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How demand-responsive water heaters can unlock Australia's electricity grid

Water heaters are batteries Australia already owns. A simple certificate can pay them to help the grid.

PRESENTED BY

Alastair McDowell, EnergyAE

EVENT

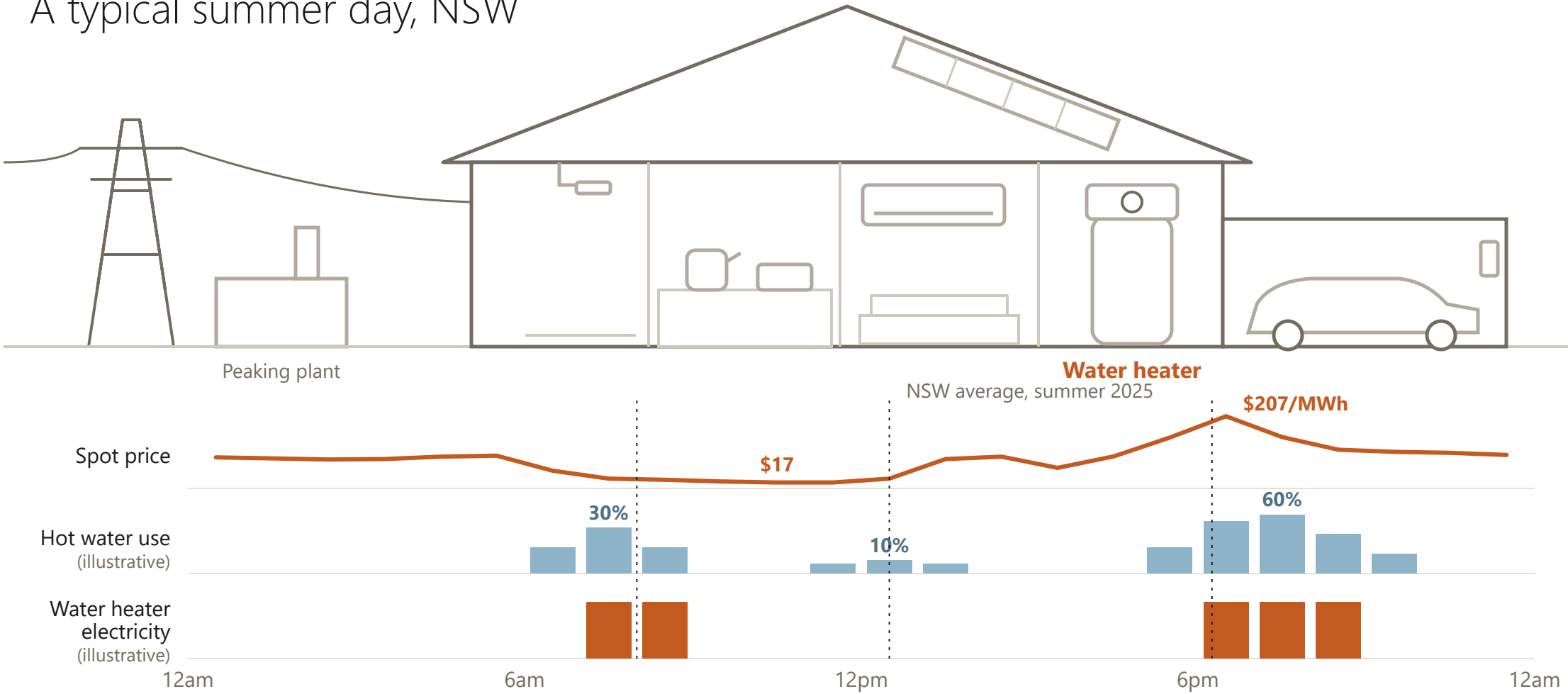
All-Energy Australia, 29 October 2026

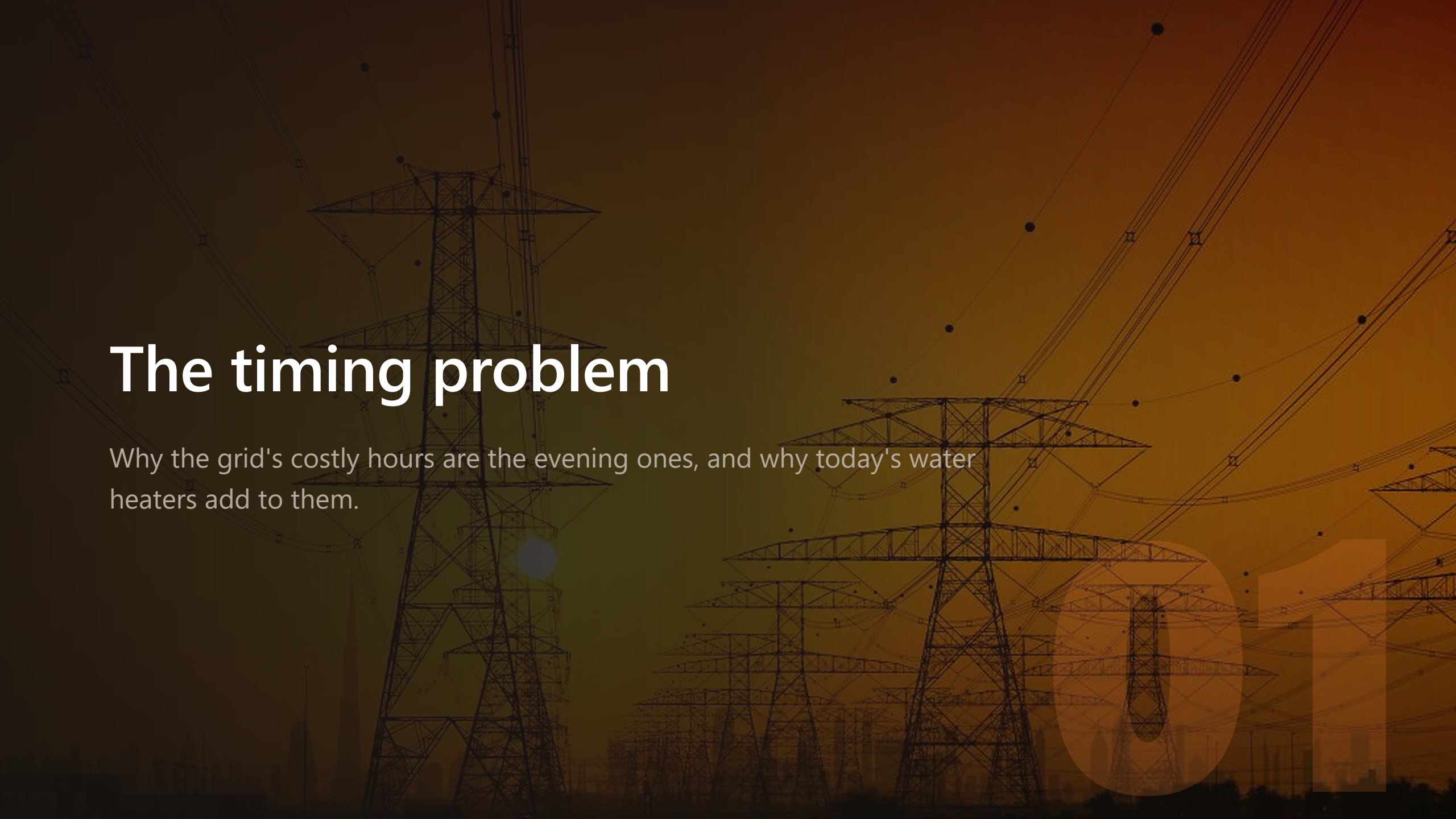
