ERICA SoERC 2024

The future of hot water flexible demand in the age of rooftop solar

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Ausgrid

solar analytics

PLUS ES

NSW GOVERNMENT Treasury

ESW ENERGY SMART WATER

SHC SOLAR HEATING & COOLING PROGRAMME INTERNATIONAL ENERGY AGENCY

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1) Project Motivation
2) Trial operations
3) Insights into network voltages
4) The future of controlled load

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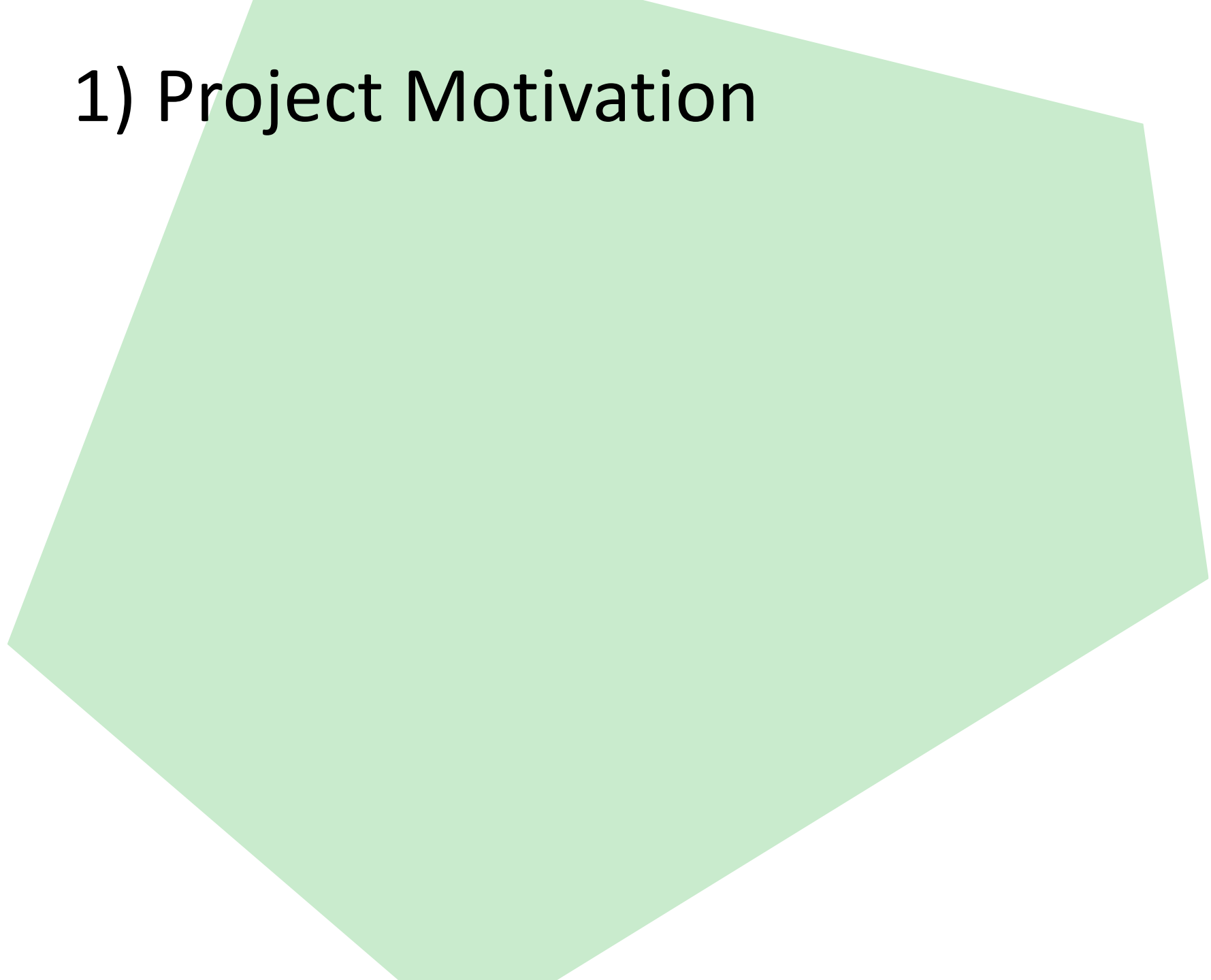
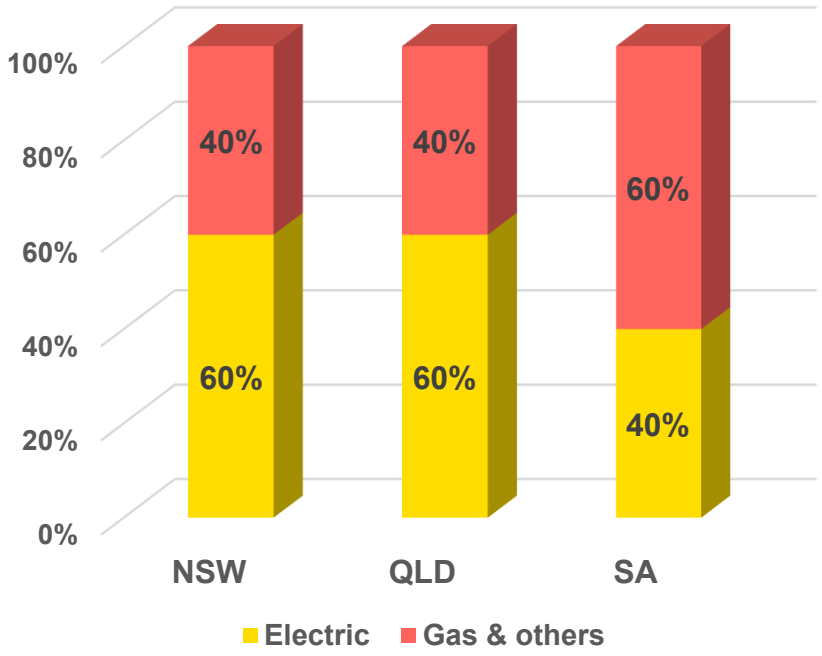
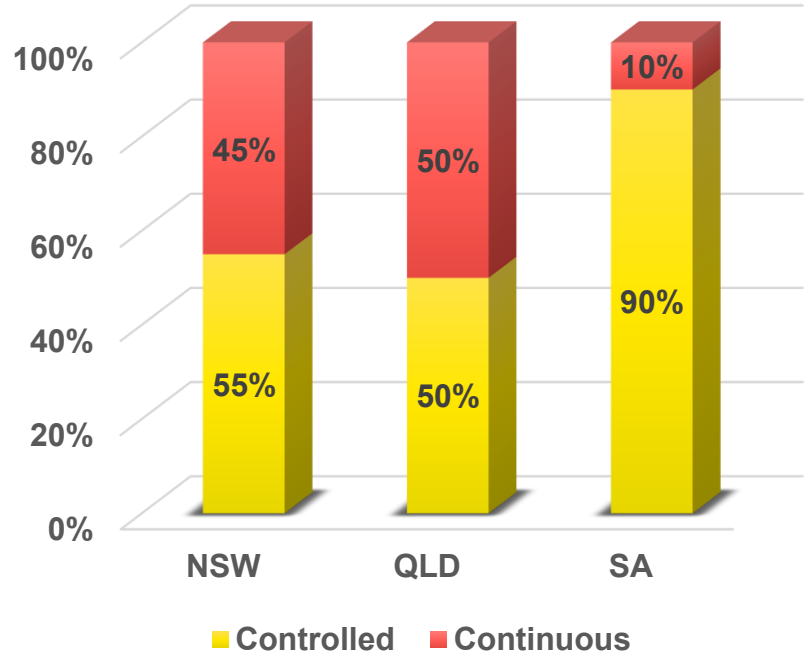
1) Project Motivation



