TURN UP THE HEAT (BEFORE PEAK)

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VERDANT

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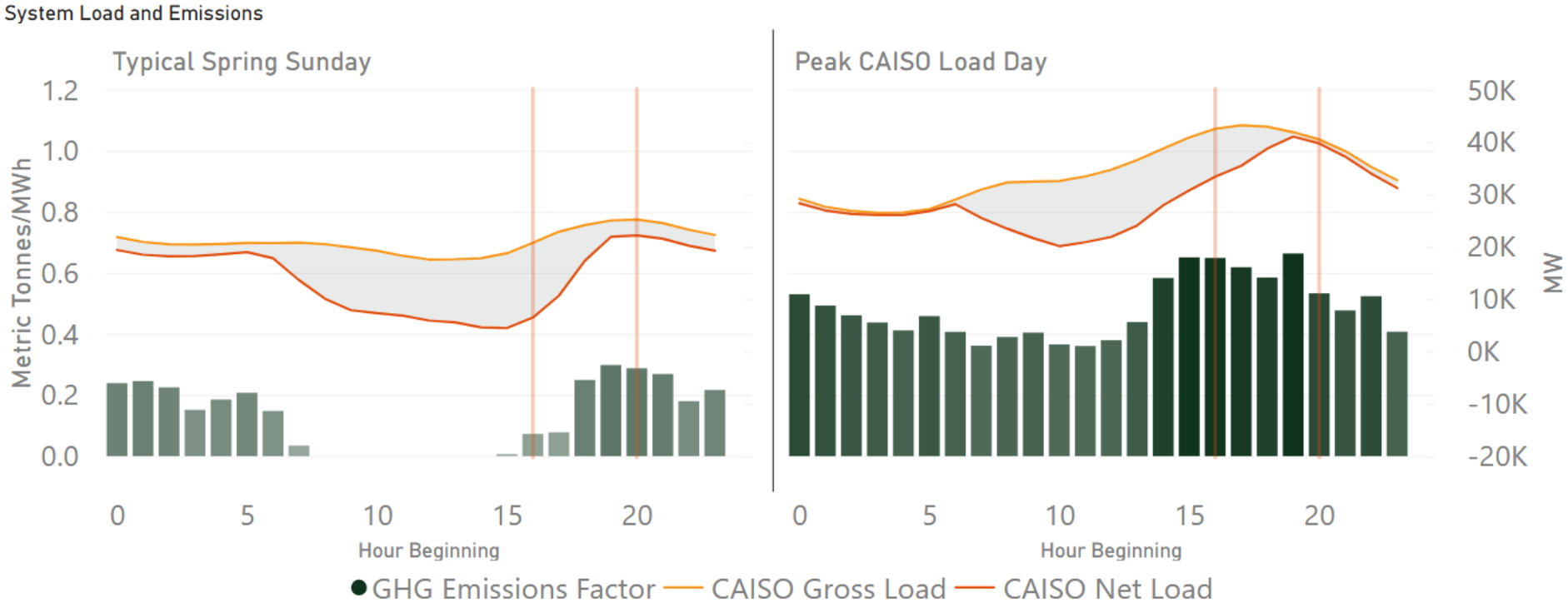
ENTER WATTERSAVER

- Pilot launched in 2022 covering PG&E customers in CA
- Goals of:
  - Shifting energy off peak demand
  - Enhancing grid reliability
  - Reducing costs for PG&E's TOU customers
- Uses a Randomized control trial for evaluability (10% baseline)

EMISSIONS


System Load and Emissions
Typical Spring Sunday
Peak CAISO Load Day
Metric Tonnes/MWh
1.2
1.0
0.8
0.6
0.4
0.2
0.0
50K
40K
30K
20K
10K
0K
-10K
-20K
MW
0
5
10
15
20
Hour Beginning
GHG Emissions Factor
CAISO Gross Load
CAISO Net Load

WHY THIS MATTERS

- Evening peaks + electrification = tighter margins and higher bills/emissions
- HPWHs are a scalable, customer-sited thermal battery– when commands land and comforts hold
- The two biggest levers: dispatch timing and reliability

