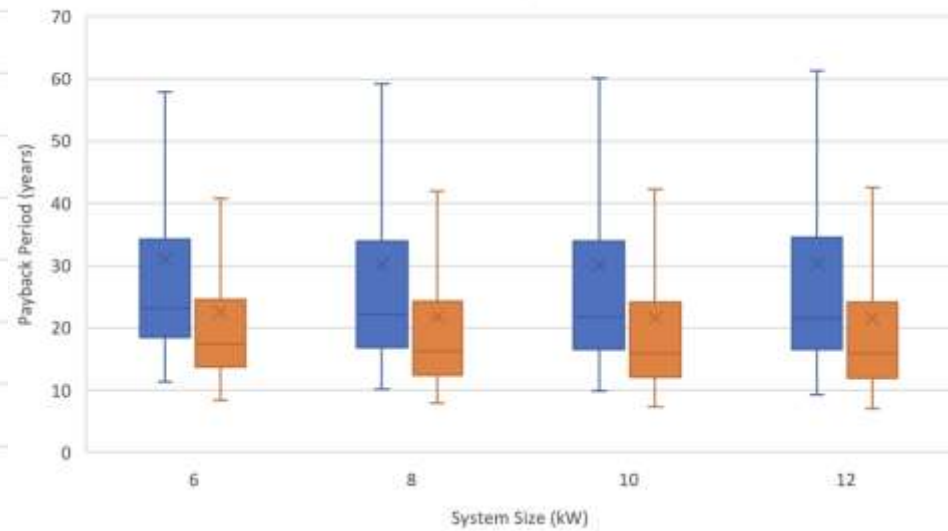
Payback periods in 2023 are now below expected lifetime

Results

Payback Period for Battery alone under Flat Rate Tariffs with 10kWh Battery



Payback Period for Battery alone under TOU Tariffs with 10kWh Battery



■ 2022 ■ 2023



Summary

- Investigated the impact of the recent changes in tariffs on annual residential bills
- PV systems protect a household from the rising tariffs
- Homes with PV and BES saw a smaller increase in their bills, saving 20-25% more than they did last year
- Payback times for solar and batteries improved further with the higher tariffs – with PV payback now as low as 3 years and PV + BES payback as low as 4 years!



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Thank you!

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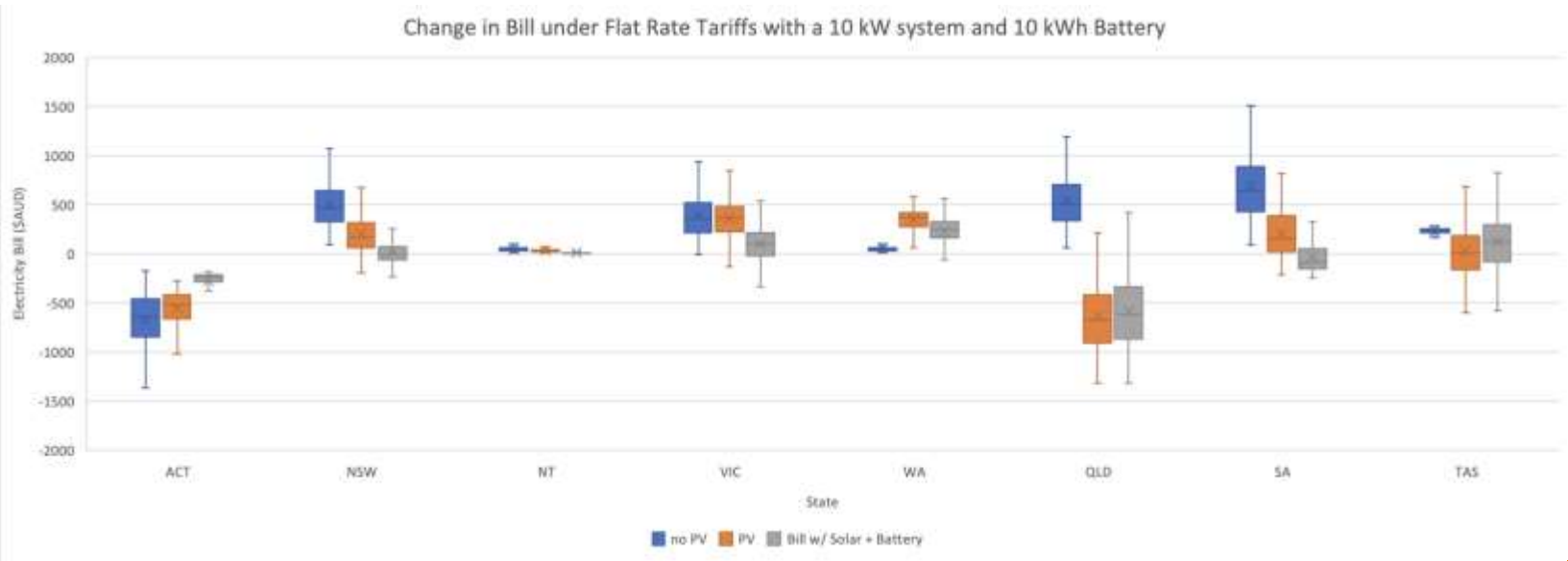
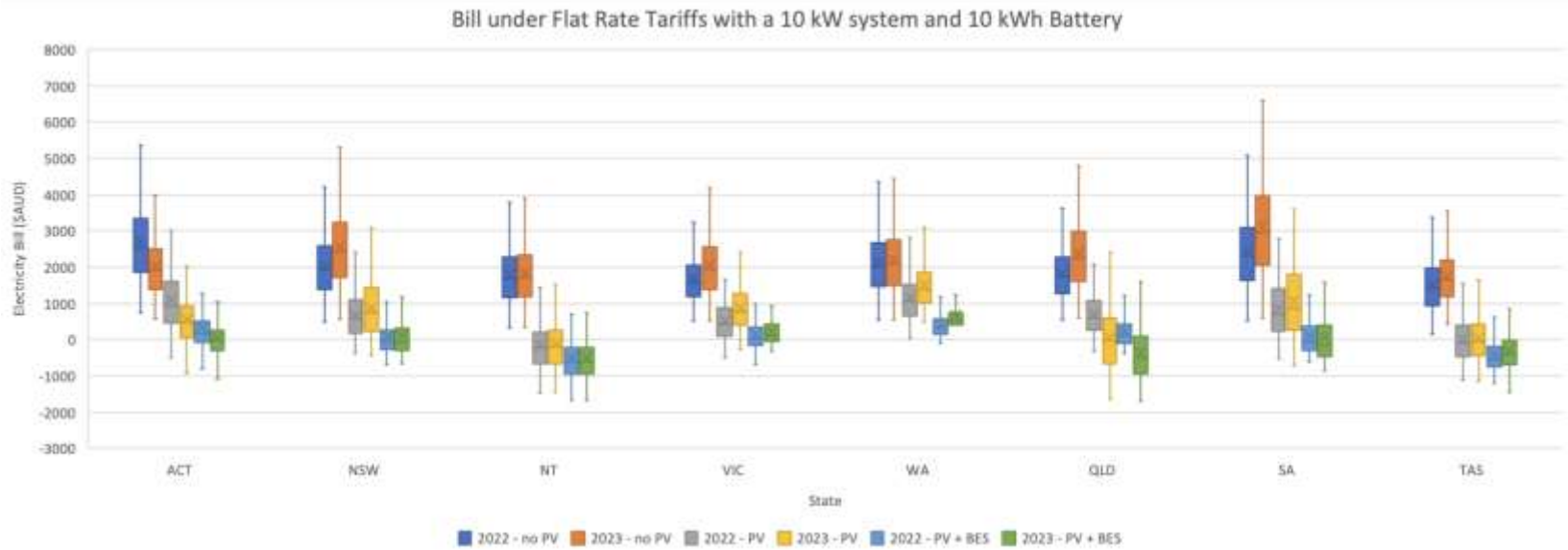


