ET Summit 2024

Presented by

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ENERGY TRANSITION
COORDINATING COUNCIL

Residential EV Managed Charging

For Multiple Use Cases

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SMUD

SMUD
Sacramento Municipal Utility District

VGI Vision

Offer rates and programs that encourage broad scale adoption of charging behaviors which maximize grid benefits, while meeting customer needs.

Customer/Utility Involvement

Low ⟷ High

Rates

Leverage TOU Rates and demand charges to influence charging behavior and minimize system impacts.

Site Load Management

Educate fleets on the value of load mitigating tools, such as Automated Load Management Software.

Managed Charging

Utilize managed charging to avoid distribution infrastructure investments and develop demand flexibility resources.

V2X

Enable customers to provide a suite of grid services via the flexible energy stored in EVs.

Key Drivers

- Support ~ 288k EVs by 2030
- Keep rate increases at or below inflation levels
- Decarbonize grid by 2030

Residential EV Managed Charging Pilot Grid Objectives

- SMUD's EV Managed Charging pilot was designed to:
  - Shift EV charging load to minimize the effect of growing EV adoption on grid infrastructure
  - Align charging load with low-cost/low-carbon intensity power when excess renewables are available

June thru February: "Valley fill!"
(nighttime intervention)

March thru May: "Soak up the sun!"
(daytime intervention)

Residential EV Managed Charging Pilot Overview

- Telematics-based pilot
  - OVGIP launched Q3 2022 with Ford, BMW, & GM (soon to launch with ChargeScape)
  - Optiwatt launched Q2 2023 with Tesla
- Incentive $150 at sign-up and $20/quarter ongoing
- 1,200+ EVs enrolled to date (~1/2 per provider), capped at 2,000 EVs
- Targeting mid-2025 transition to Program

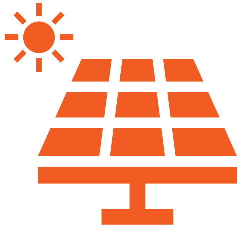
Key Goals

Customer savings & acceptance

Incentives & customer surveys

Mitigate transformer overloads

Staggered local discount period



Consume excess solar

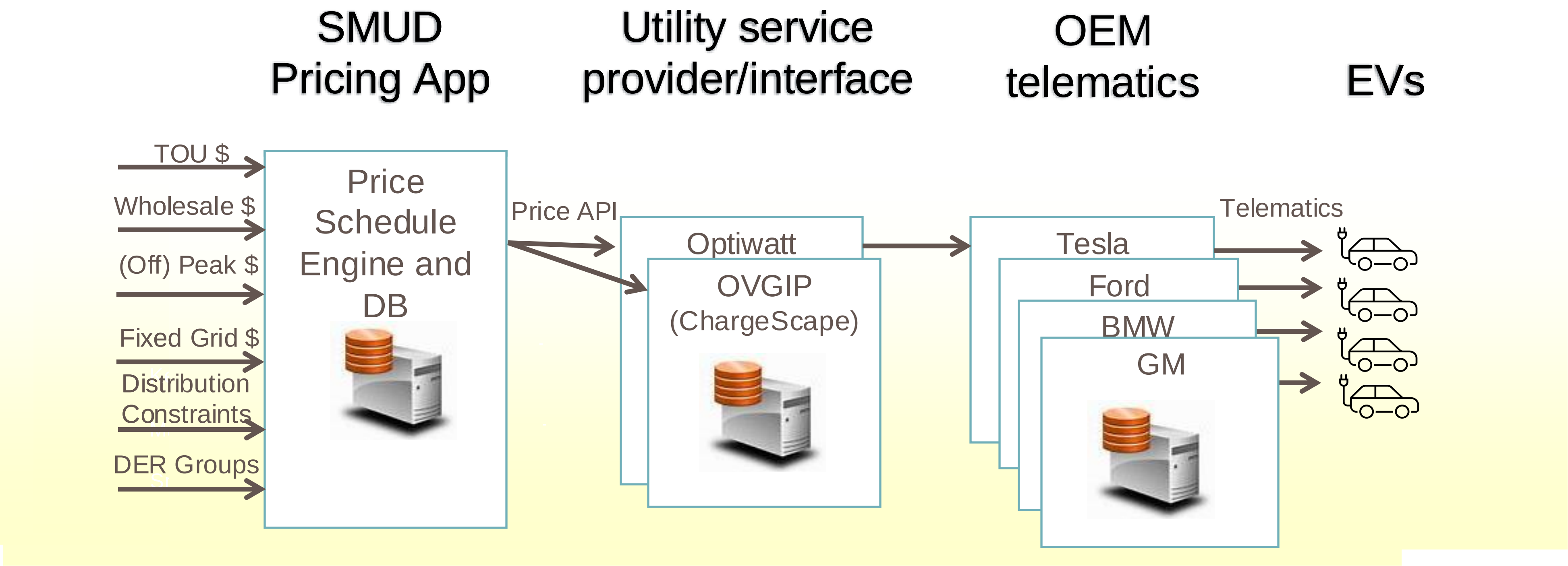
Low daytime energy supply costs in spring