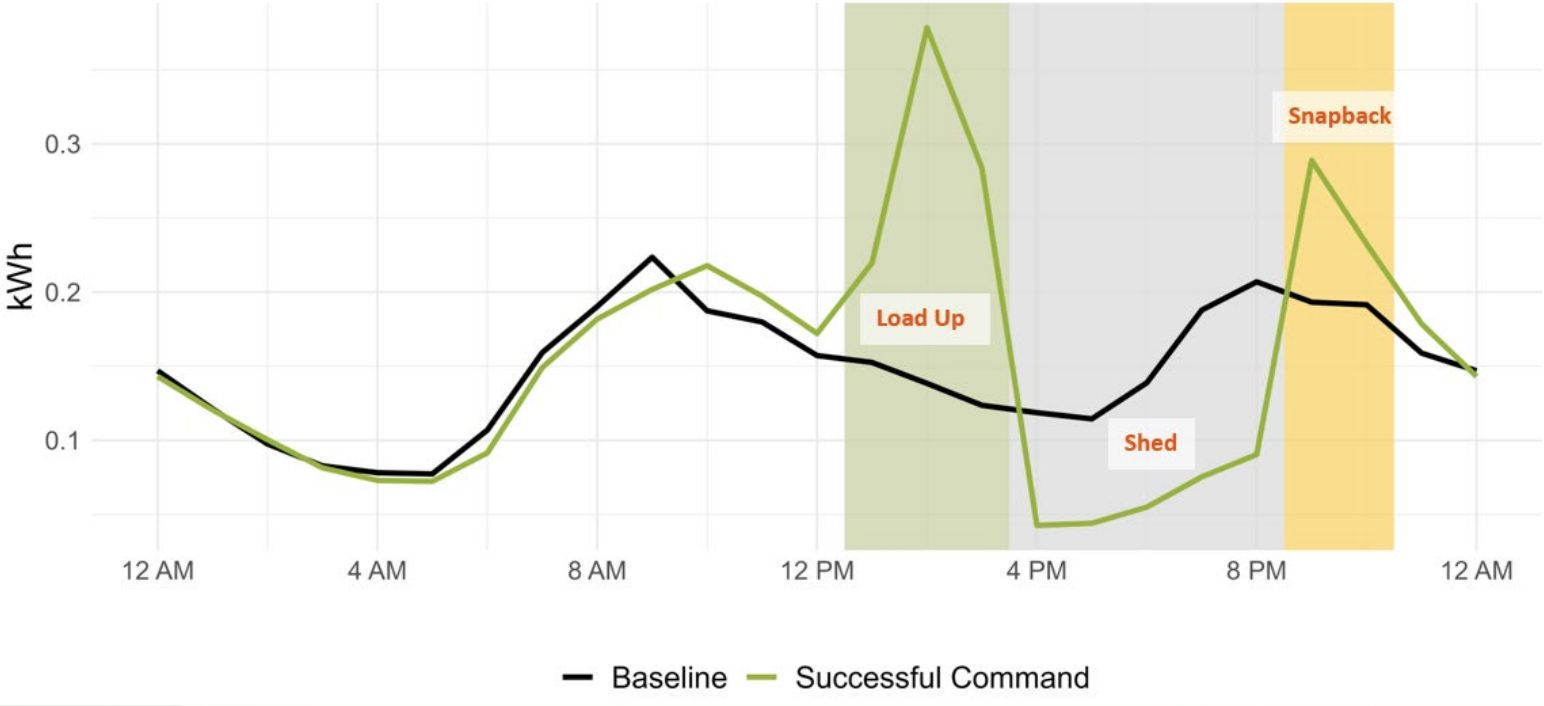
WHAT WE TESTED (DISPATCH GROUPS)

- Multiple Advanced Load Up (ALU) and Basic Load Up (BLU) platoons with distinct windows
- What we track: Devices, events, and command success rates for each group

