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Targeting New Heat Pump Customers and Quantifying Impacts on Demand Flexibility

Brian F. Gerke | ESIG 2023 Technical Workshop | 24 Oct 2023

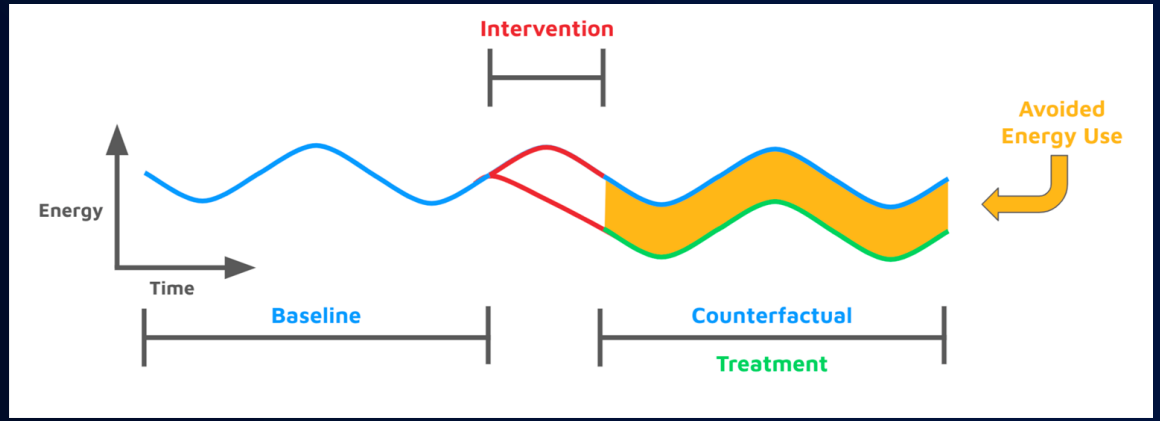
Overview

- How to: measure (and value) electrification impacts at the meter(s)
- TECH Clean California: Early results on heat pump deployment
  - Measured impacts on electricity and gas consumption
  - Targeting for grid impacts and equity
- Unlocking electrified loads as a grid resource
  - Demand FLEXmarket
  - Load shifting with electrified loads in MCE Peak FLEXmarket

Measuring electrification impacts at the meter

Recurve's open-source **FLEXmeter** toolkit:

- **OpenEEmeter** generates counterfactual energy consumption via time-of-week and temperature regression
- **GRIDmeter** corrects for exogenous effects with comparison groups
- **FLEXvalue** computes the dollar value of energy savings to the grid



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TECH Clean California Overview

What is TECH Clean California?

- California's flagship heat pump market transformation initiative for space/water heating, designed to help put California on a path towards carbon free homes by 2045
- Guiding principles of scale, equity, regulatory simplicity, and market transformation

Activities:

- Spur the market with statewide incentives, training, and outreach
- Address market barriers with regional pilots
- Inform decarbonization framework through reporting and analysis

	California Heat Pump Goals
Heat Pump Water Heating	**6 million heat pumps installed by 2030** **Climate ready / friendly homes**: • 3 million by 2030 • 7 million by 2035 **50% of funding** delivered to low-income households or disadvantaged communities
Heat Pump HVAC	

Source: California Office of Governor website. July 2022.
"Governor Newsom Calls for Bold Actions to Move Faster Towards Climate Goals"

For a more complete overview check out techcleanca.com.

TECH Team: Energy Solutions, Association for Energy Affordability, Building Decarbonization Coalition, Recurve, Ortiz, veic, Ardenna Energy, Frontier energy, Electrify My Home, NCI, Tre'Laine

The TECH Clean California initiative is funded by California ratepayers and taxpayers under the auspices of the California Public Utilities Commission.