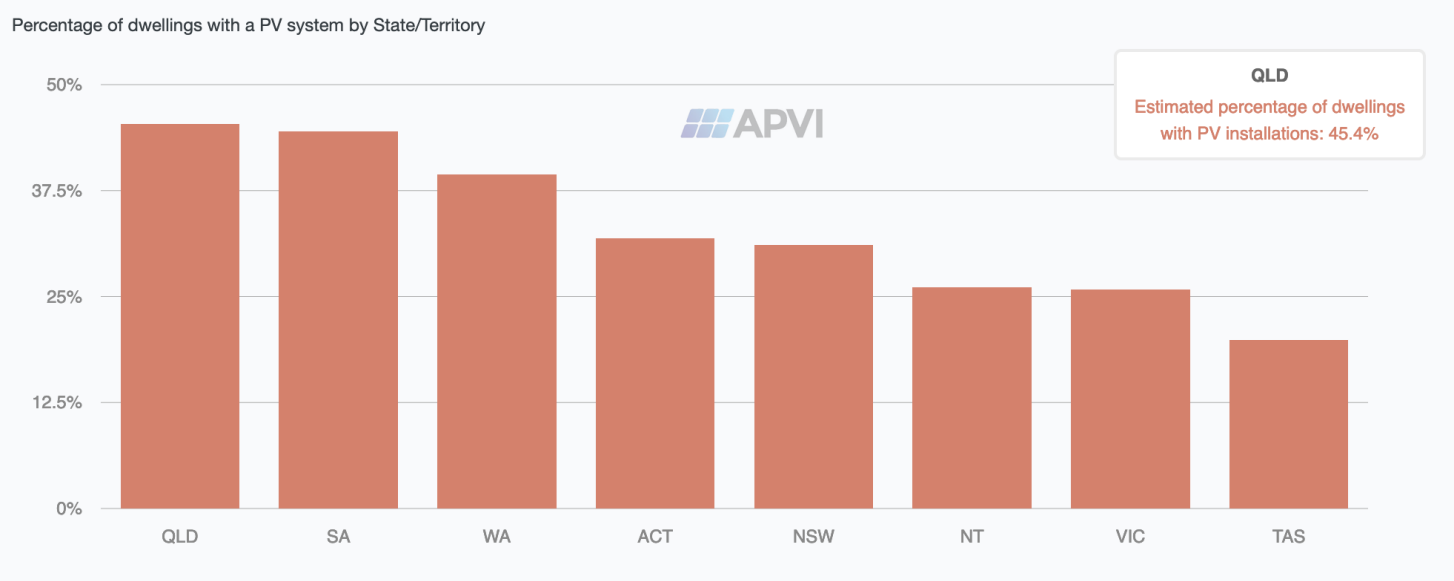
Project motivation #1

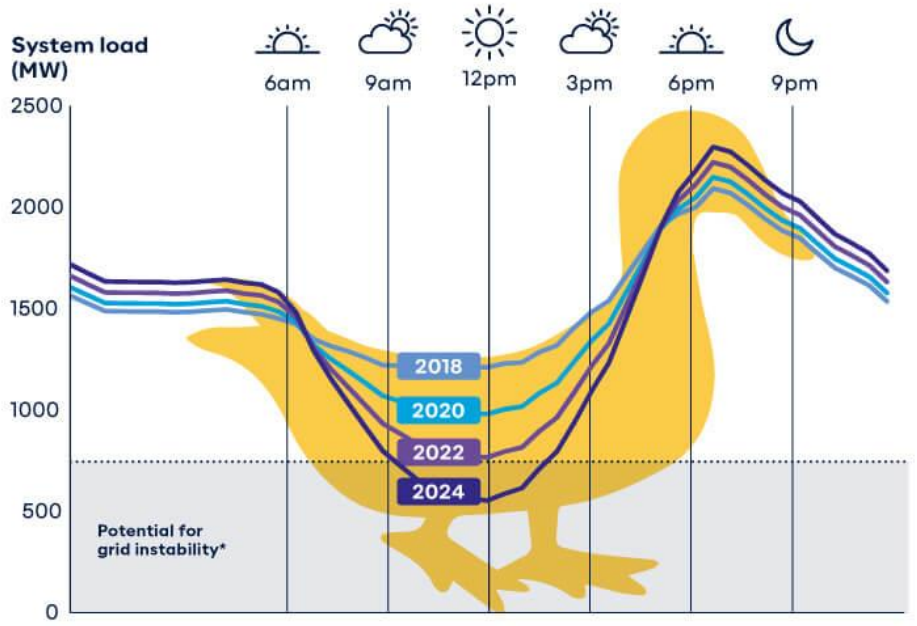
- Around 25%-33% of residential energy use is attributed to water heating in Australia
- More than 50% of water heating is done through electricity
- 25 GWh of daily electricity demand in the NEM