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Appendix

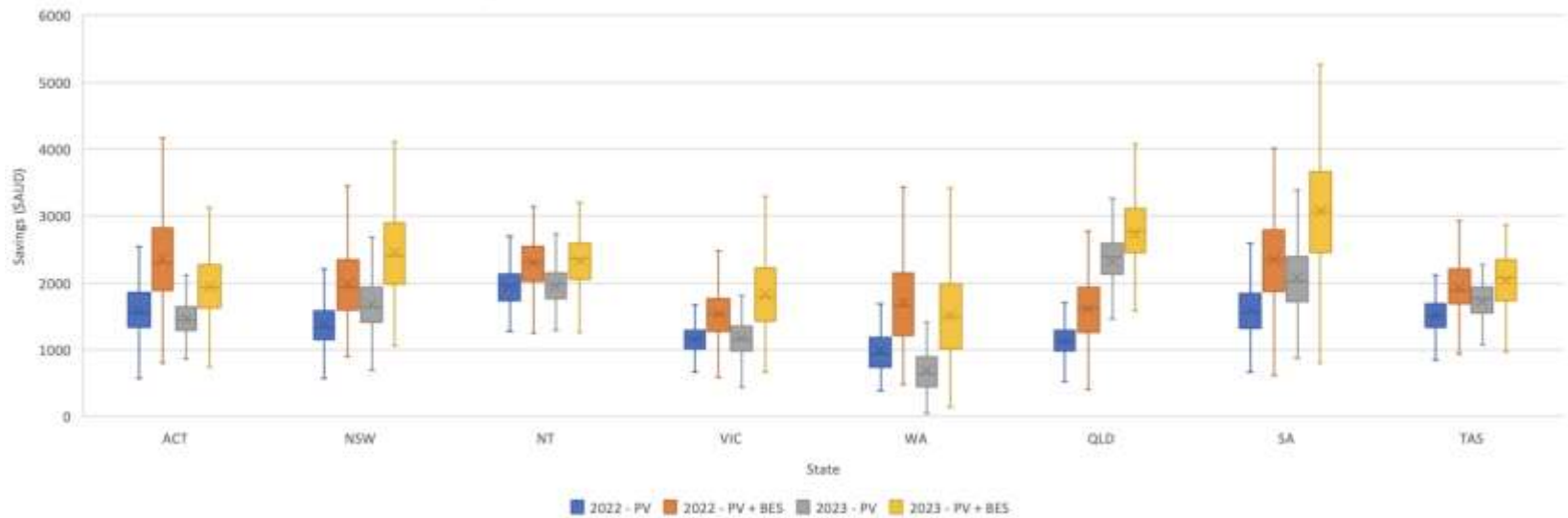
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Electricity bill – by state