TECH year 1 results summary

Significant net grid (total system benefit) and climate impacts

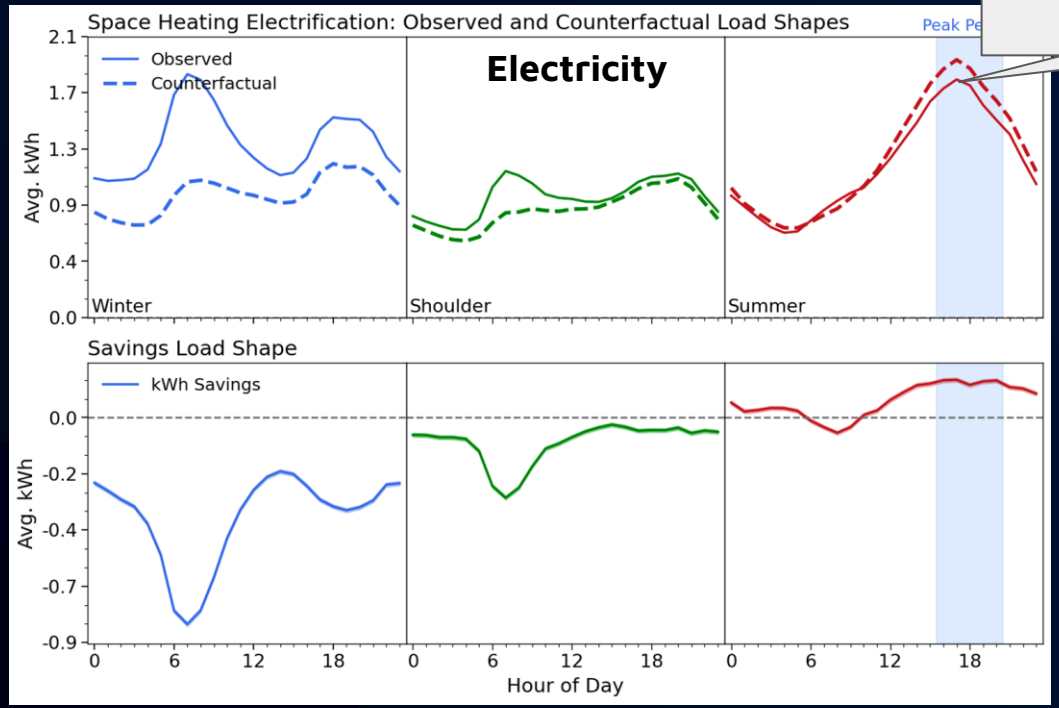
- Net benefit to the grid **$3,750** per HVAC project and **$1,696** per heat pump water heater project
- Net benefit to climate **10.89** and **5.69** tons GHG saved, respectively

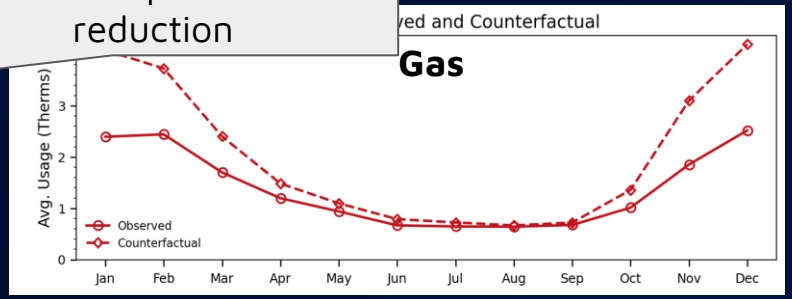
Average Project	Electric Impacts				Gas Impacts			Total Lifetime Impacts	
Portfolio	Annual MWh Savings	Peak^ MWh Savings	Lifetime TSB*	Lifetime GHG Savings (Tons)*	Annual Therms Savings	Lifetime TSB*	Lifetime GHG Savings (Tons)*	**Total Value***	**GHG Savings (Tons)***
Space Heating†	-1.25 ± 0.11	0.09 ± 0.03	-$347	-5.25	235 ± 29	$4,097	16.14	**$3,750**	**10.89**
Water Heating‡	-1.47 ± 0.10	-0.08 ± 0.03	-$778	-4.23	219 ± 21	$2,475	9.92	**$1,696**	**5.69**