Project motivation #2

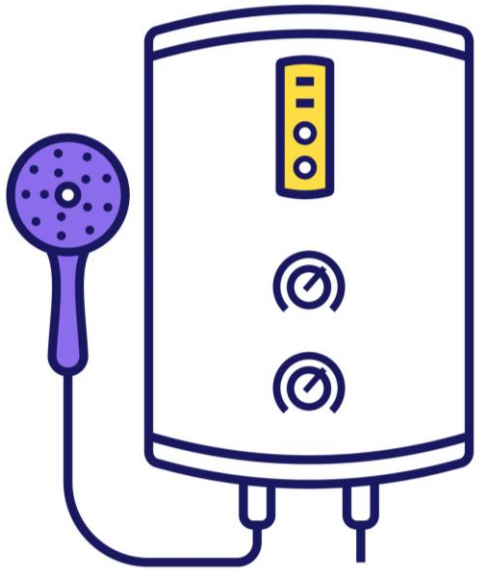


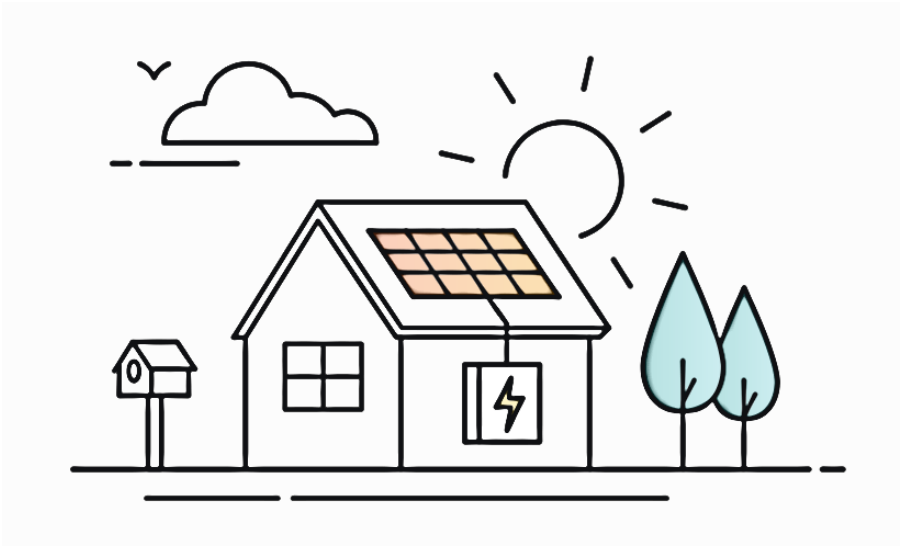


References: APVI 2023, Synergy,

Project motivation #3

Project SolarShift





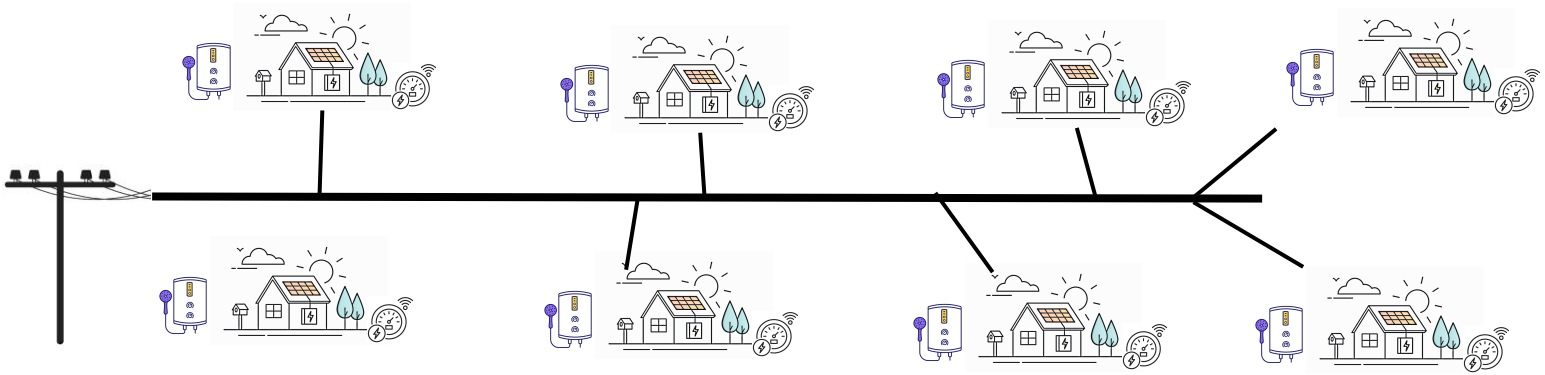
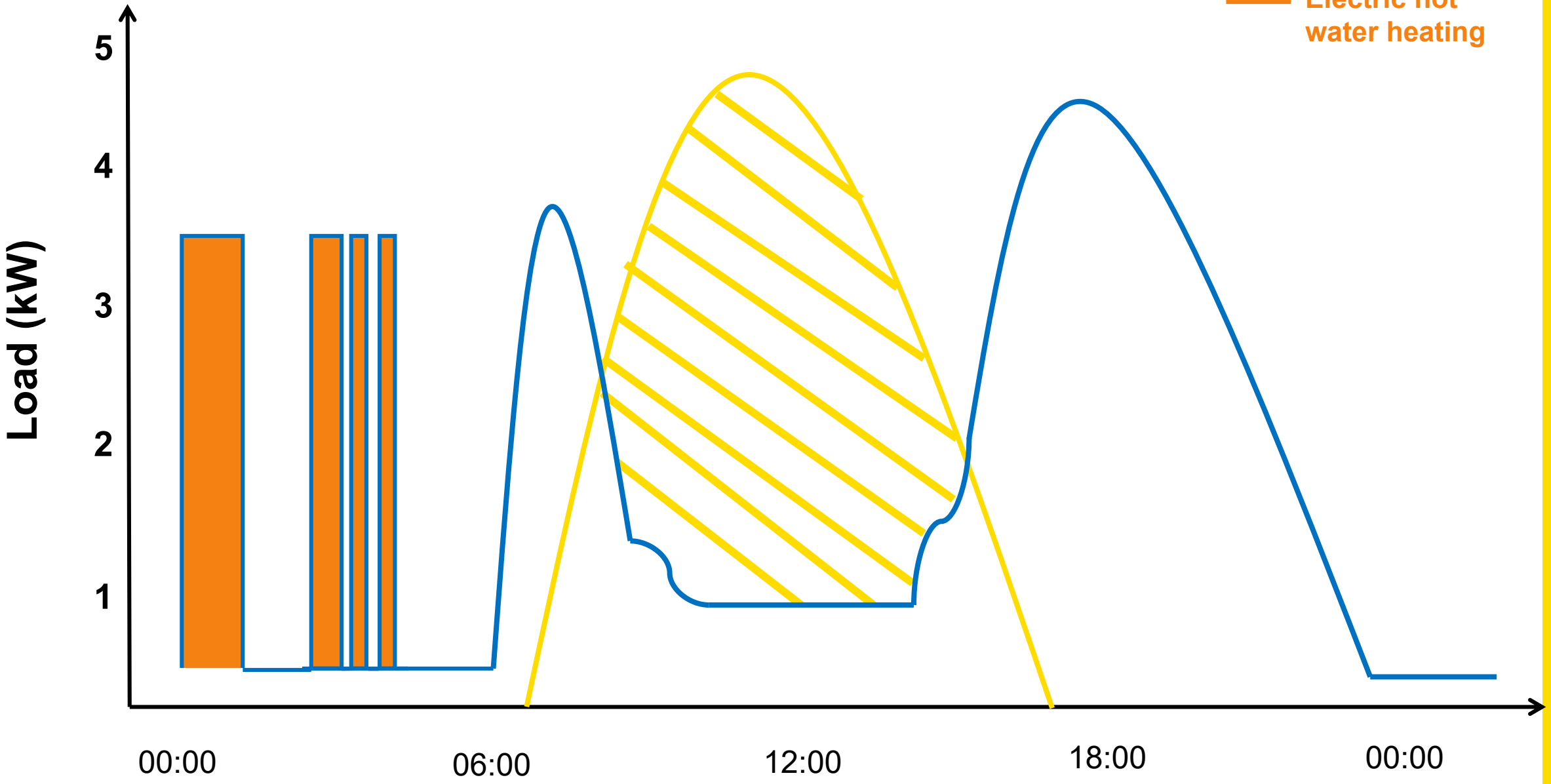
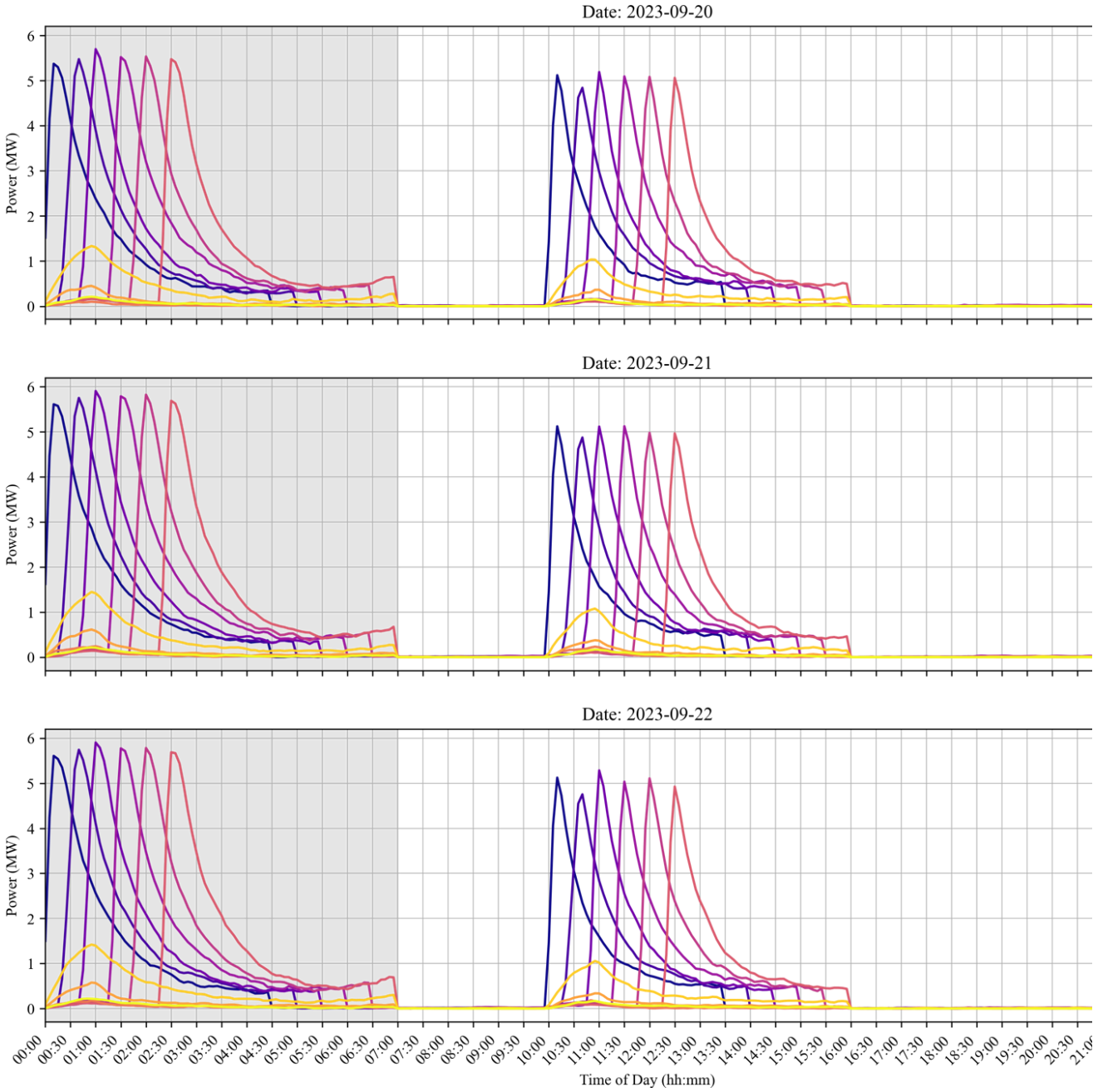