Based on the Demand Response Certificate white paper by Dr Dean Clift and Alastair McDowell. Dean Clift works part-time for Rheem Australia; EnergyAE models water heaters for many manufacturers. No product is promoted here.


Australia's energy transition is constrained
not by supply, but by peak demand.

A day in the life of a water heater

A typical summer day, NSW



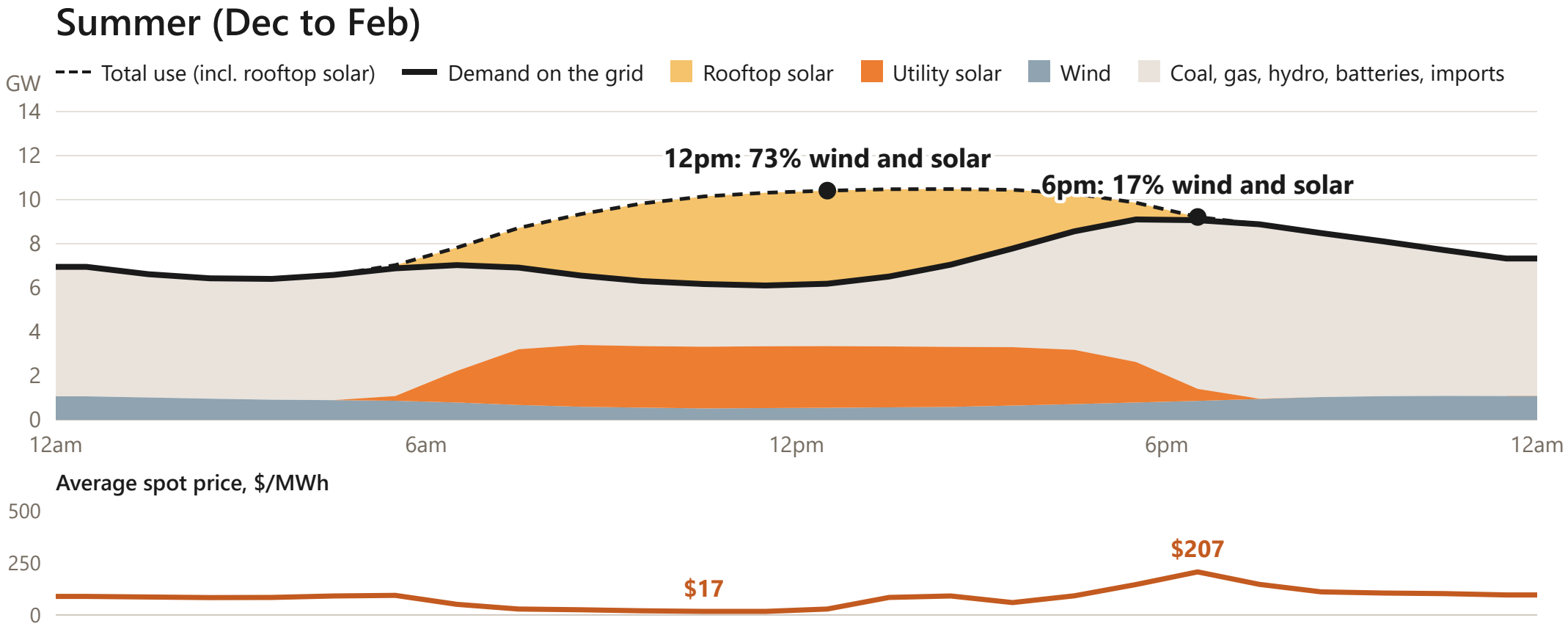


The timing problem

Why the grid's costly hours are the evening ones, and why today's water heaters add to them.