	Shed Period	N Devices
ALU	4PM-9PM	89
ALU	3PM-12AM	41
BLU	4PM-9PM	86

HOW CONTROL WORKS – ALU 4-9PM

Average Load Shape Example



THE PROBLEM: RELIABILITY, COMFORT, AND BASELINES

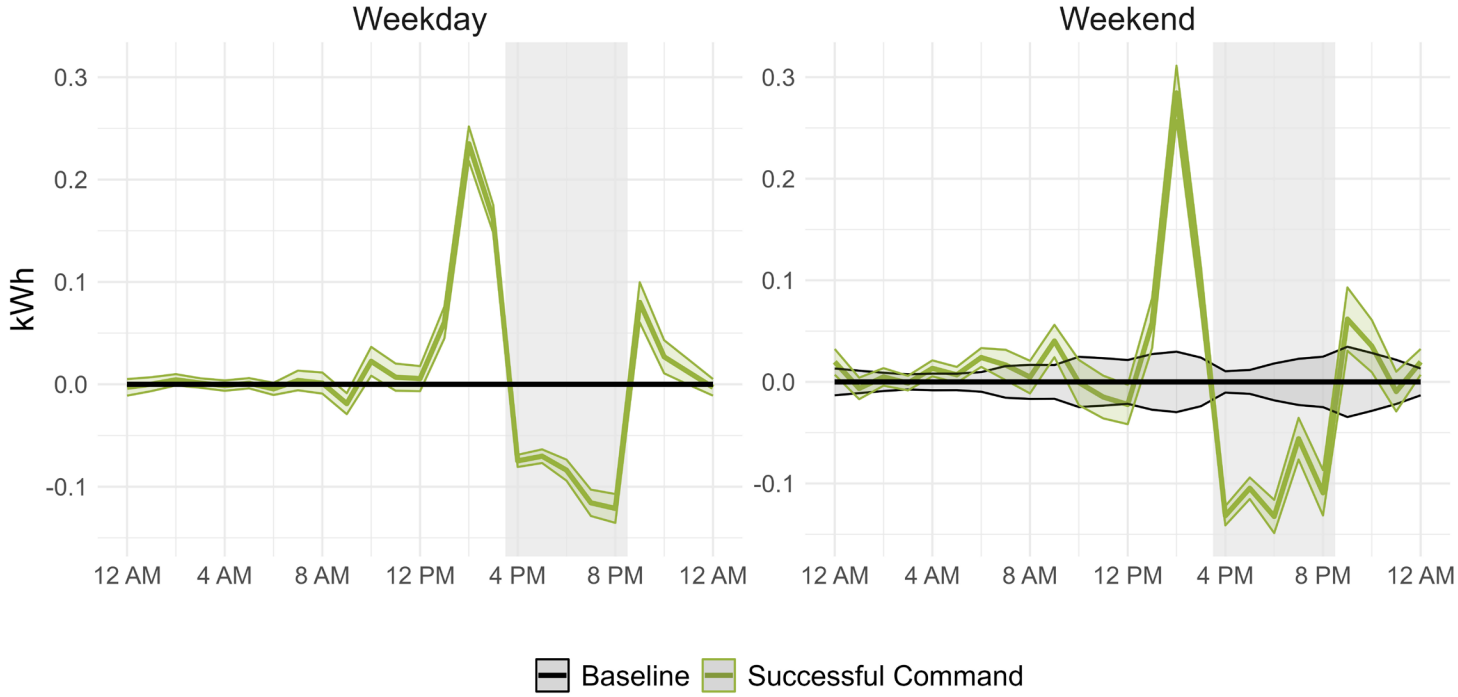
- Command reliability varies by pathway (cellular CTA-2045 ~ 98% success; Wi-Fi ~ 13-82% success)
- Opt-outs higher in long shed windows and BLU – hot water availability issues
- To attribute hourly effects, baselines must be representative

HOW WE MEASURED IMPACTS

- Hourly panel with device fixed effects and day fixed effects; success/fail/baseline indicators
- Define group-specific windows: pre/on-window/post
- Random daily hold-outs give fair baseline days
- Convert to bills (rate calc) and emissions (marginal rates)

ALU 4-9PM SHED

Estimated Impacts



FINDINGS

- All groups shed on-window; magnitude differs by window timing
- ALU: bigger peak shed + more pre-load = higher annual kWh/bills
  - Control refinements may change this
- BLU: Net lower energy/CO2/bills but bigger snapback
- Long 3PM-12AM: more opt-outs, less shed per hour, success limits impact
- RCT works, could begin at 25 water heaters

LEARNINGS

- Tune ALU preheat – cap the boost, start later, compressor-only; gentle post-shed ramp
- Shorter/targeted windows – bound snapback & cut opt-outs
- Build reliability telemetry –comm help, auto-triage, customer nudges if unit unresponsive
- Focusing on ensuring devices are working as expected may have more impact than control algorithm tweaks