* Lifecycle net, 0.85 NTG, 2022 ACC, 7.6% quarterly discounting, varying climate zones
† 15 year EUL
‡ 10 year EUL
^ June - Sept, 4 - 9 pm

TECH year 1 results: Electrification drastically reshapes energy consump

More efficient cooling = summer peak load reduction





Space heating electrification

- Dramatic increases in winter electricity usage, especially in mornings
- Equally dramatic reductions in winter gas consumption
- Small reductions in summer peak load

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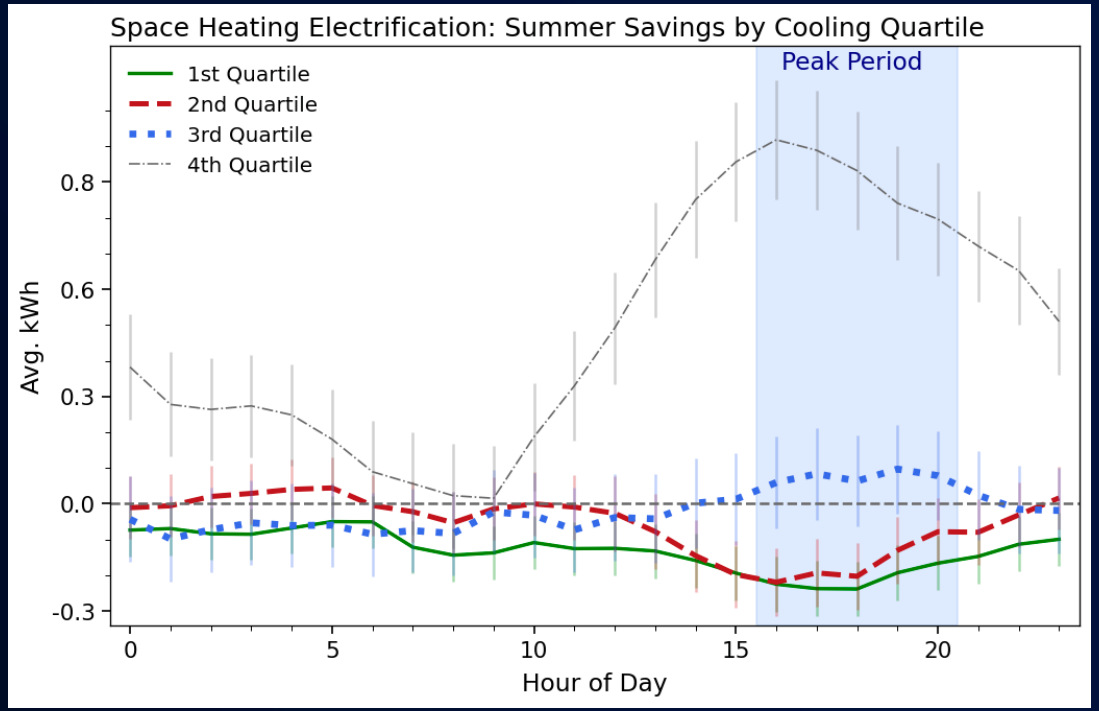
Targeted electrification can yield improved near-term outcomes

- Top quartile pre-electrification cooling users achieved over 500 kWh per year in summer peak savings
  - Median pre-program annual cooling usage of 5,200 kWh
- New AC users (bottom 50%) added about 100 kWh of summer peak usage
- Moderate cooling users (3rd quartile) stayed about the same