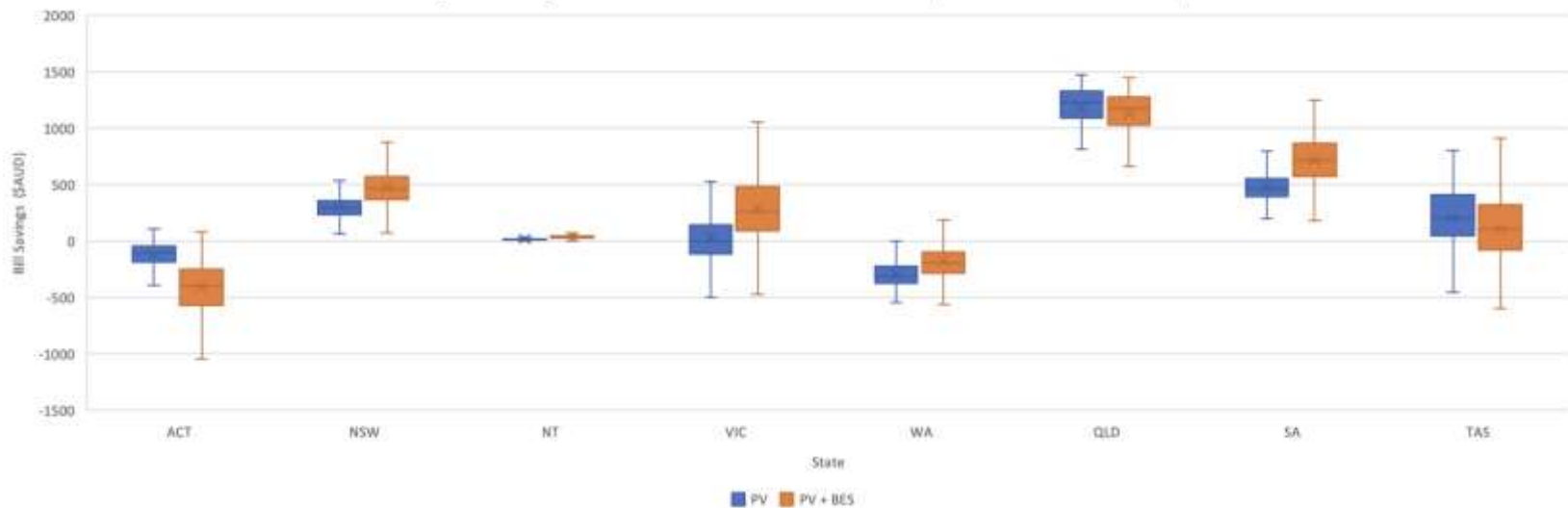


Savings – by state

Savings under Flat Rate Tariffs with a 10 kW system and 10kWh Battery

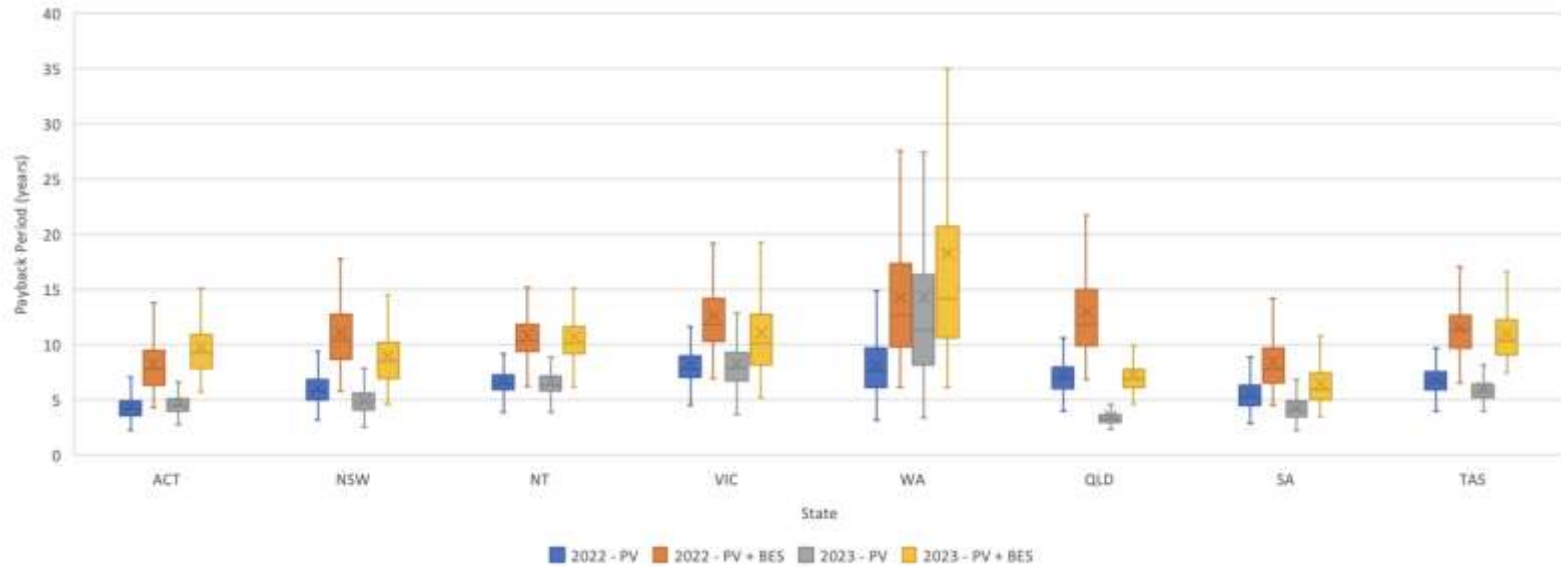


Change in Savings under Flat Rate Tariffs with a 10 kW system and 10kWh Battery

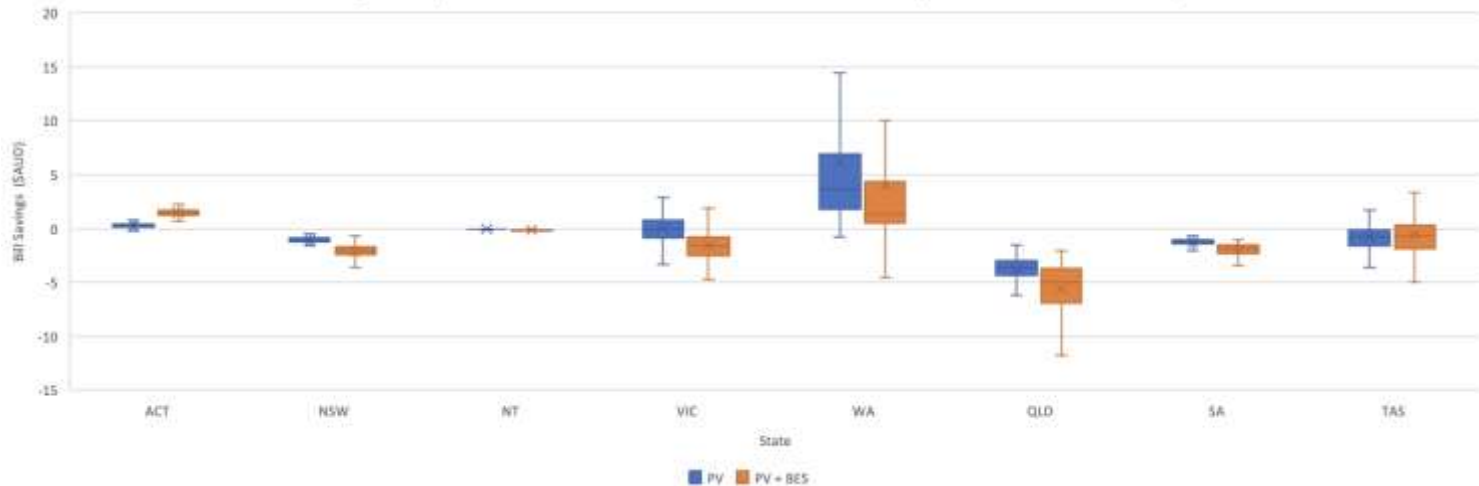


Payback Period – by state

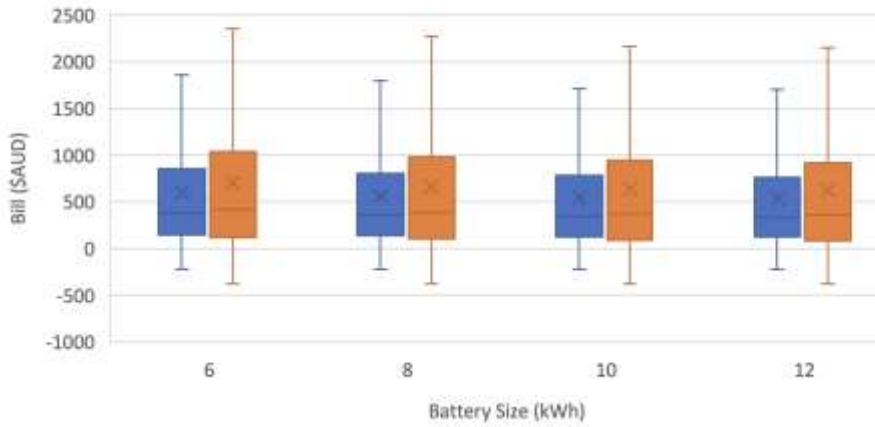
Payback Period under Flat Rate Tariffs with a 10 kW system and 10kWh Battery