01

NSW supply and demand across a day



Source: AEMO, NSW 2025.

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Expensive ways to meet the evening peak



Peaking generation

Gas plant that runs a few hundred hours a year.



Grid-scale batteries

Storage built to shift solar into the evening.

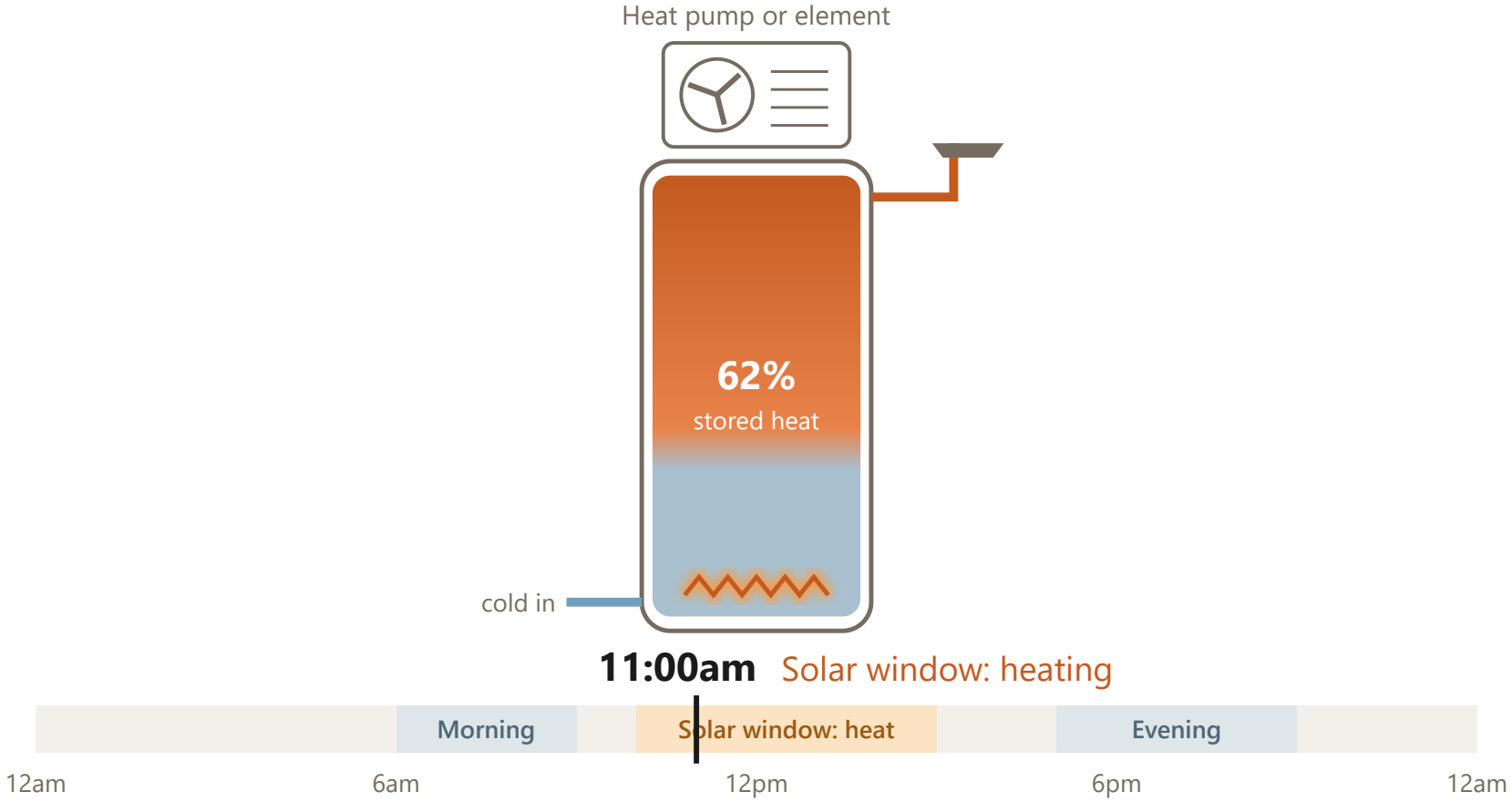


Network upgrades

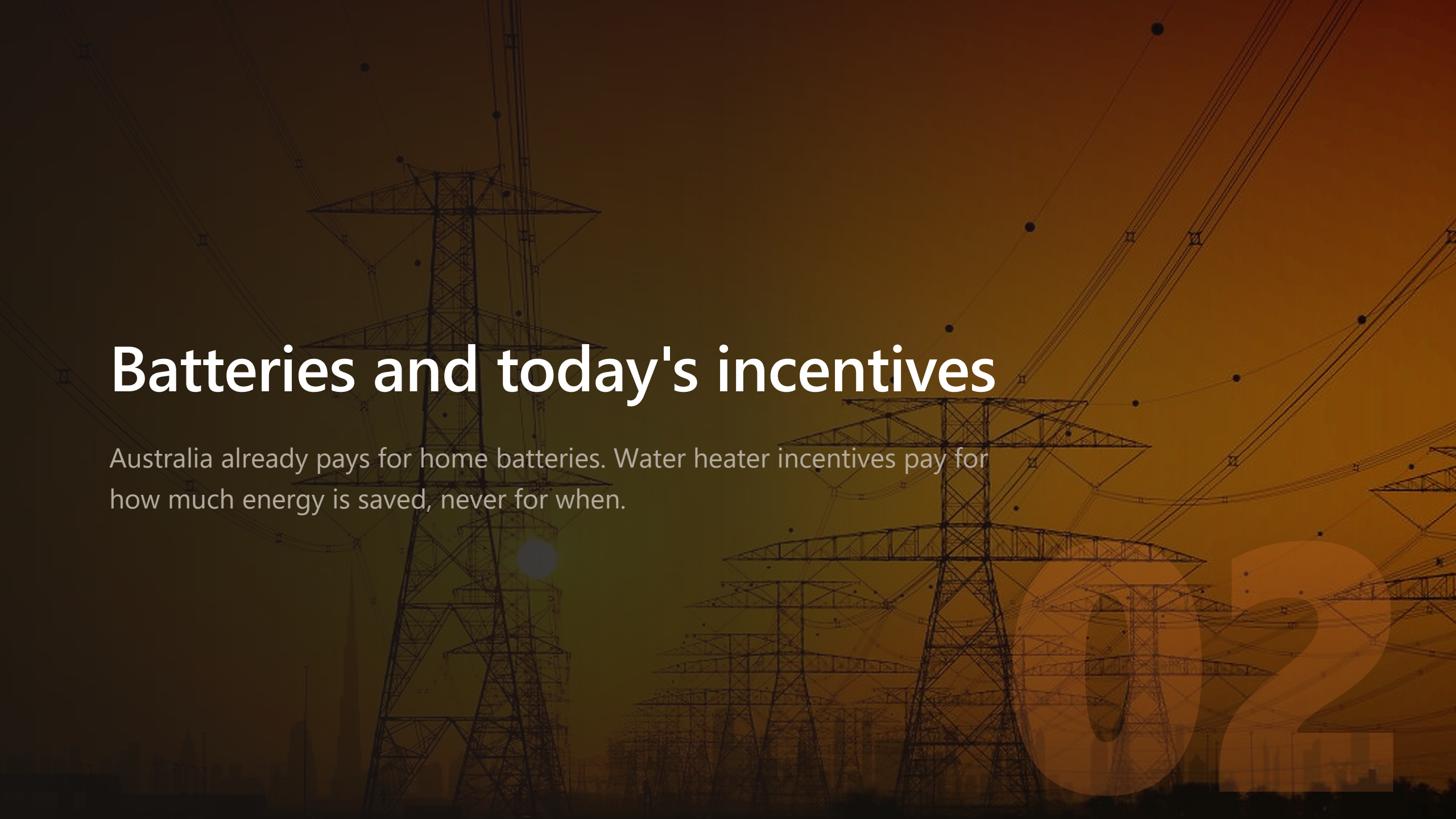
Poles, wires and substations sized for the peak.

There is a cheaper solution.

Solution: demand-responsive water heaters



Water heater = cheap thermal battery that can shift load
away from morning & evening peaks to midday solar