Image credits: Vecteezy, Solar Victoria, iStock

What is SolarShift?



2) Trial operations



- Trial in South Australia in collaboration with PlusES & AGL with around 13,500 participants

- Participants are grouped into 10 load control groups

-Simple and static control strategies & **wholesale arbitrage (retailers)**

- **40-50%** of daily hot water demand is shifted to day-time with relatively simple strategies

- **When we switch from Control Load 1 (CL1) to Control Load (CL3), the daily hot water demand can increase between 2 - 10% (depends on the household hot water consumption & season)**

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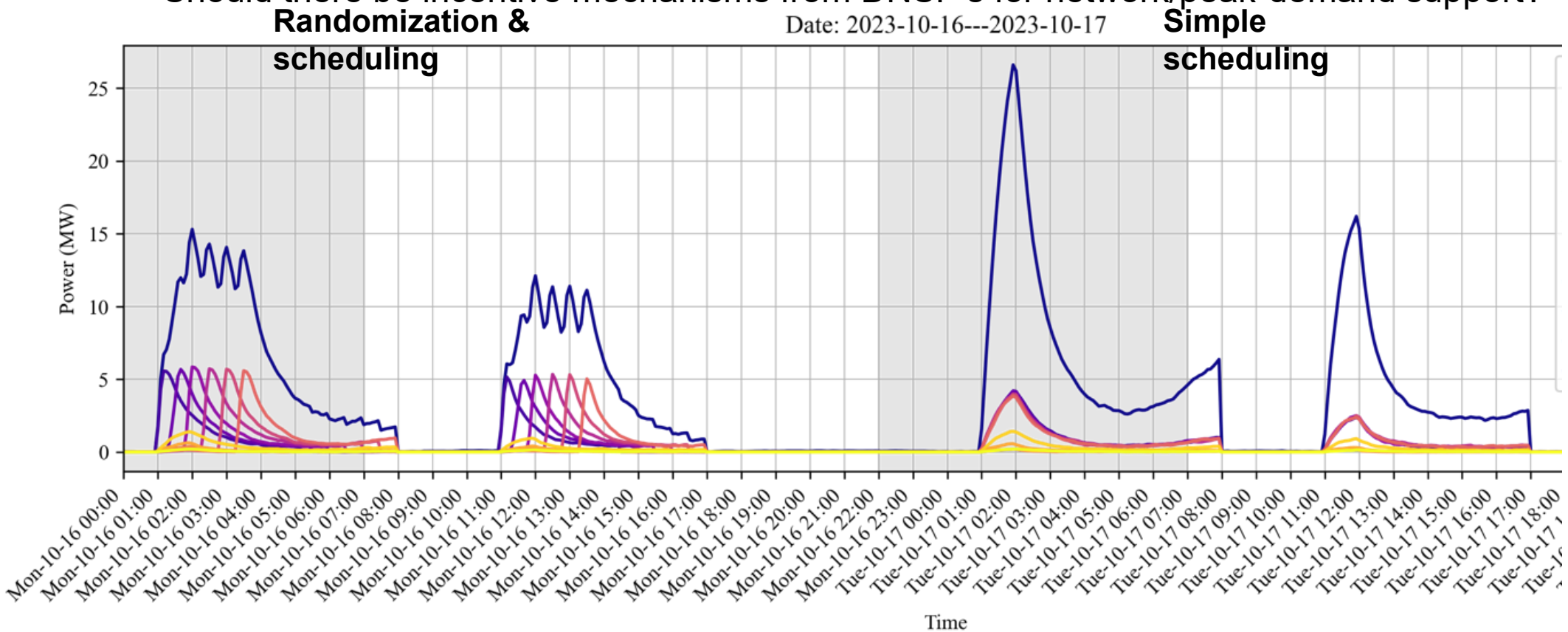
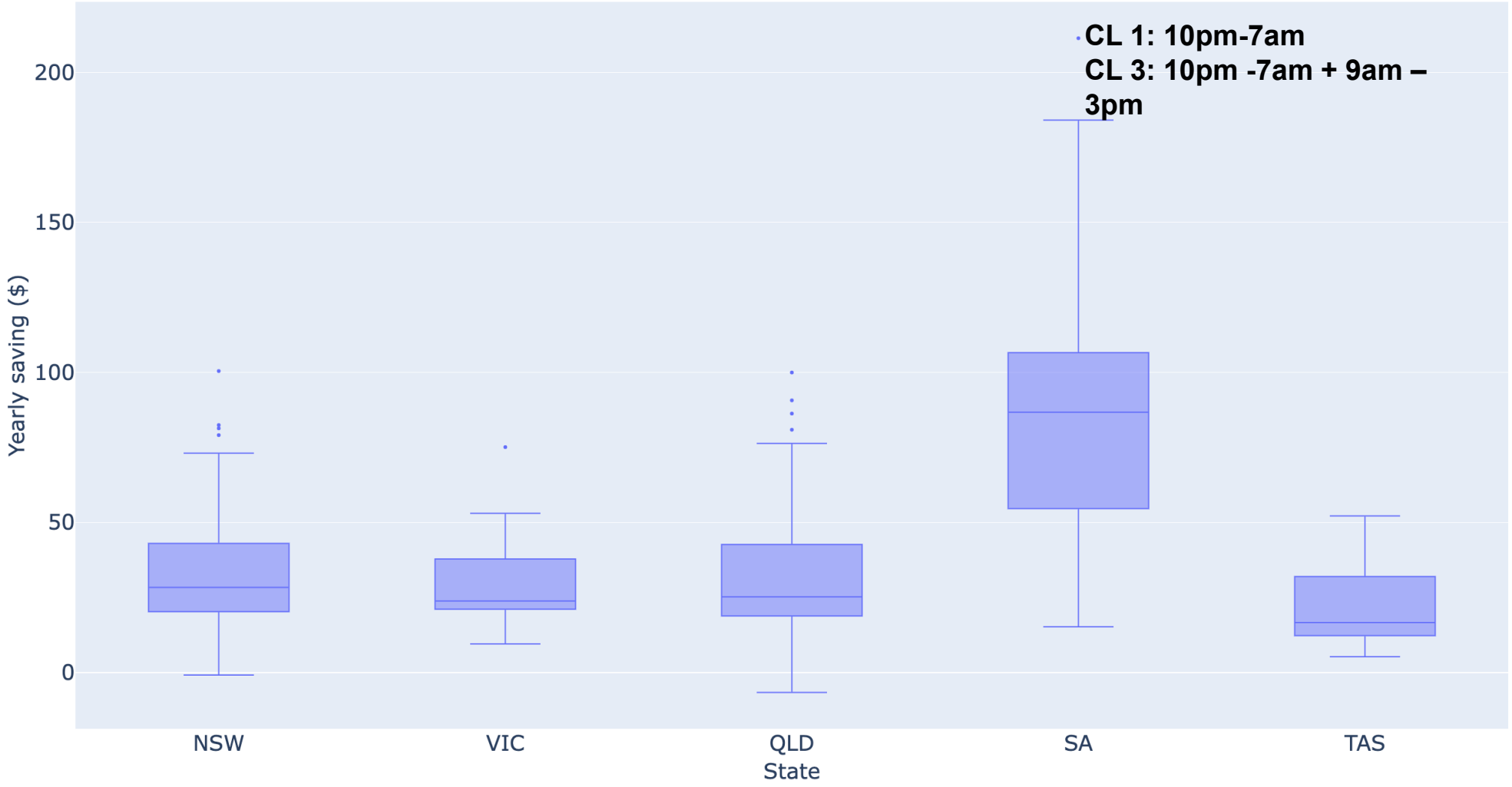
Scheduling and control of hot water fleet