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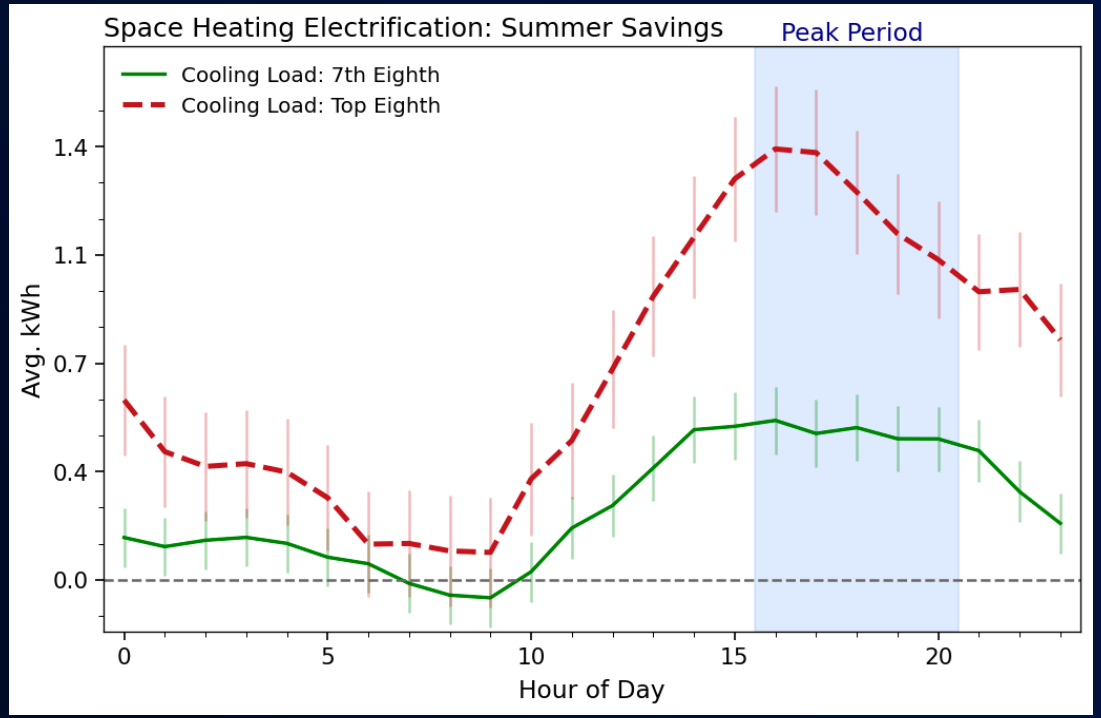
Significant benefits are possible for extremely cooling-burdened customers

- The top 8th of pre-electrification cooling users saved >750 kWh during summer peak
  - $2,500 in lifecycle grid value for electricity alone
  - Virtually 0 net GHG electric impact. Large summer cooling savings offset winter heating increases
  - + all the benefits of gas savings
  - Most likely to experience significant bill impact benefits
- Over 1.5M residential customers in CA already meet this profile



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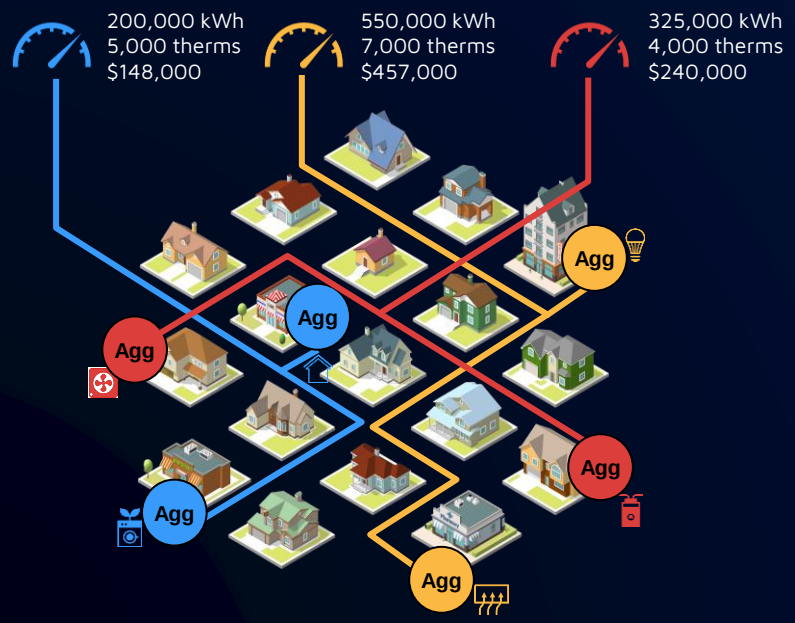
Turning electrified loads into grid resources with an open market for demand flexibility



DEMAND FLEXMARKET

an open, pay-for-performance marketplace where aggregators receive incentive payments for flexing energy at the meter.