HOW OTHERS CAN USE THIS

- Dispatch design: pick the window with the best shed and rebound, test ALU boost and start time
- Customer comfort: segment by usage, adjust shed length, add hot-water safeties
- Connectivity: prioritize cellular connections over WiFi
- Evaluation: adopt a RCT daily hold-outs, run baseline QC

THANK YOU

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CONTACT DETAILS

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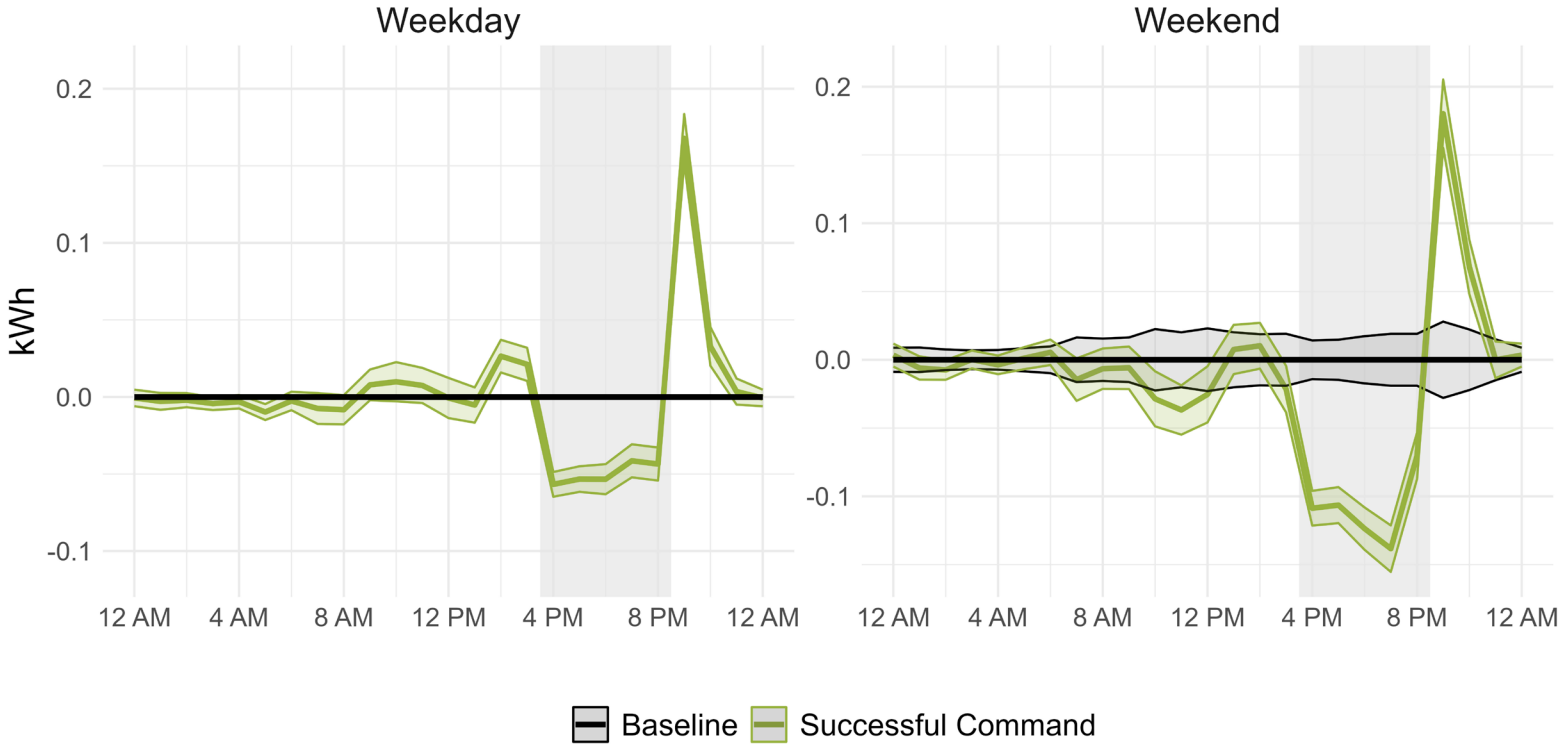
BLU 4-9PM SHED



ALU 3PM-12AM SHED