ET Summit 2024

Presented by

SCE's Vehicle to Grid Integration Roadmap and Industry Overview

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Agenda

Why VGI

Overview of VGI

- Definitions, Market Status, and Landscape

SCE's Approach

- Enabling Customer Participation
- 2045 State of VGI
- Gaps to Address

Questions & Contact Info

SCE envisions VGI playing a role to meet CA's climate goals by 2045

Challenge	• To meet CA's climate goals, 3x as many resources will be needed by 2045 from today to provide reliable electricity to SCE's customers. • Existing resource types will not be sufficient to meet this demand and the grid will increasingly need to rely on load flexibility with EVs as the largest source • Actions are needed now to enable VGI as a reliable resource for the future.
Vision	• Deliver a safe, simple, affordable, and equitable **menu of opportunities** for customers to leverage the battery capabilities within their electric vehicles • Provide **grid reliability and customer resiliency** services without impacting mobility • Allow customers to **capture value** that their EV provides to the grid • **Integrate VGI** with DERMS and incorporate services into utility grid planning to ensure customer vehicles are effectively contributing
Goals	1. **Increase grid resiliency and customer resiliency**[1] 2. **Increase grid reliability**: 2 GW V2G, 2 GW of load shed (including VGI), and 65% smart charging by 2045; subcircuit dispatch of VGI resources by 2030 3. **Increase customer affordability**[2]

[1] *Goals to be developed within new Future Electrification Infrastructure Architecture initiative*
[2] *Goals to be developed along VGI roadmap*

There is a growing potential within vehicle batteries to provide grid services

EVs with publicly announced plans for bidirectional charging capability

gm, NISSAN, Volkswagen, FISKER, LUCID, HONDA, RIVIAN, STELLANTIS, KIA Movement that inspires, HYUNDAI, Ford, MITSUBISHI MOTORS, BMW, Mercedes-Benz, polestar