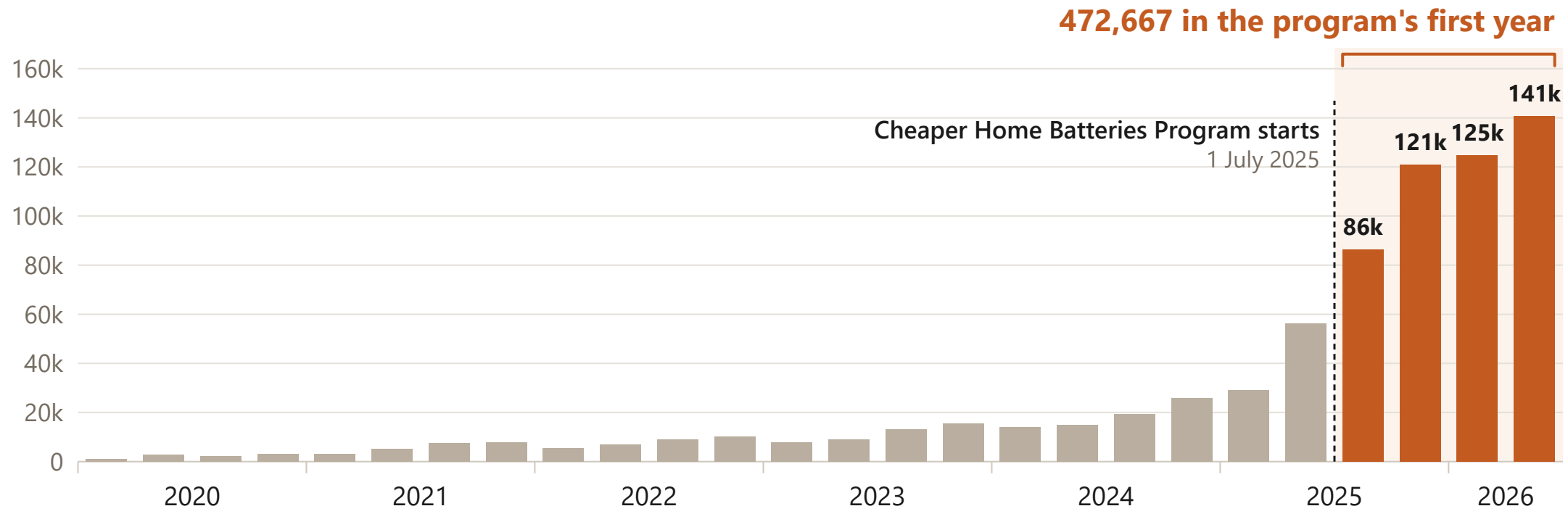


Batteries and today's incentives

Australia already pays for home batteries. Water heater incentives pay for how much energy is saved, never for when.

02

Incentives drive massive uptake: home batteries



2020 to mid-2025: industry chart, read from image (source to confirm). From July 2025: CER installation data.

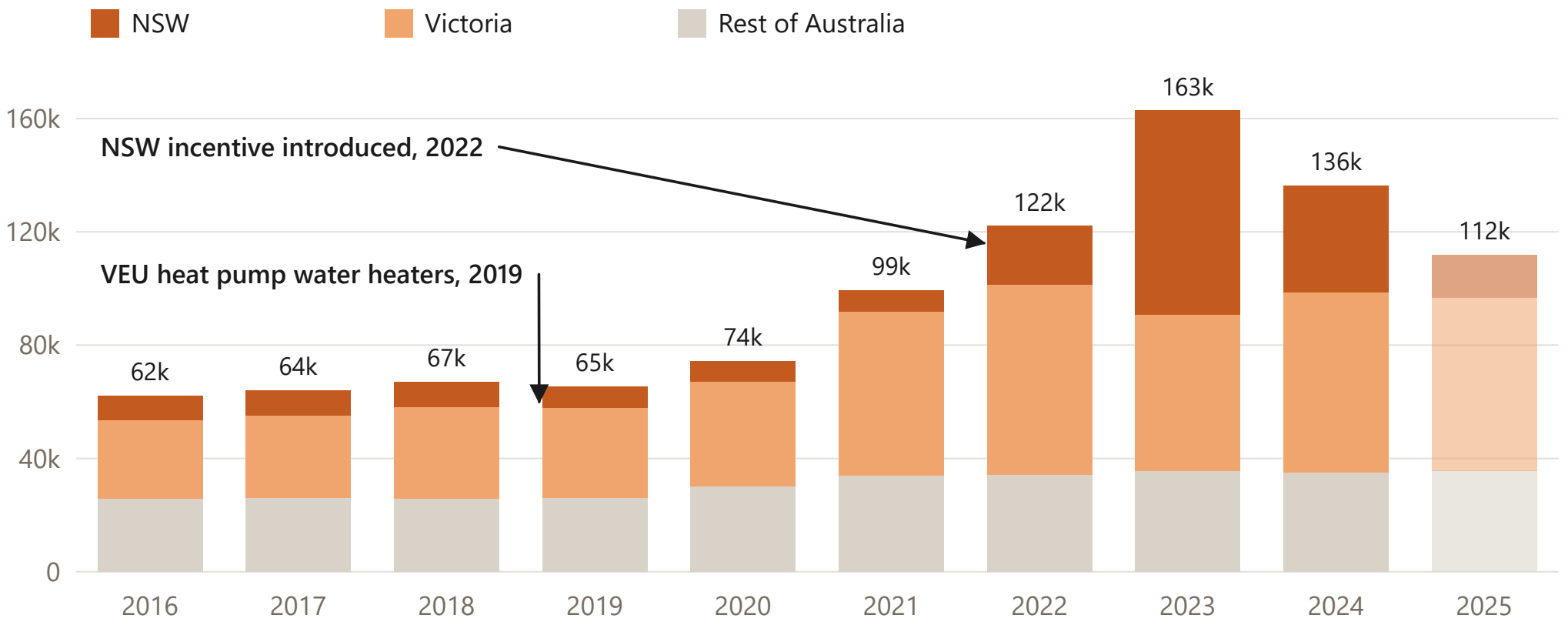
More than 500,000 home batteries in about 13 months, paid through STCs in the SRES.

Thermal and electric batteries

	Home battery	Demand-responsive water heater
What it shifts	Any household load, or export	Its own hot water, about 5 to 6 kWh a day
Storage	20 to 30 kWh usable on average	About 13 kWh of heat in a 250 L tank
Cost per kWh	About $208 of incentive	About $92 of extra hardware
Wear	Capacity fades with use	Water and steel: no capacity loss

Complementary. The water heater carries its own load, so the battery is free for the rest of the house.