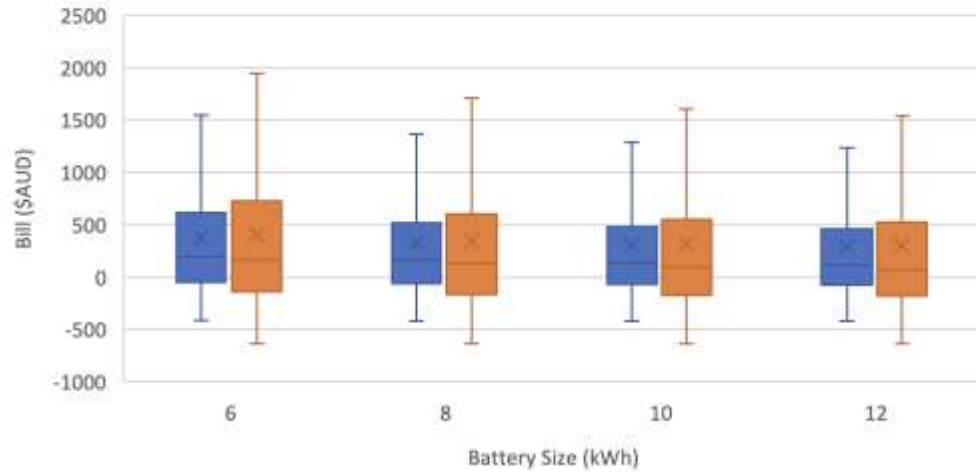
Change in Payback Period under Flat Rate Tariffs with a 10 kW system and 10 kWh Battery