And batteries are getting bigger…

2018 Focus EV - 34kWh

2022 Lightning - 131kWh

2015 Spark EV - 19kWh

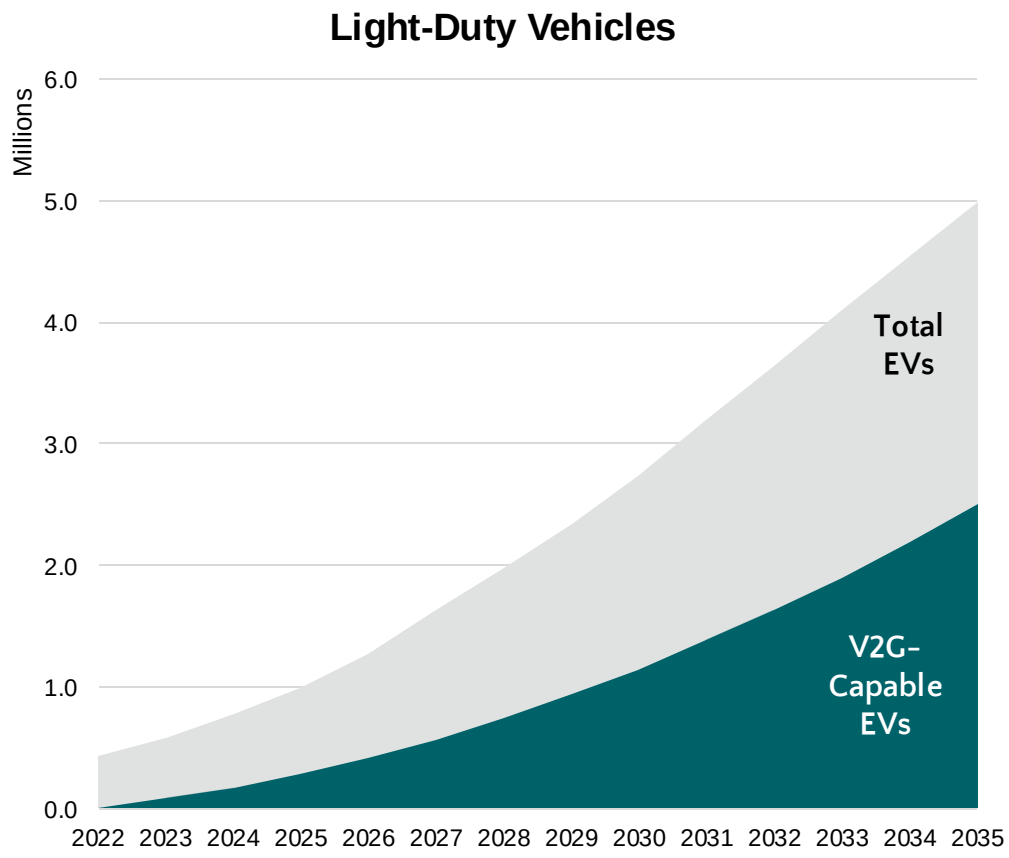
2022 Hummer EV - 212kWh

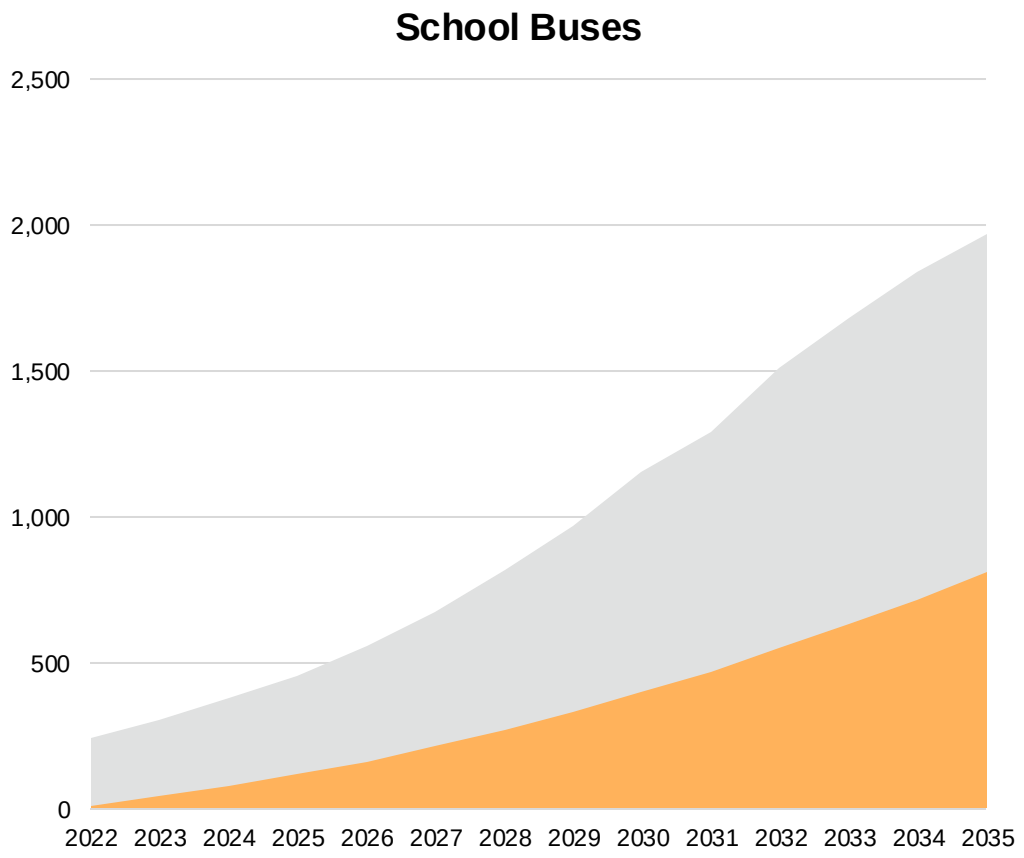
- A typical home energy storage system (~26kWh) can be achieved with only 10%-20% of EV battery capacity
- V2X systems being installed at 19.2kW

Source: ChargeIn presentation during Veloz Webinar 8/23/2022

About half of electric vehicles may be V2G-capable by 2035, representing 2.5 million LDVs and 800 school buses in SCE service area

V2G Capable Vehicles in SCE Service Area





Source: SCE 2022Q4 TE Forecast + EPRI V2G Assumptions (70% EV sales are V2G capable by 2035)

Reliability, Resiliency, and Value Have Many Pathways

Vehicle Grid Integration (VGI)

- VGI refers to the seamless integration of electric vehicles (EVs) with the power grid, enabling bidirectional energy flow and optimizing the use of renewable energy sources.

V1G

- V1G involves varying the time or rate at which an electric vehicle is charged.

Smart Charging (V1G)

- Smart charging involves the use of advanced technologies and algorithms to intelligently manage the charging of electric vehicles, considering factors such as grid demand, electricity prices, and renewable energy availability to minimize costs and maximize efficiency.

Vehicle-to-Everything (V2X)

- V2X is the overarching term for transferring the electricity stored in electric vehicle (EV) batteries to the grid, buildings, houses, and other energy-consuming destinations.

Vehicle-to-Grid (V2G) Isolated

- V2G Isolated refers to the arrangement where an EV and customer site is operating in isolation to the grid.