Incentives drive massive uptake: water heaters

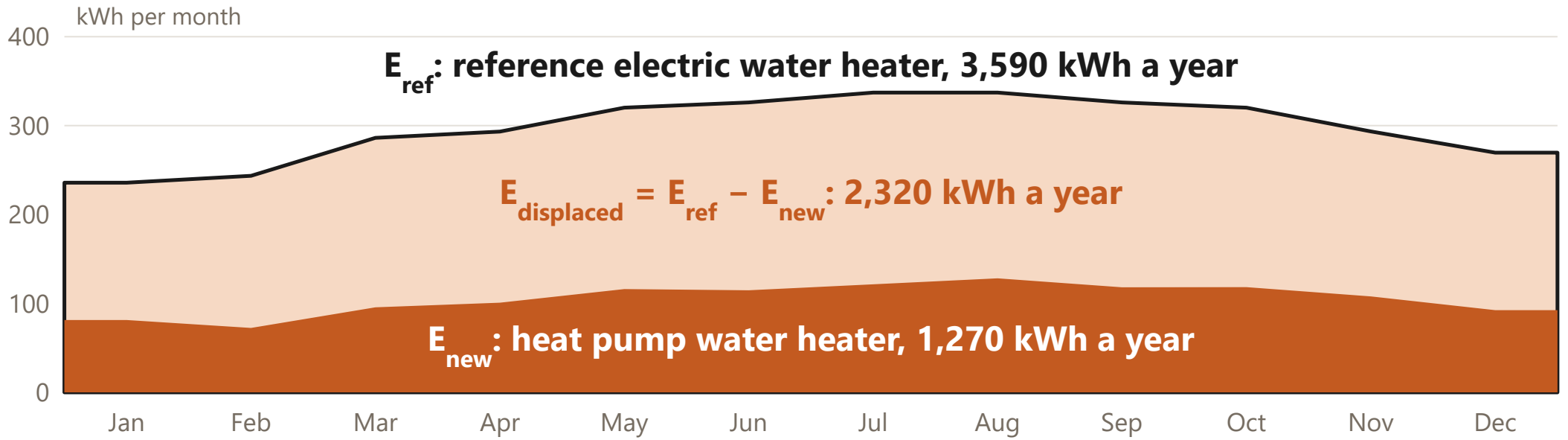


2025 may still rise: certificates can be created up to 12 months after installation. Source: CER.

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Today's energy efficiency incentives do not account for time-of-use

$$\text{STCs} \propto (E_{ref} - E_{new}) \times \text{deeming years}$$



The certificate counts the annual total. The time of day never enters it.

Simplified illustration: EnergyAE simulation, AS/NZS 4234:2021 zone 3, against an electric heater at 97% with no standing losses.

> **For the grid, when a water heater runs can matter more than how efficient it is.**



Demand response certificates

A simple certificate, calculated the same way as STCs, that pays for when energy is used.

03

Barriers to demand response today

The benefits are well evidenced in theory and in early field trials. Uptake is still minimal.

- Households don't know demand response can save them money
- Few aggregators can control water heaters at scale
- Few tariffs pass on five-minute wholesale prices
- Little pays households for deferring network upgrades, beyond overnight controlled load
- Smarter controllers add cost that nothing pays back

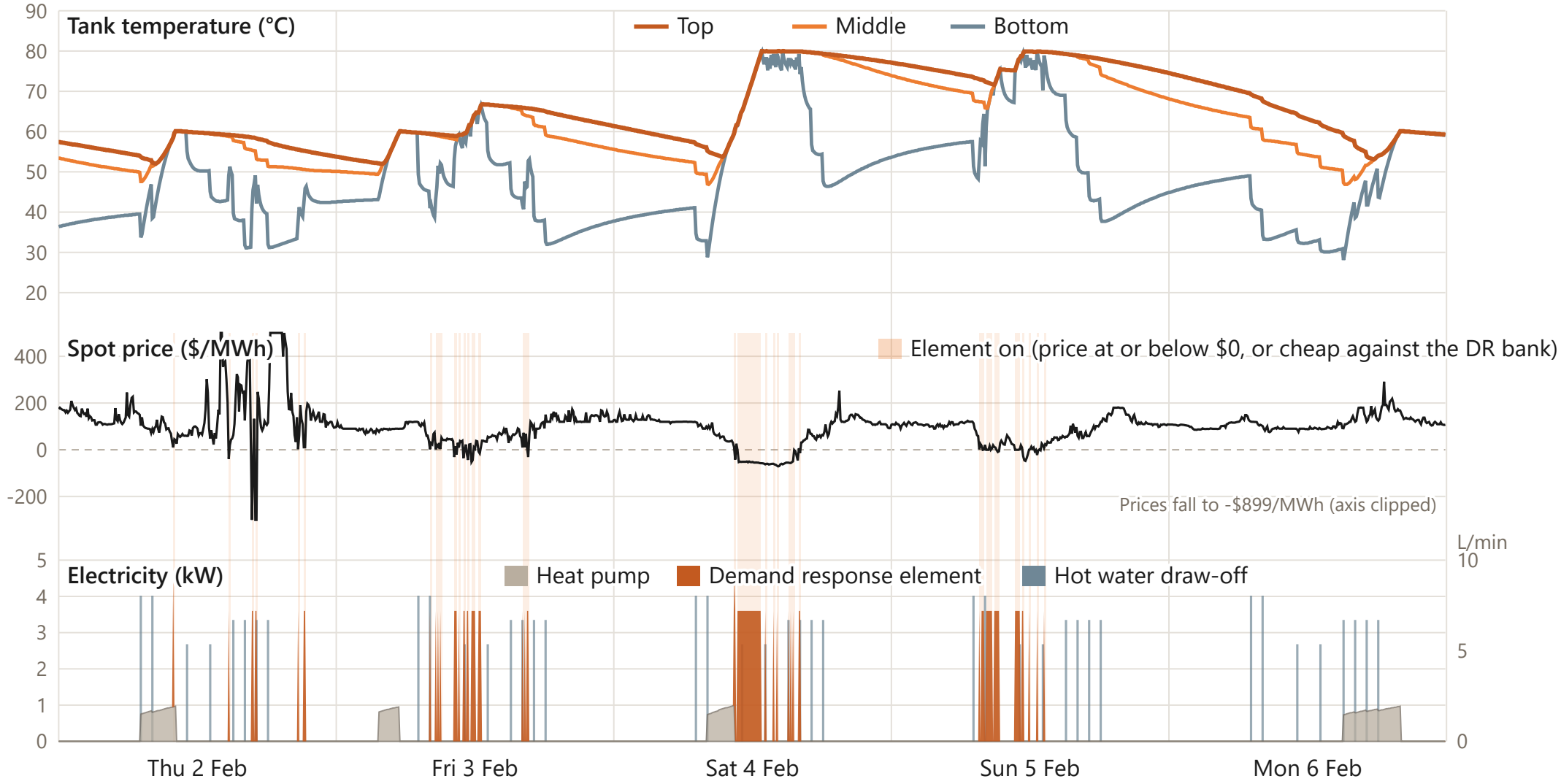
STCs = energy displaced (MWh a year) × 10 years