Reduce system peak

System peak capacity adder

Experiment Design

- Experiment design modeled 2030 energy & capacity costs and EV density on the distribution system



Experiment Design

Randomized control trial:

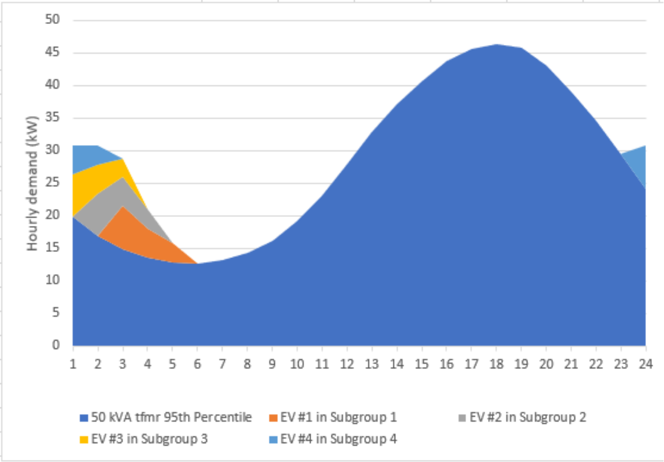
- 30% control group (no managed charging
- 70% treatment group

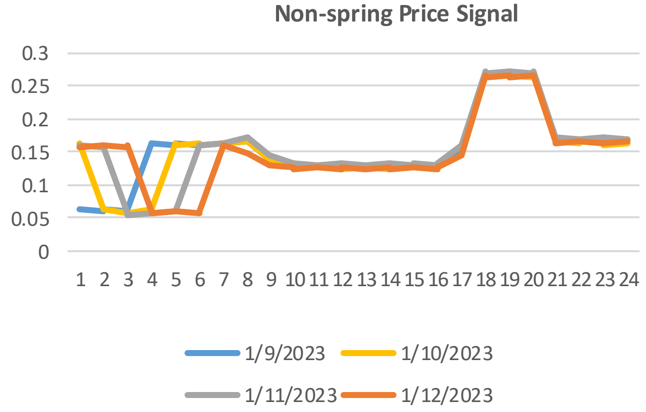
Non-spring schedule:

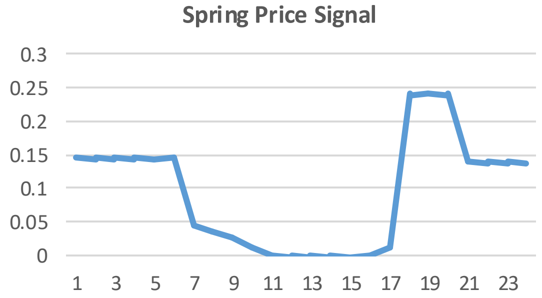
Each participant vehicle cycles through each low-price period

- Midnight –> 3 a.m.
- 1 –> 4 a.m.
- 2 –> 5 a.m.
- 3 –> 6 a.m.