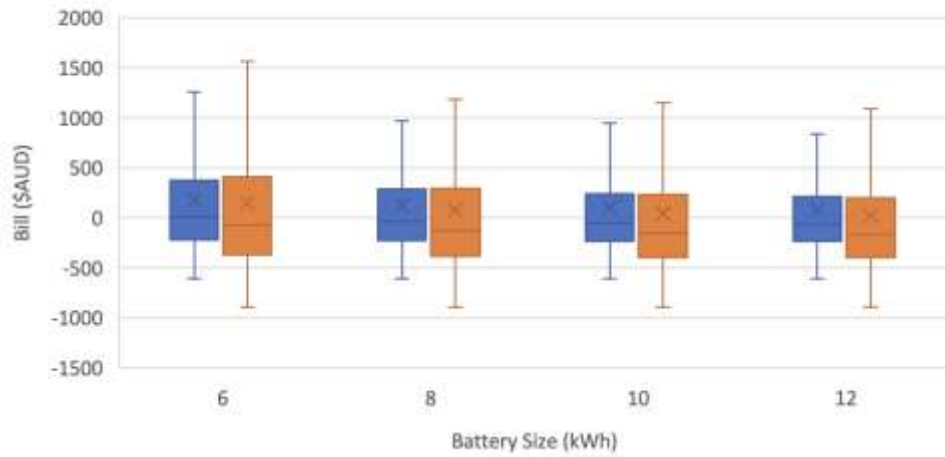
Bill with a 6kW System and Battery



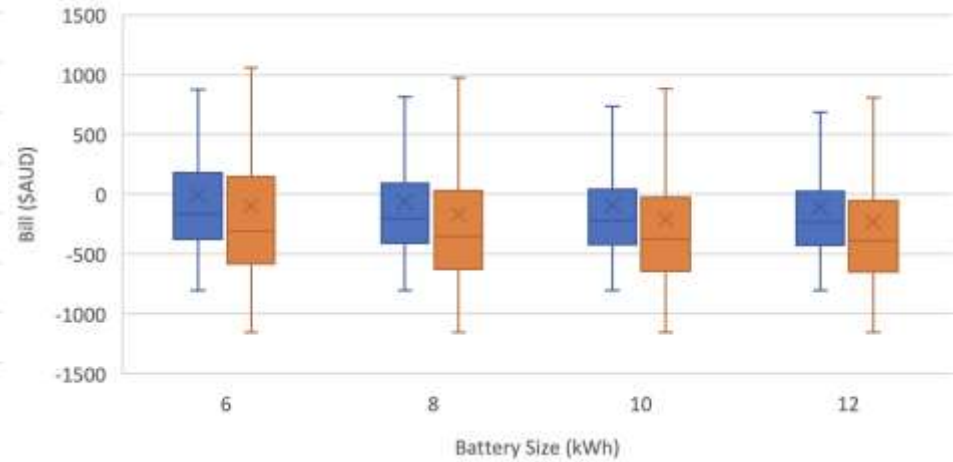
Bill 8kW System and Battery



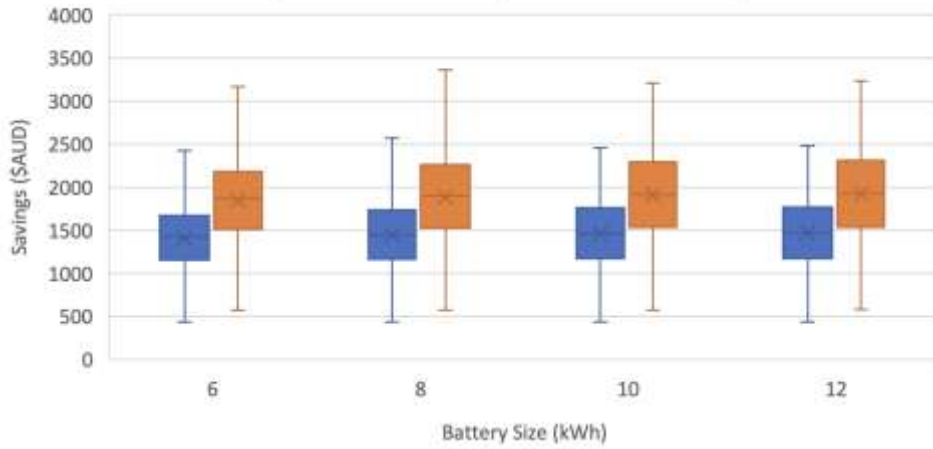
Bill with 10kW System and Battery



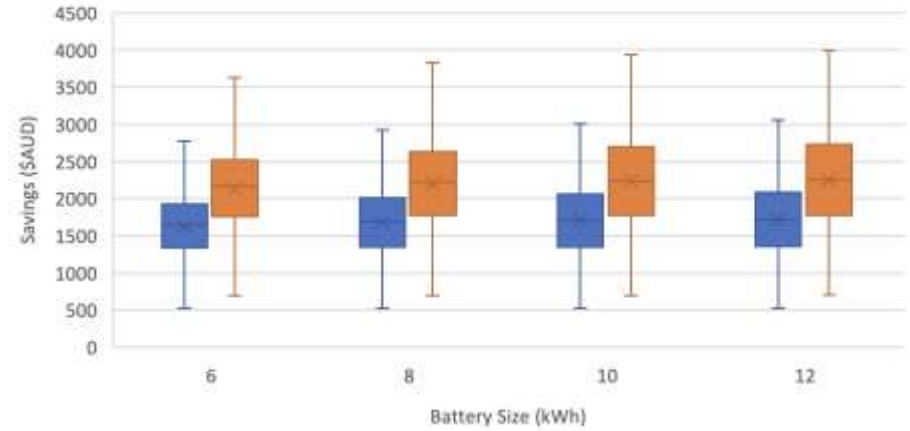
Bill with 12kW System and Battery



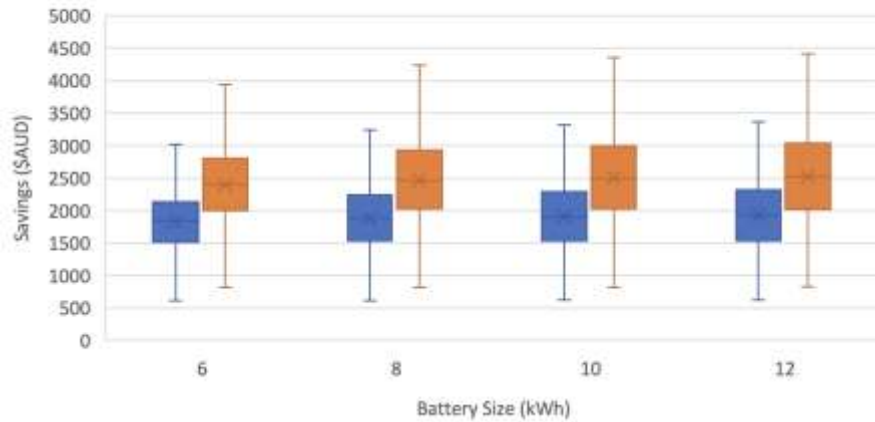
Savings with a 6kW System and Battery



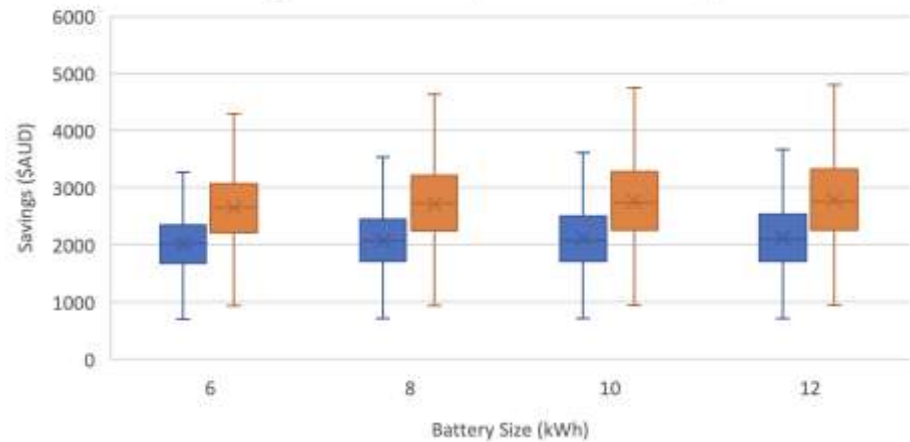
Savings 8kW System and Battery



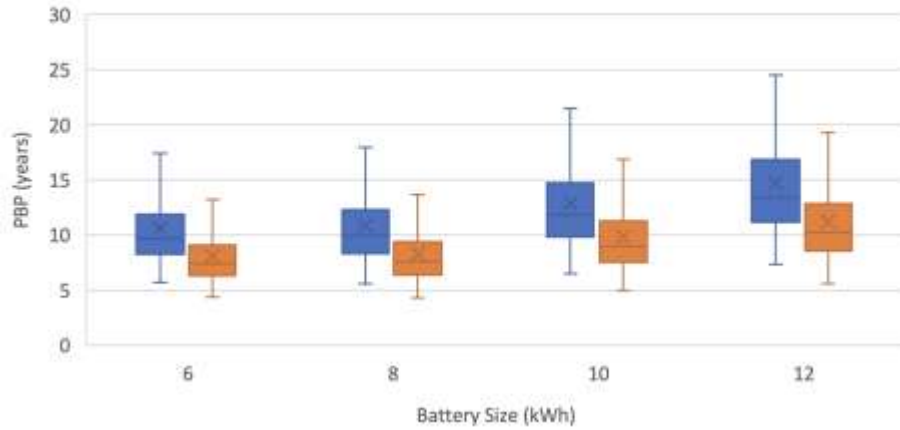