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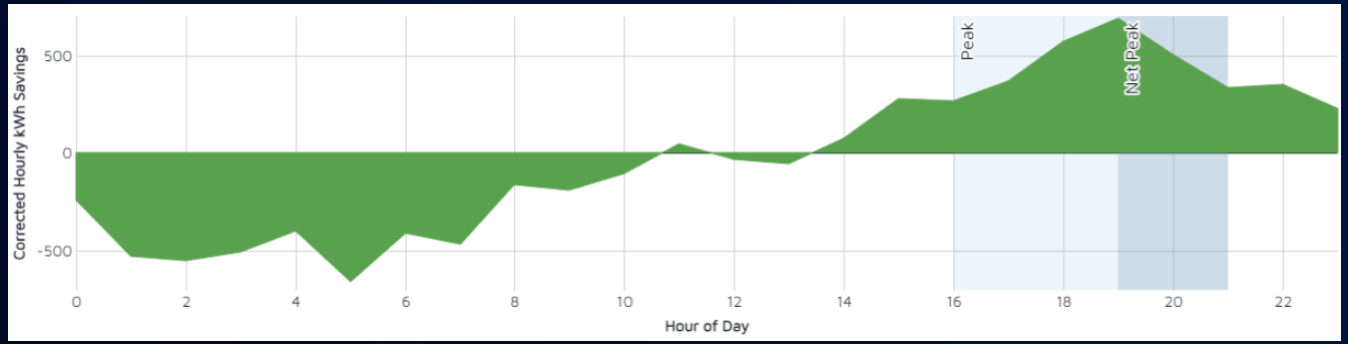
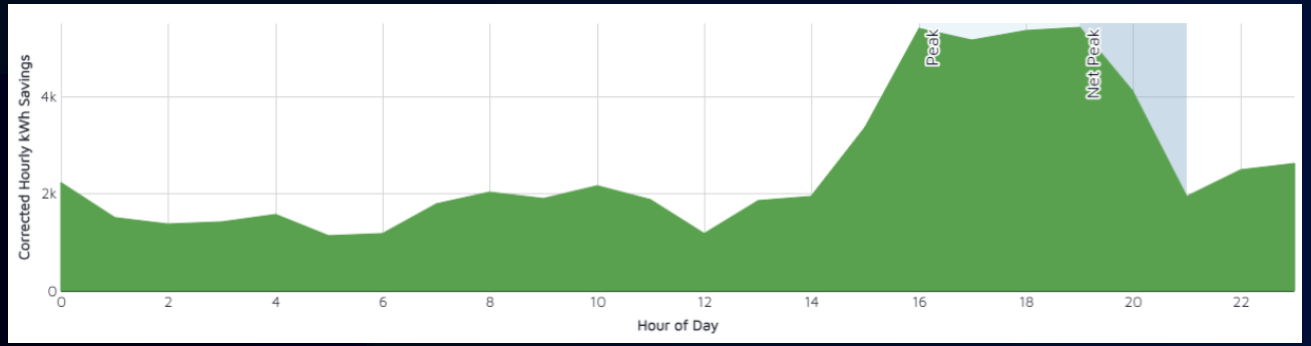
Electrification as a flexible resource in MCE's Peak FLEXmarket

EV charging load shifts out of the evening peak





Smart thermostats reduce load across all hours, focusing on the peak

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MCE Empowering Our Clean Energy Future
CONTRA COSTA | MARIN | NAPA | SOLANO

Summary

- Electrification of space and water heating at scale is now underway in California via the TECH program
- Significant challenges exist for customers and the grid as the transition proceeds
- By measuring the impacts at the meter, we can understand and plan for the transition in detail
- Targeting customers appropriately can minimize negative impacts and maximize benefits in the near term and allow time to mitigate the thornier challenges
- The right incentives can turn some challenges into opportunities by turning electrified loads into a new, flexible resource

Thank you!