DRCs = demand response electricity (MWh a year) × 10 years

Counts only if that electricity cost $0 or less, on balance, at spot prices over the year.

- Uses the same AS/NZS 4234 simulation as STCs
- One new input: AEMO five-minute spot prices
- A plain timer heats by the clock, so it earns nothing
- Proposed: electricity bought at $0 or below is not counted against STCs

TRNSYS: transient system simulation



DR bank: -$3.72

Simulation time = 887.9 hr

TRNSYS 15 simulation: integral 320 L R290 heat pump with a 3.6 kW element on V1.1 tier T3 (DR bank), climate zone 4, AEMO NSW spot prices capped at $500/MWh.

How a product would be assessed

Manufacturer designs the control

Any strategy, using only what the heater can observe.

→

Modeller simulates a year

The product's AS/NZS 4234 TRNSYS model, plus AEMO spot prices.

→

DRCs counted and checked

Demand response electricity, the $0 test, Legionella and 45°C delivery.

→

Regulator audits and approves

The same path STC claims follow today.

Manufacturers already hold these models for STCs, so applications could open within three months of a scheme starting.

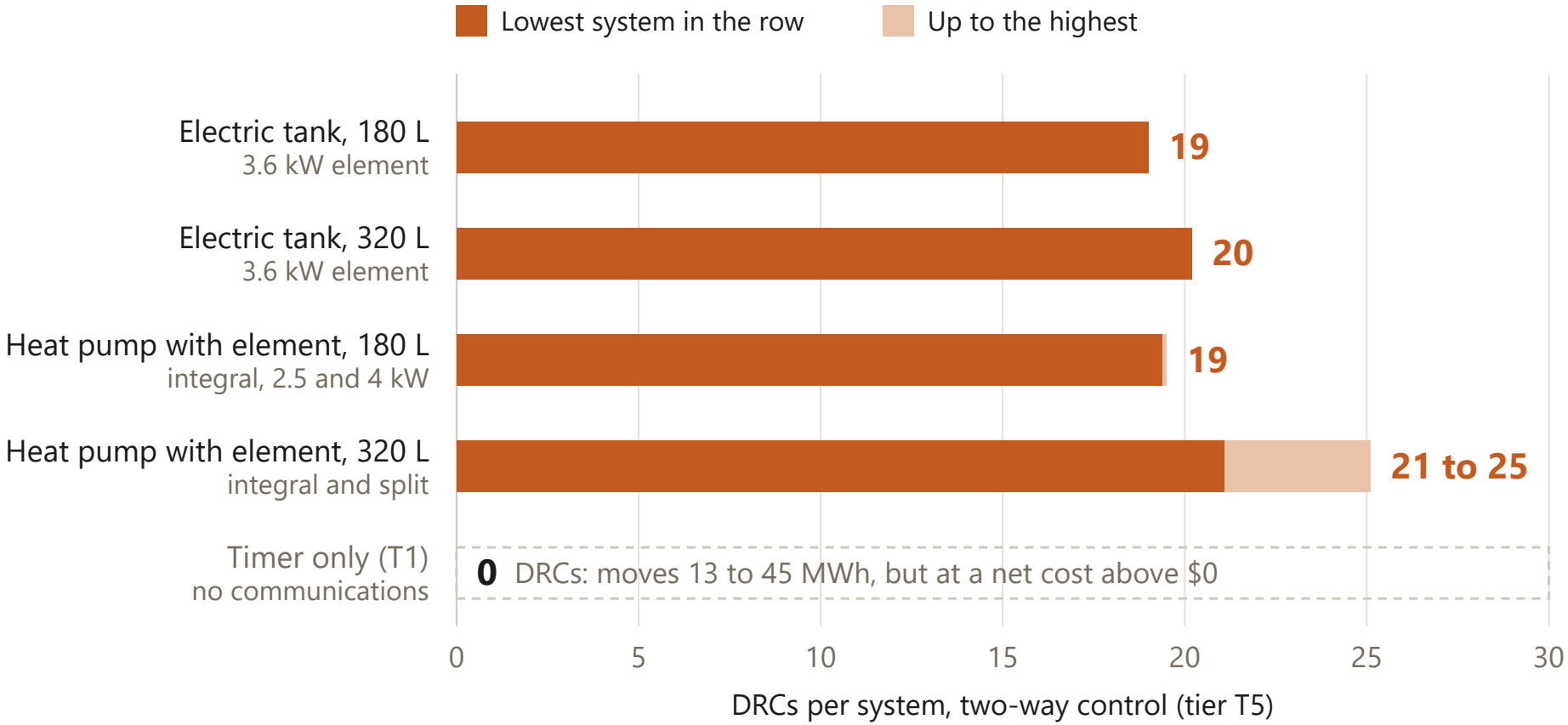
How it was tested

14 water heaters, simulated for a year in TRNSYS on six control tiers: electric tanks, R290 and CO_2 heat pumps, 180 L and 320 L, with and without a 3.6 kW element.

Tier	Control	Link to the heater
T0	Thermostat, no demand response	None
T1	Timer: heats 10am to 4pm and 9pm to 7am	None
T2, T3	Element on when prices are negative or low	One-way signal
T4, T5	As T3, weighted by how full the tank is	Two-way, reads the tank

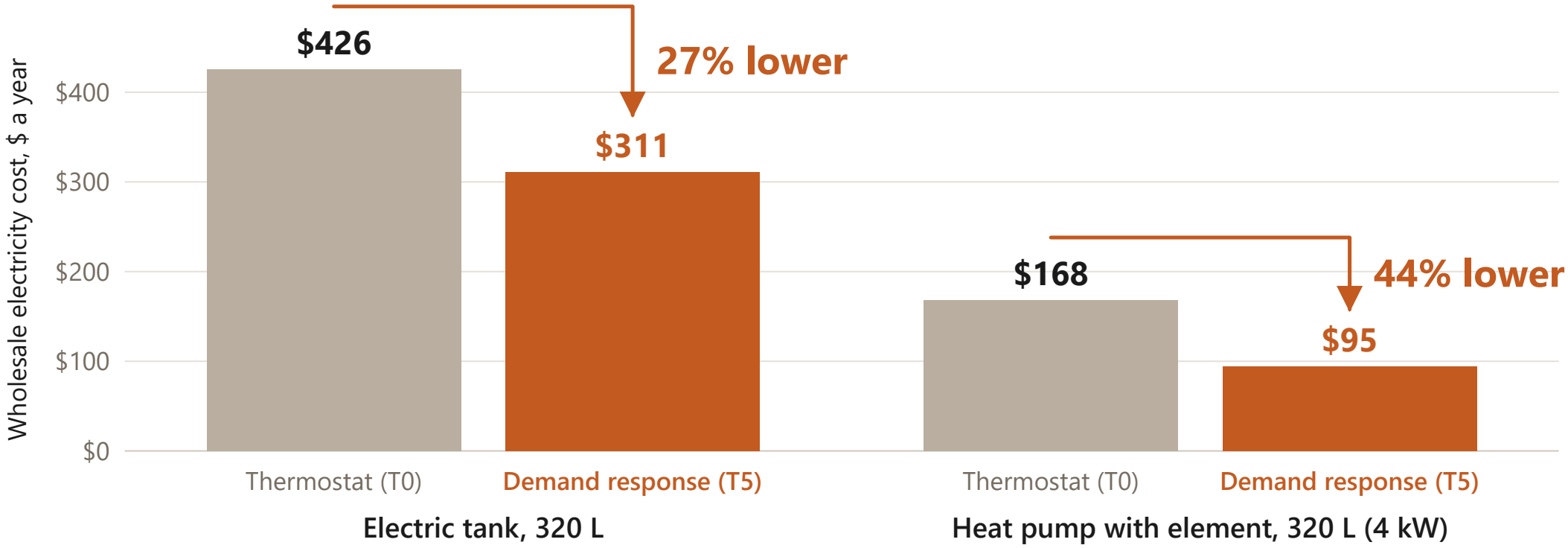