Savings 10kW System and Battery



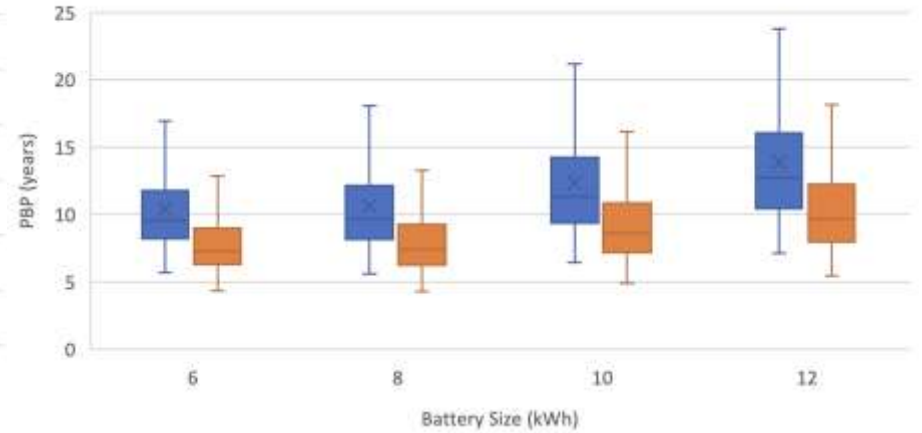
Savings with 12kW System and Battery



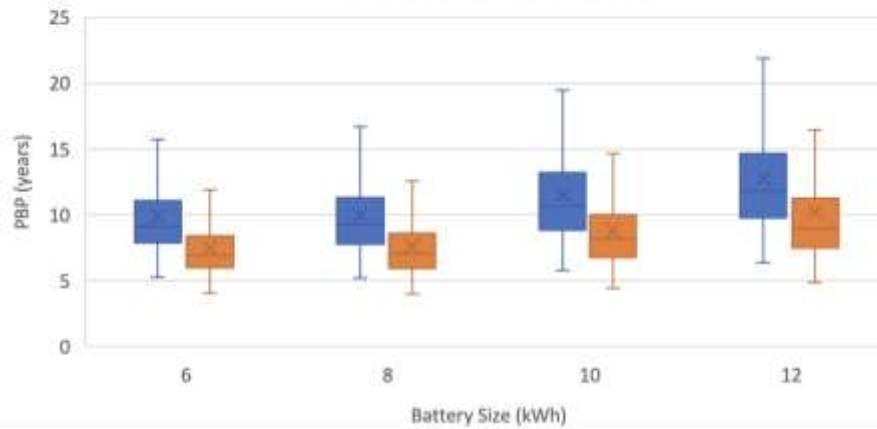
PBP with a 6kW System and Battery



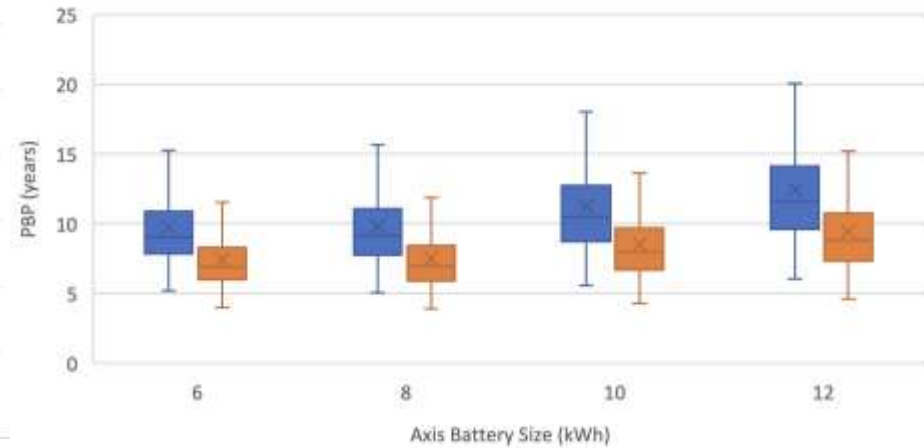
PBP 8kW System and Battery



PBP 10kW System and Battery

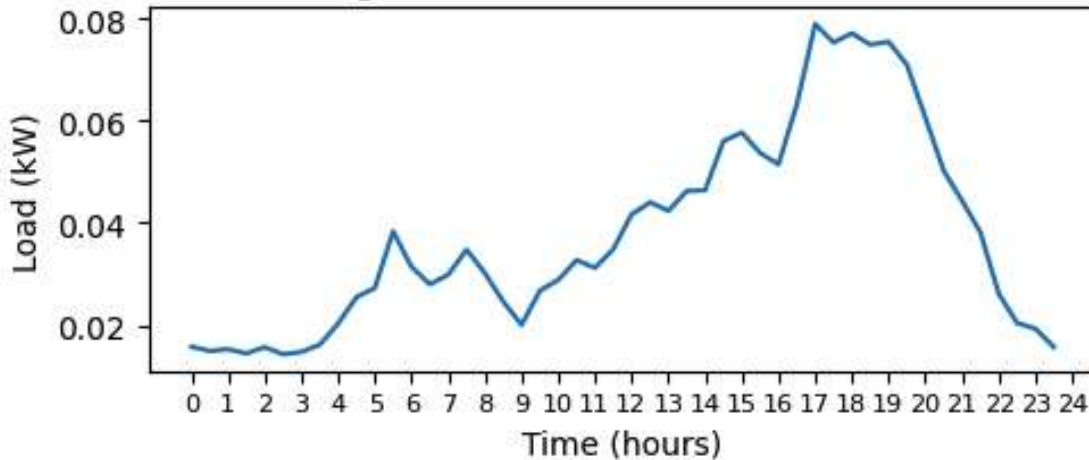


PBP with 12kW System and Battery

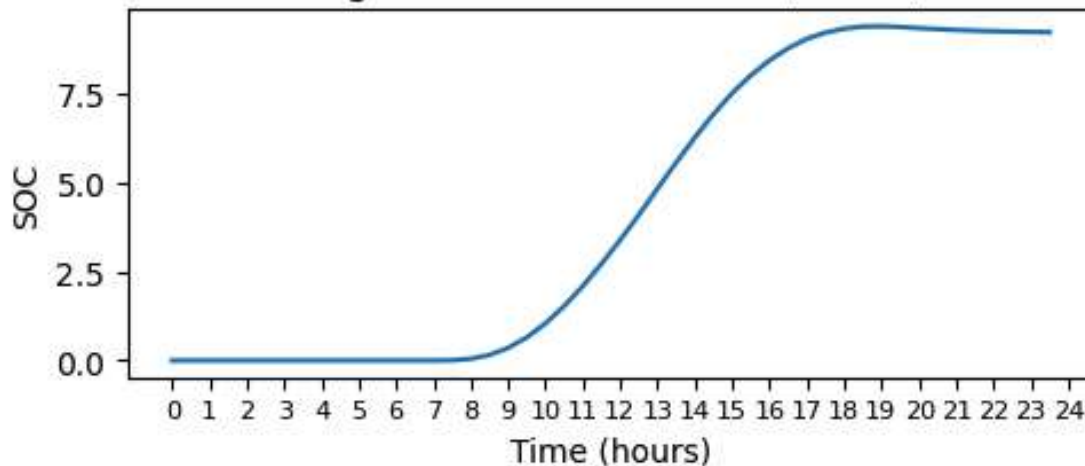


Least Likely to Benefit from Battery 2022

Avg Load Profile 8156681 (316.8)