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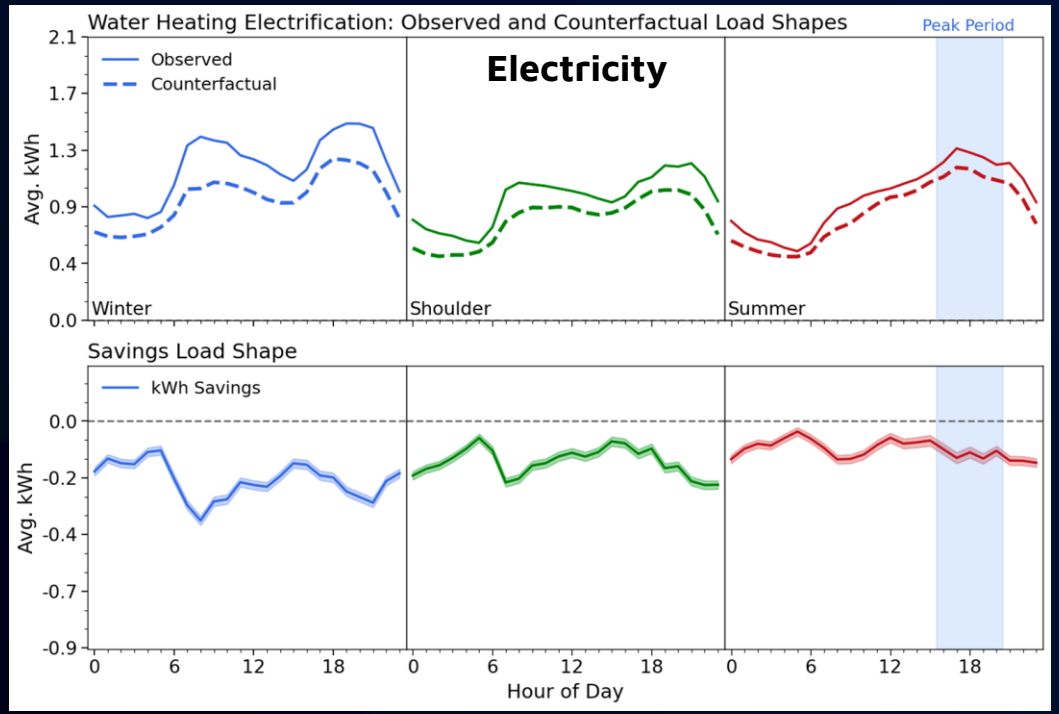
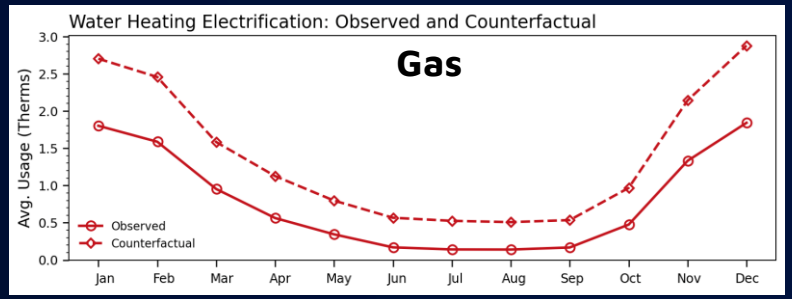
TECH year 1 results: Electrification drastically reshapes energy consumption profiles





Water heating electrification

- Year-round electricity use increases, peaking in winter
- Offsetting decreases in gas consumption
- Slight increases in summer peak load

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