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Demand response certificates by water heater



Any tank with an element earns about 20 DRCs. A plain timer earns none.

Wholesale electricity cost: efficiency plus timing



Timing cuts the wholesale cost of the same water heater by a quarter to almost half.

Benefits of a demand response certificate scheme

Households

- Lower upfront cost for flexible appliances
- Lower bills on tariffs that reward timing
- Lower wholesale prices for everyone
- No change in behaviour required

Networks

- Better use of existing assets
- Better reliability
- Faster electrification

The grid and generators

- Lower peak demand and grid stress
- More midday demand for solar, less curtailment
- Network upgrades avoided or deferred

Retailers and aggregators

- New retail plans that pass on wholesale prices
- The critical mass large aggregators need

Three decisions for regulators

What is a DRC worth, and who funds it?

The white paper suggests aligning its value with the network cost avoided.

How do DRCs stack with STCs, VEU and ESS?

Proposed: electricity at $0 or below is left out of STC energy use.

Which control tiers qualify?

No link, a one-way signal, or two-way control that reads the tank.

The same day, replayed

A typical summer day, NSW



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Demand-responsive water heaters can unlock Australia's energy grid

Reduced grid stress, deferred network infrastructure, maximised renewable utilisation, lower household energy bills.

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Based on the Demand Response Certificate white paper by Dr Dean Clift and Alastair McDowell. EnergyAE Ltd (NZ) / EAE Pty Ltd (AU)