- Scheduling and randomization of different customer groups reduces **hot water peak demand by 40%.**

- From aggregator/retailer's point of view, reducing the peak demand is not always the priority, unless it makes financial sense for them (wholesale arbitrage).
  - Should there be incentive mechanisms from DNSP's for network/peak-demand support?



Distribution of aggregator/retailer wholesale arbitrage savings (change from Control Load 1 to Control Load 3)



4) Insights into network voltage

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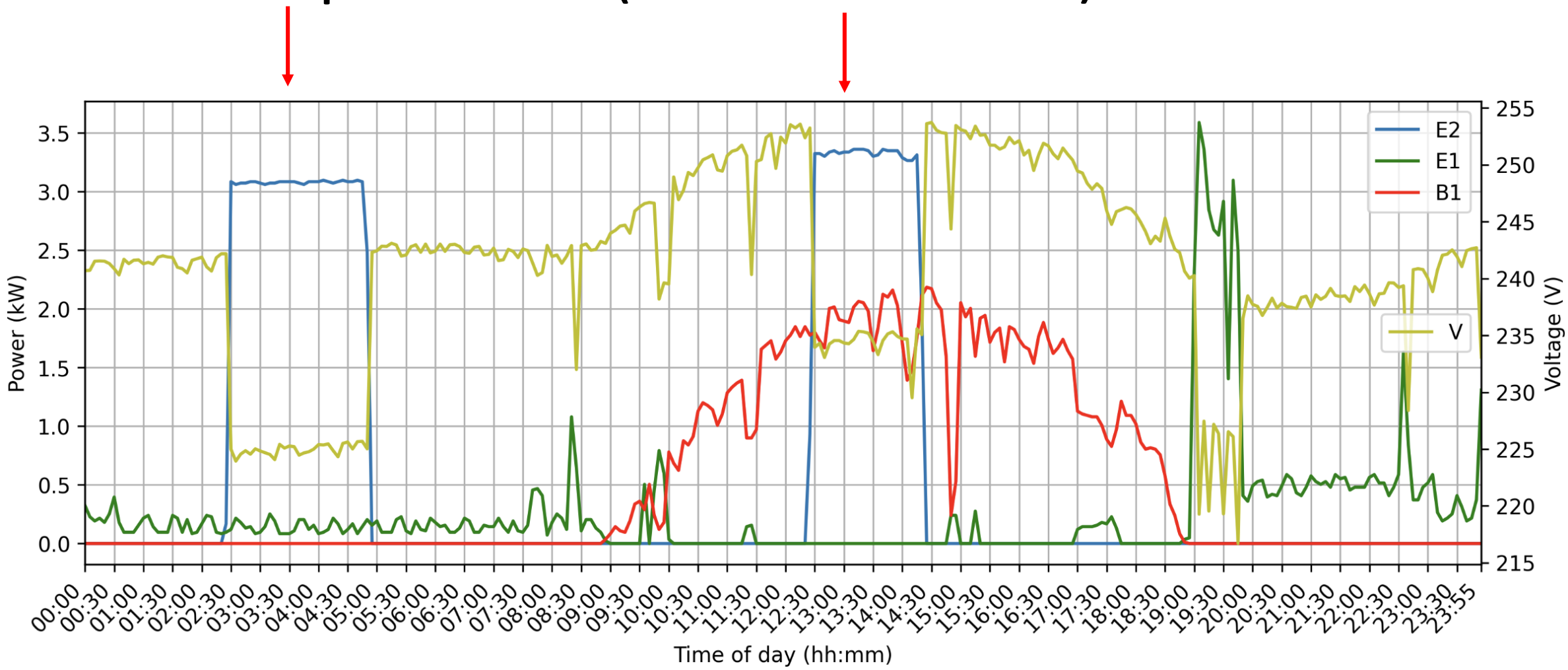
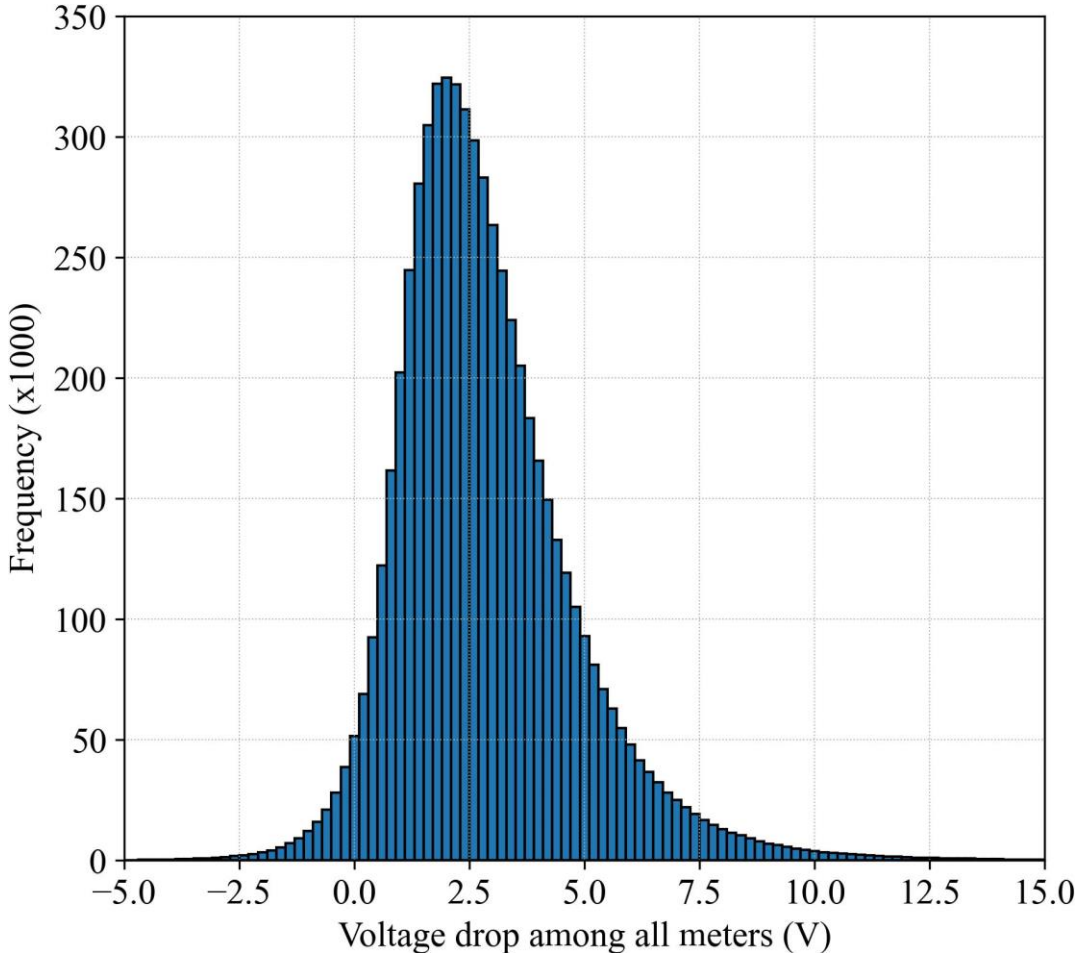
Voltage drop at the household level with hot water operations (South Australia)