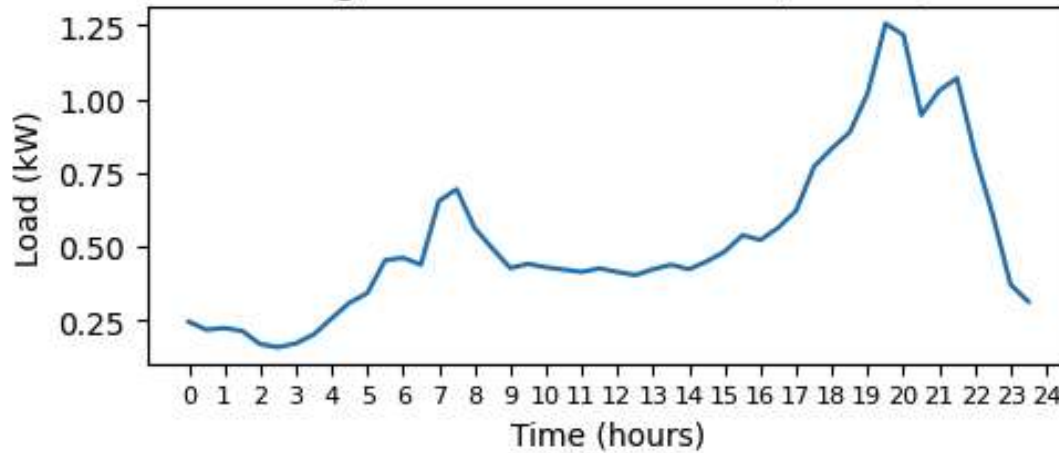
Avg SOC Profile 8156681 (316.8)



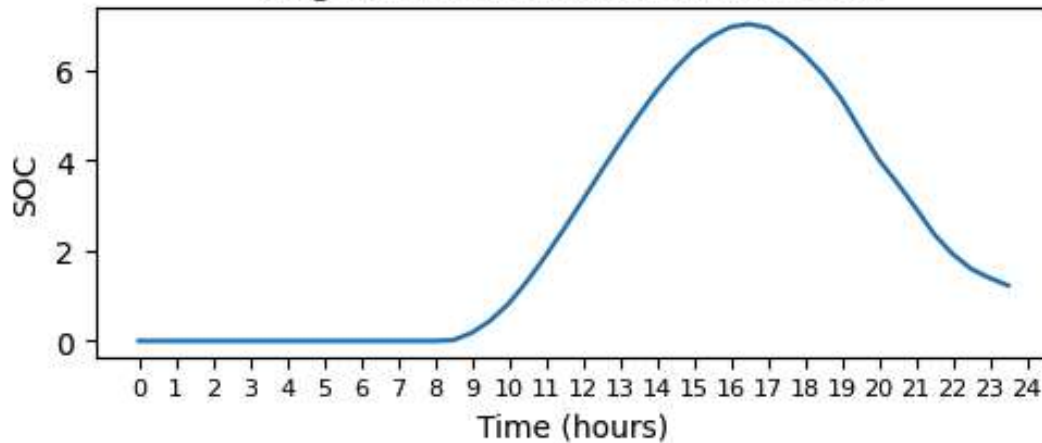
Bill no Solar	\$512.72
Bill w/Solar	\$-58.69
Savings	\$571.41
Bill w/ Solar + Battery	\$-125.75
Savings with Battery	\$638.47
Payback Period	27.0 years

Most likely to Benefit from a Battery 2022

Avg Load Profile 8208299 (6241.6)



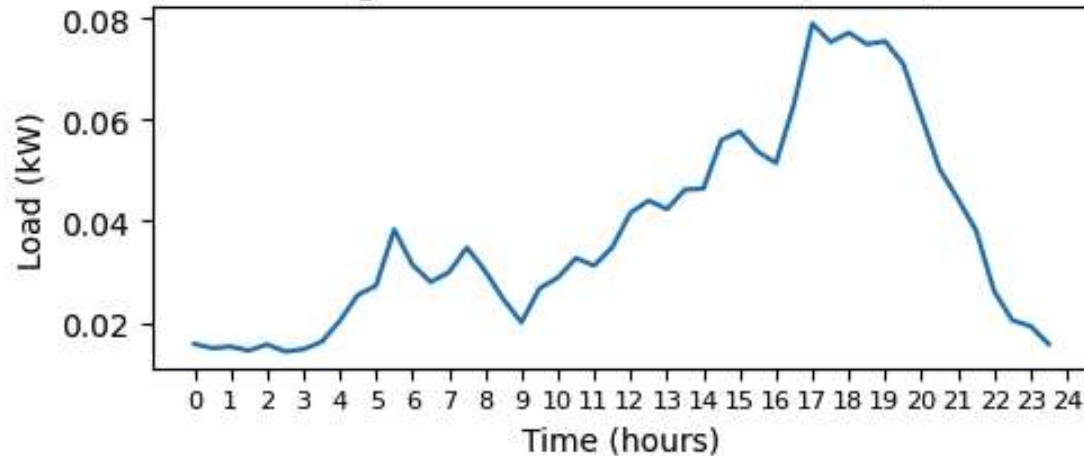
Avg SOC Profile 8208299 (6241.6)