Non-spring Example

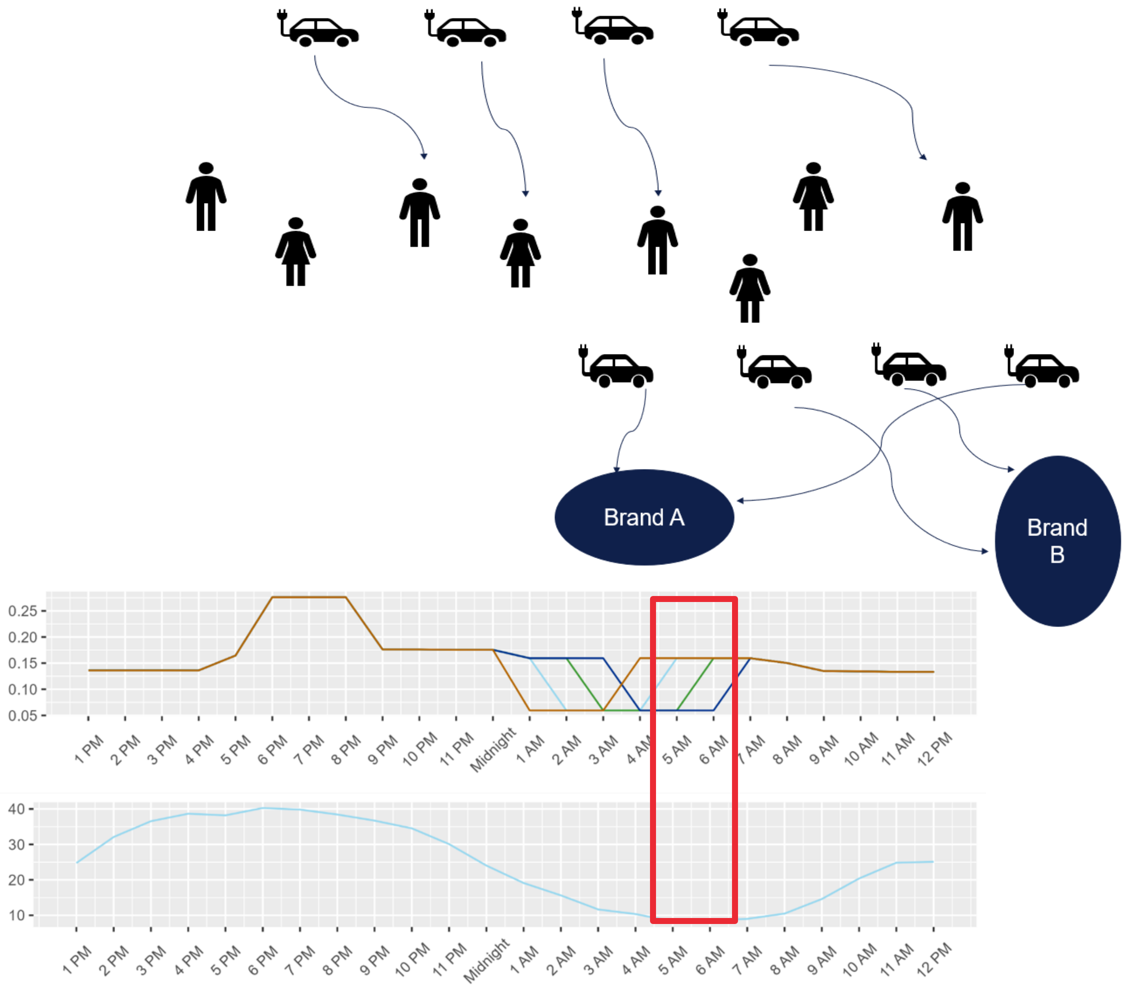






Transformer Overload Simulation

- **Method:** Monte Carlo simulation consisting of 1,000 simulations per adoption scenario (46,000, 120,000, 288,000 EVs)
  - Different households assigned EVs
  - Different OEMs assigned
  - Different loadshapes assigned to each EV
  - Assignment of low-price period based on transformer load
- Compare number of transformers with 5%+ chance of overload with and without managed charging using actual capacities and historical peak-day demand data



Early Findings

- Average bill savings due to shifting charging away from TOD peak hours=>$4.23/yr
- Transformers >=5% chance of overload => ~25% reduction vs unmanaged
- Slight increase in daytime charging, reduction in afternoon peak-hour charging
- Reduction of system peak load (5pm-8pm) => as much as .25kW/EV
- Shift and reduction in midnight timer peak => ~23%, delayed 1 hour

Lessons Learned & Opportunities

Program Design	Customer Experience	Utility Business Case	Control Performance	Streamline Technology
Load-shifting potential depends in part on participant plug-in behavior, frequency	Vehicle Not Charging as Customer Expected	Emphasize recruitment on constrained Transformers	Overcoming preexisting schedules is difficult	
Level 1 charging load doesn't lend itself well to flexible shifting	Difficulty Using Vendor Application	Prioritize "bad actors" & customers available to "soak up solar"	Optimizing valley-filling against driver constraints is complex	Integrate with DERMS
Access to morning/midday charging is not uniform across drivers and may not be consistent for a given driver	Infrequent incentives can lead to increased dropout	Weigh nighttime charging value against available chargeable load during the day	Utility control alignment with OEM	Automate program administration

Next Steps

Pilot

- Replace single peak-day transformer load with 8760 transformer data in simulations
- Incorporate vendor process improvements
- Incorporate post-electrification transformer load
- Incorporate participant survey analysis

Program

- Incorporate lessons learned into scaled program design (ETA mid-2025)
- Emphasize providers with direct relationships with OEMs & experience optimizing for distribution system constraints

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SMUD®

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