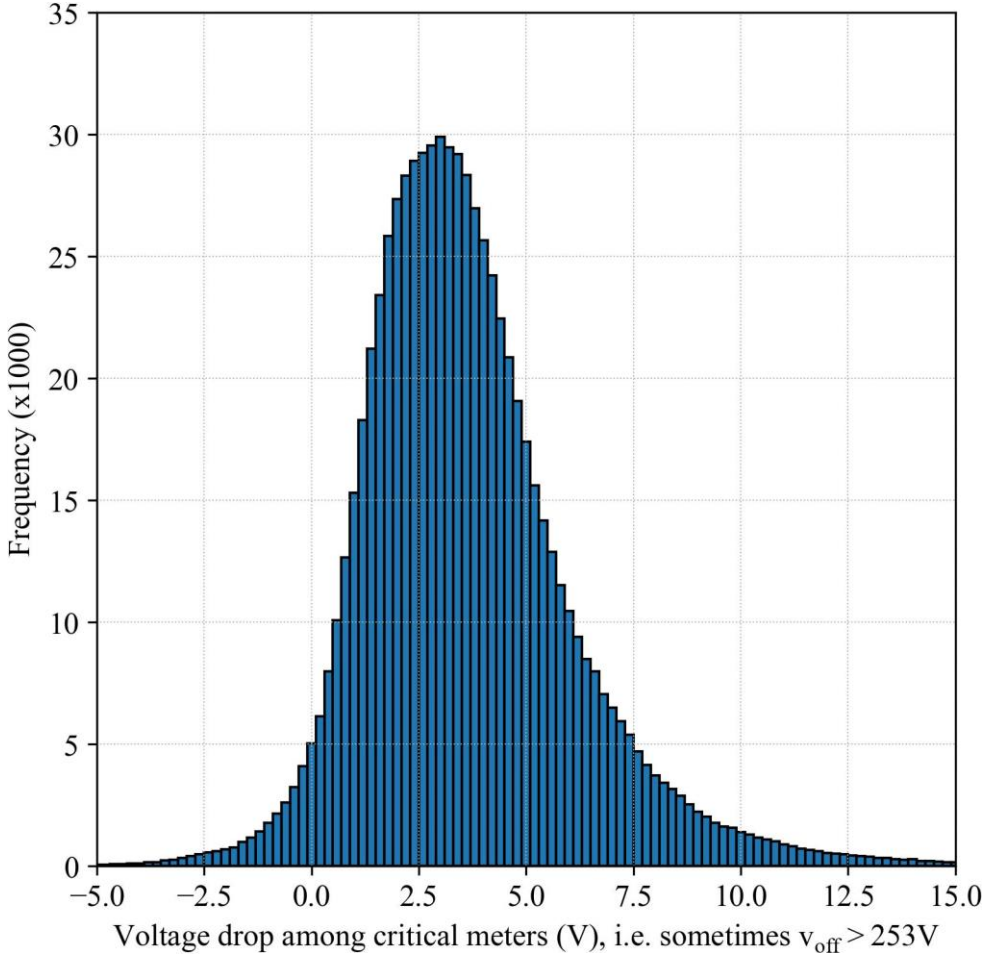
Average voltage drop statistics

All meters (13,500)