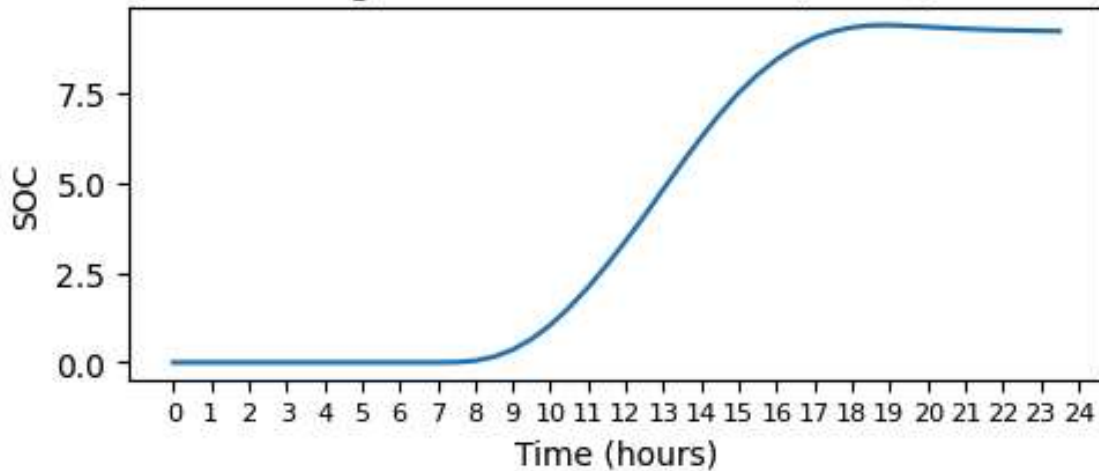
Bill no Solar	\$2983.58
Bill w/Solar	\$1816.84
Savings	\$1166.75
Bill w/ Solar + Battery	\$866.60
Savings with Battery	\$2116.99
Payback Period	8.2

Least Likely to Benefit from Battery 2023

Avg Load Profile 8156681 (316.8)



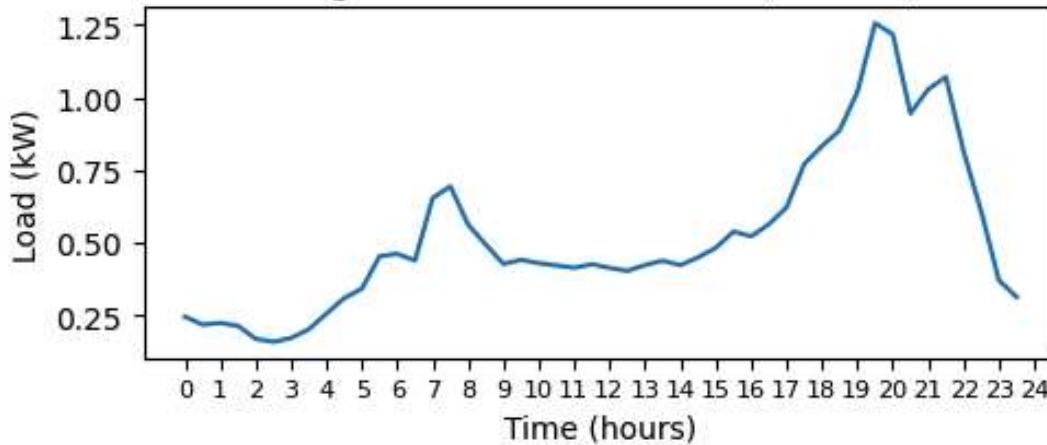
Avg SOC Profile 8156681 (316.8)



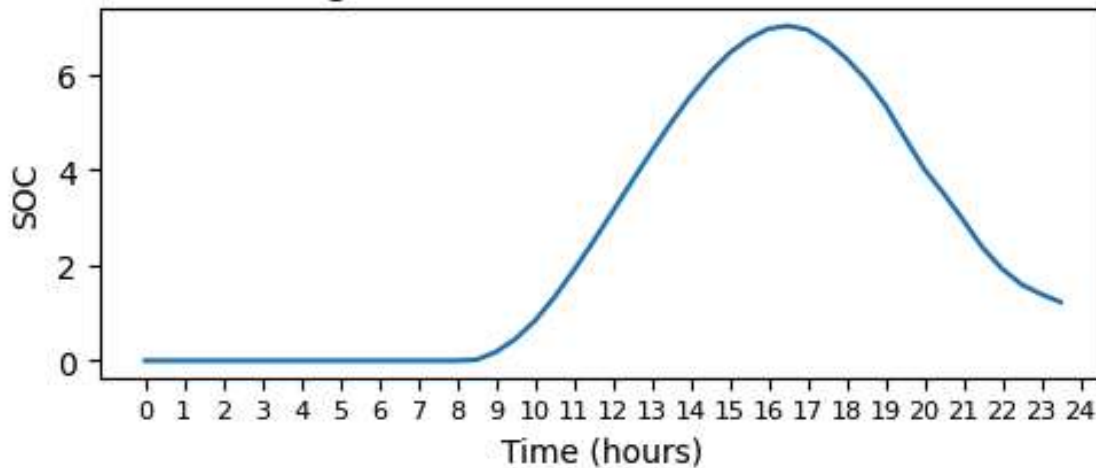
Bill no Solar	\$598.55
Bill w/Solar	\$-160.67
Savings	\$759.22
Bill w/ Solar + Battery	\$-247.34
Savings with Battery	\$845.89
Payback Period	20.4

Most likely to Benefit from a Battery 2023

Avg Load Profile 8208299 (6241.6)



Avg SOC Profile 8208299 (6241.6)



Bill no Solar	\$3819.34
Bill w/Solar	\$2286.54
Savings	\$1532.80
Bill w/ Solar + Battery	\$1057.79
Savings with Battery	\$2761.55
Payback Period	6.3

Least Likely to Benefit from Battery

Customer	Metric	Savings from Battery (\$) 2022	Savings from Battery (\$) 2023
8198431.0	310.5	545.78	723.94
8156681.0	316.8	638.47	845.89
8191291.0	741.1	839.54	1107.11
8193367.0	778.6	869.03	1145.65
8183135.0	798.8	391.95	514.10
8179493.0	814.4	799.34	1052.10
8207487.0	870.2	865.97	1140.63
8200941.0	878.4	825.43	1088.20
8181475.0	888.6	833.21	1100.07
8179505.0	942.8	833.21	1273.04

Most Likely to Benefit from Battery

Customer	Metric	Savings from Battery (\$) 2022	Savings from Battery (\$) 2023
8212719.0	5552.1	2121.77	2767.81
8170201.0	5612.9	1876.57	2449.12
8212189.0	5688.1	1938.54	2530.04
8163687.0	5778.4	2088.23	2723.96
8195825.0	5902.1	2231.51	2910.93
8164629.0	5934.4	2088.19	2725.29
8194421.0	5940.4	2103.09	2744.77
8211127.0	5989.6	1865.57	2435.87
8158377.0	6222.1	1574.53	2058.31
8208299.0	6241.6	2116.99	2761.55