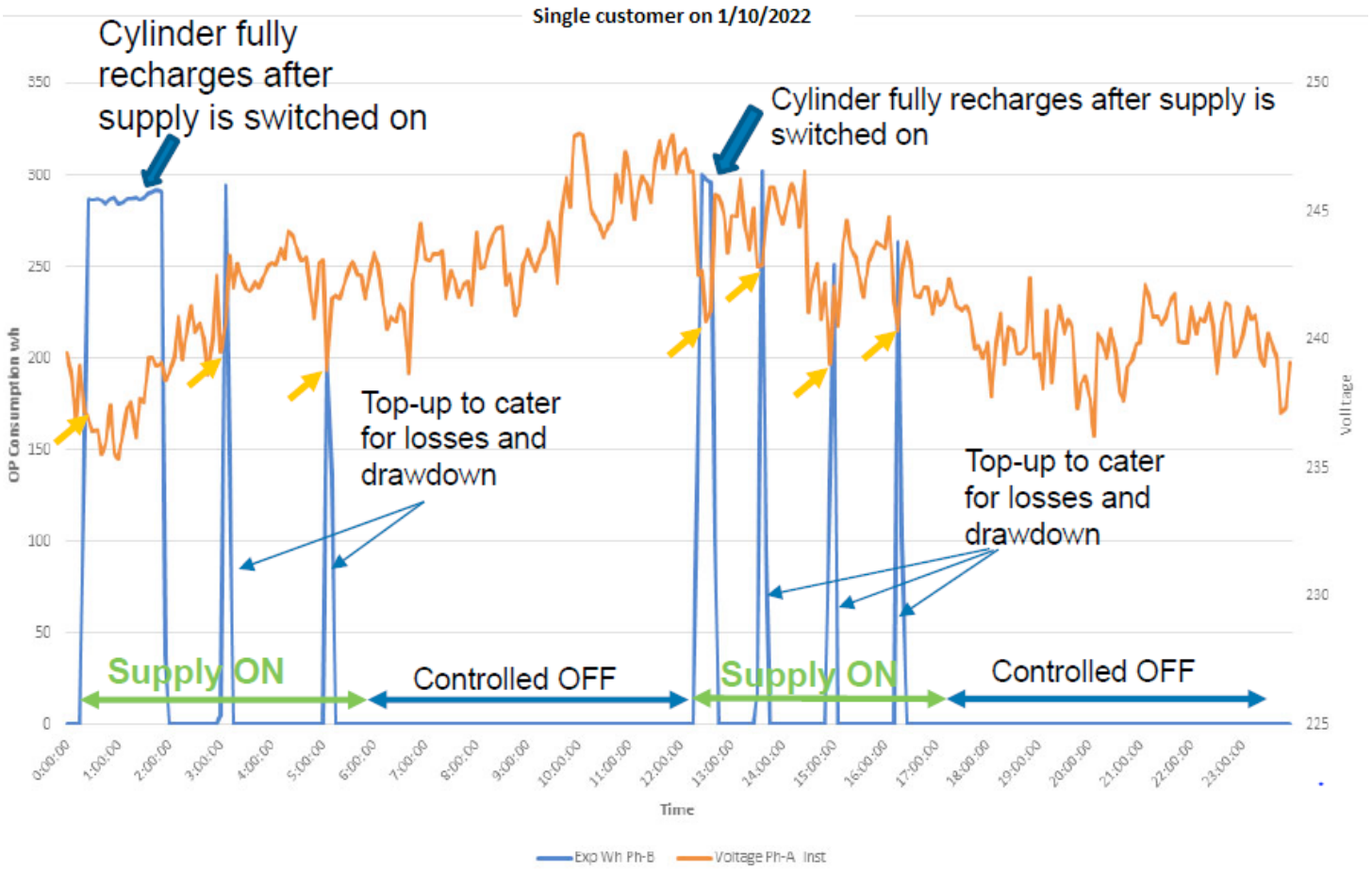
	DV-5%	DV-50%	DV-95%
All	0.4	2.6	6.4

Critical meters with V>253 V (1,529)



	DV-5%	DV-50%	DV-95%
All	0.5	3.4	8.2

Voltage drop at the household level with hot water operations (NSW)



- Goal is to achieve smoother voltage drop at each household level.
- Voltage fluctuations based on water usage, temperature and thermostat settings
- Smart control & randomisation of hot water system operations may help smooth the voltage response at upstream distributor level (aggregate level).
- Hot water systems on their own may not be sufficient to achieve smooth voltage response at the site level.
- Implications for DER/CER?

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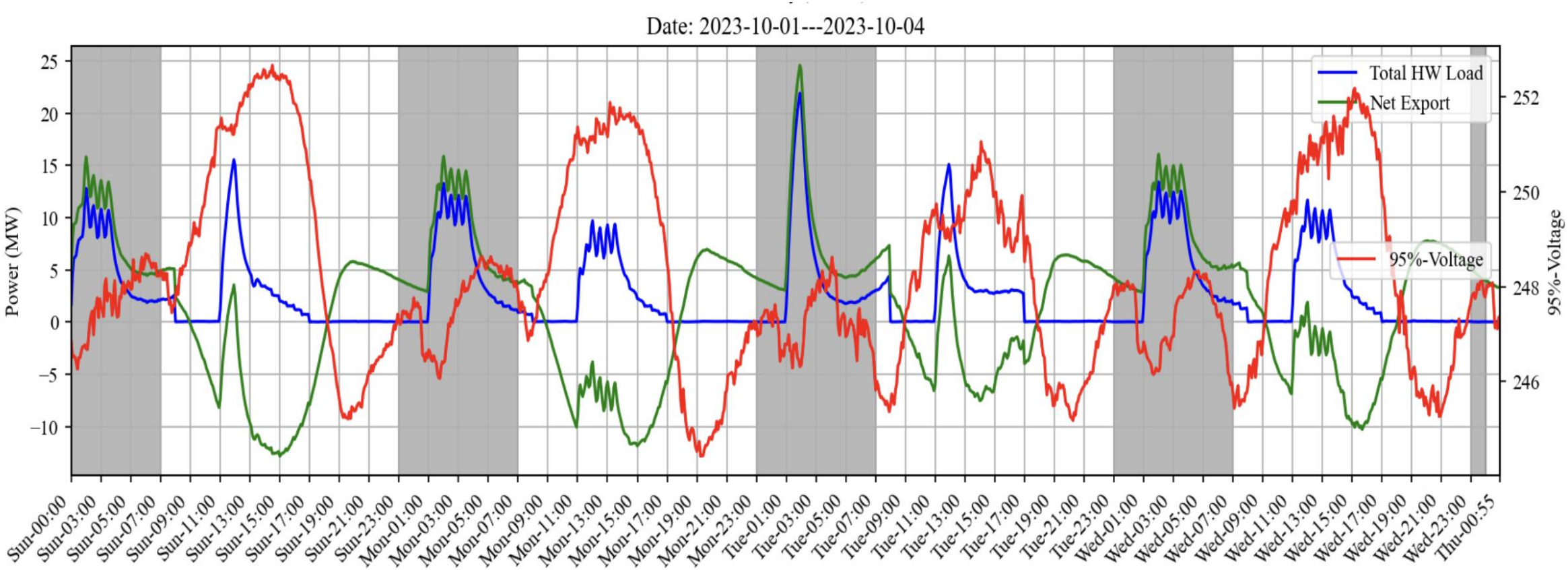
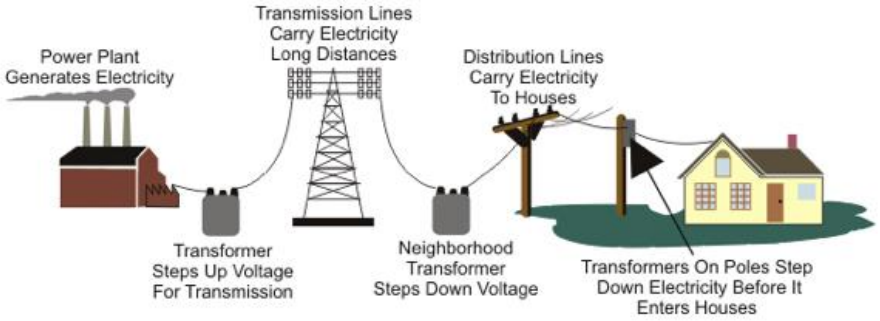
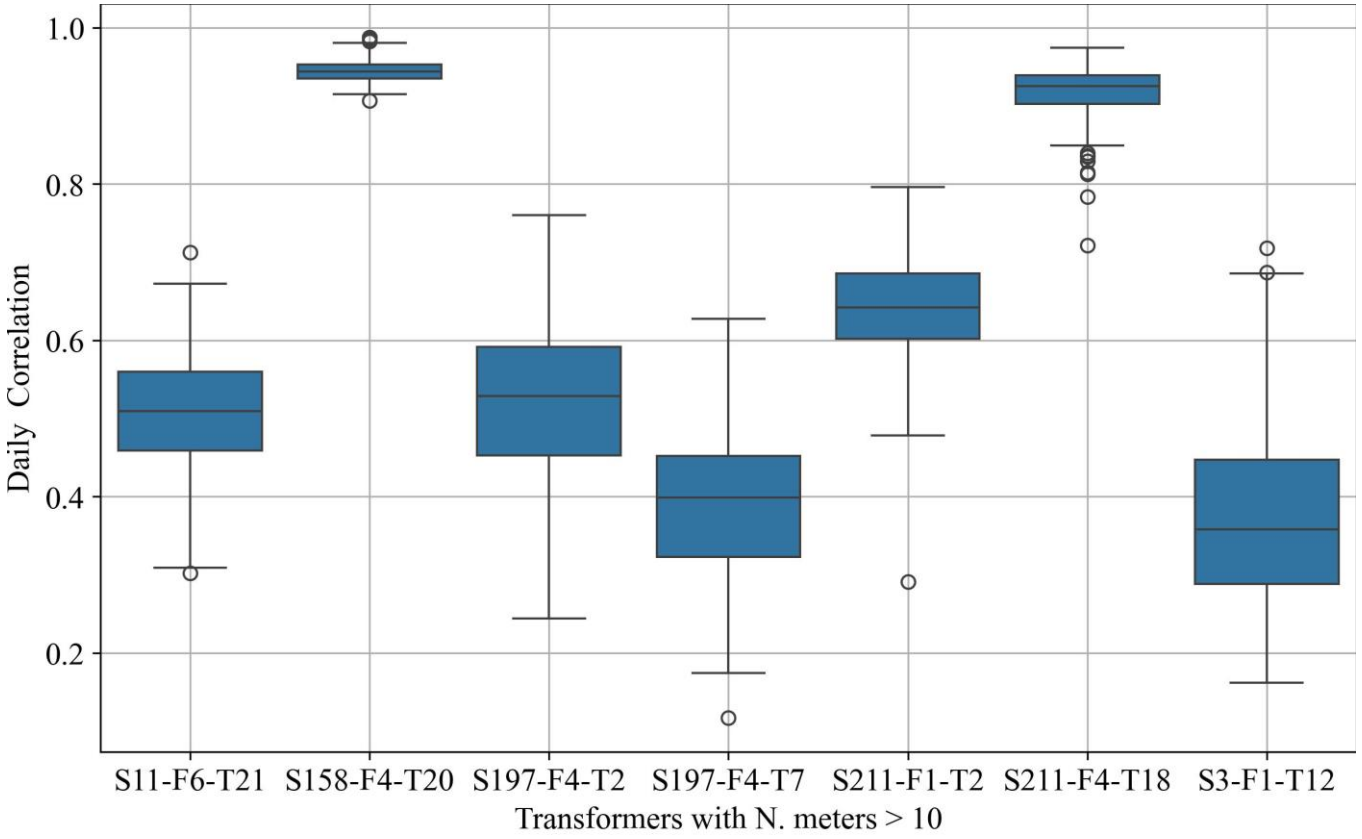
Voltage vs. net export and hot water load (entire fleet with ~13.5k households across South Australia)



It’s not that simple





- **Correlation of site voltages within 7 transformers (amongst thousands) which has more than 10 meters**
  - **LV transformers typically have 50-100 meters**
- We have limited number of meters at each transformer level
- Other factors that influence the voltage drop: household’s location with respect to feeder, type and X/R ration of the line, strength of the network etc.
- Further work in progress…

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The future of controlled load?

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Changes in controlled load fleet (CL)

- Households can change their water heating technology options without notifying DNSPs or retailers
  - There are costs associated with disconnection CL (~$150-200)
  - Most people avoid these by leaving the connection on, but they may keep paying the daily connection fee
- In SA, ~ 20-25% of the CL fleet is inactive
- In NSW, ~15-20% of the CL fleet is inactive
- In QLD, 75% of solar installers recommend timers/diverters (switch to general supply)

New DNSP tariffs for controlled load

- Ausgrid Solar Soak option B (seasonal solar soak windows)
- Endeavour Energy Off-peak+ tariff with solar soak window
- Citipower, United Energy & PowerCor 24/7 ToU controlled load
- SAPN Solar Sponge 24/7 ToU controlled load window
- Energy Queenslad new tariff trials for “trough demand” (solar-soak)

➢ **These new tariffs offer cheaper network rates during the solar soak period!**

Table B.4. Load control schedule for Type 4 meters (In this table – unless otherwise noted all times are in EST to match meter programming)

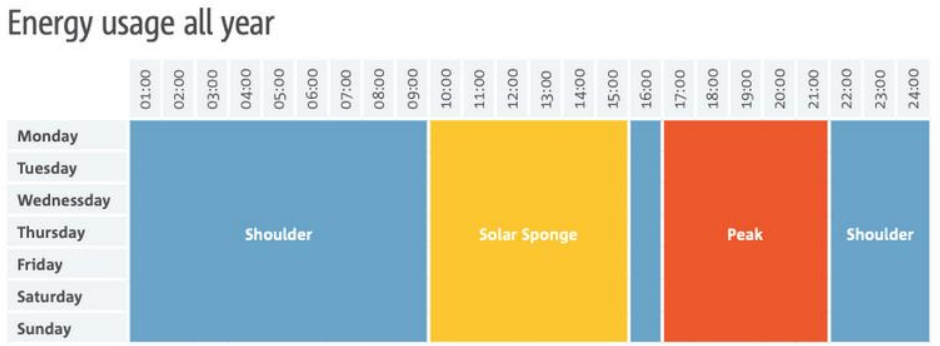
Switching Program	Load Control Schedule Controlled Load 1 (EA030) Legacy – OPTION A	Load Control Schedule Controlled Load 1 (EA030) Solar Soak Option – OPTION B	Load Control Schedule Controlled Load 2 (EA040)
Winter	1st Sun Apr – 1st Sun Oct ON at 22:00 OFF at 07:00 Randomised Delay ON 180min	1st Sun Apr – 1st Sun Oct ON at 22:00 OFF at 6:45 ON at 10:00 OFF at 16:45 Randomised delay ON **210 min** OFF 15 min	1st Sun Apr – 1st Sun Oct ON at 20:00 OFF at 17:00 Randomised Delay ON 180 min
Spring		1st Sun Oct – 1 Nov ON at 21:00 (22:00 DST) OFF at 4:15 (5:15 DST) ON at 9:00 (10:00 DST) OFF at 15:45 (16:45 DST) Randomised delay ON **210 min** OFF 15 min	1st Sun Oct – 1 Nov ON at 19:00 (20:00 DST) OFF at 16:00 (17:00 DST) Randomised Delay ON 180 min
Summer	1st Sun Oct – 1st Sun Apr ON at 21:00 OFF at 6:00 Randomised Delay ON 180min		
Peak Summer		1 Nov - 1st Sun Apr ON at 21:00 (22:00 DST) OFF at 5:45 (6:45 DST) ON at 9:00 OFF at 13:30 Randomised Delay ON 180 min OFF 15 min	1 Nov – 1st Sun Apr ON at 19:00 (20:00 DST) OFF at 14:00 (15:00 DST) Randomised Delay ON 180 min

1. Residential Daytime Saver

From 1 July 2022 to 30 June 2026 United Energy will offer an optional residential Daytime Saver trial tariff with the following tariff structure and indicative rates.

Time band	Fixed (cents/day)	Usage rate (cents/kWh)
10am – 3pm	23.29	0.0
4pm – 9pm		15.7
All other times		5.6

All times are in local time
Same rates apply every day of the year



Key Messages

! Incentive to solar-soak has doubled by the recent increase in electricity prices (while solar feed-in remained mostly the same)!

!!DNSPs have started to offer new network tariffs to encourage consumption during solar-soak periods. There aren't many retail tariffs that reflect these cheaper rates !!

!!! DNSPs are losing their control load fleet. Solutions:

- **Fair and equitable incentives for households**
- **New & innovative retailer tariffs to pass savings on to households**

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Heat-pumps

- Government incentives and subsidies for heat-pumps:
  - VIC (Solar Vic, Victorian Energy Upgrades),
  - NSW (Energy Efficiency Scheme, Peak Demand Reduction Scheme),
  - QLD (Climate Smart Energy Savers),
  - ACT (Home Energy Support)
- There are quality & customer satisfaction concerns regarding the cheaper heat-pumps!!!
- What happens to the flexible demand with more heat-pumps?
  - Heat-pump have much smaller rating than resistive types (1kW vs. 3.6 kW)
  - Heat-pump use 2 to 4 times less energy than resistive types (depending on COP)
  - Heat-pump manufacturers/installers recommend installing them on the general supply without control (continuous/un-interrupted operation)
- Solar Victoria: Heat pumps with integrated-timers or PV connected (as of March 2024)

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Thank you!

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