Vehicle-to-Grid (V2G) Parallel

- V2G Parallel refers to the arrangement where an EV and customer site is operating in parallel to the grid.

V2H

- Vehicle-to-Home allows electric vehicles to serve as a backup power source for homes during outages or peak demand periods by utilizing their stored energy to power household appliances.

V2B

- Vehicle-to-Building transfers power from parked EVs to the building's power management system during peak load times or power outages.

V2G

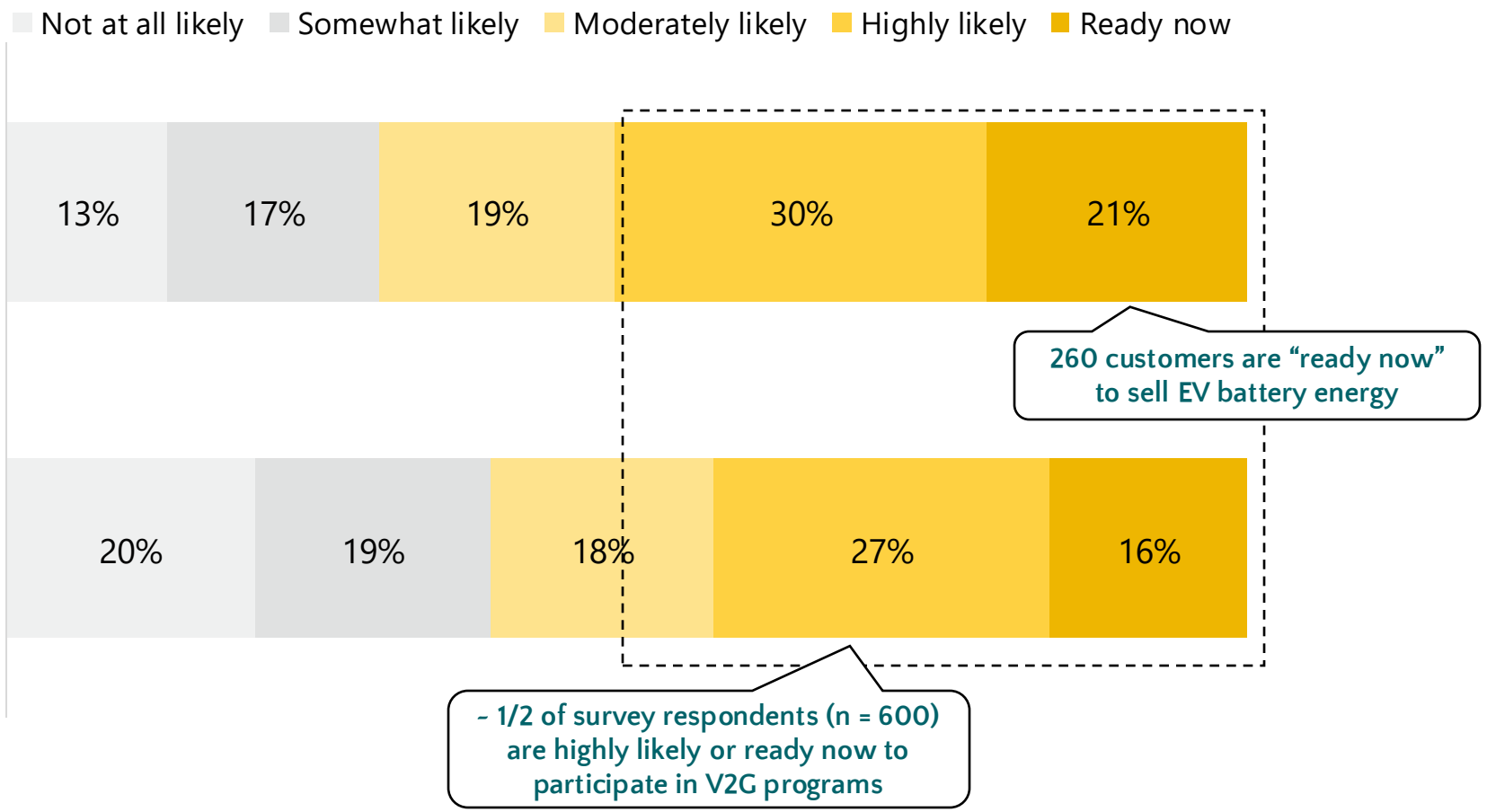
- Vehicle-to-Grid technology enables bidirectional energy flow between electric vehicles and the grid, allowing EVs to not only draw power from the grid but also to discharge energy back into the grid when needed, providing grid services and supporting grid stability.

Vision | In-Operation | Pilots

V2L, V2V, V2F: Vehicle-to-Load (2L), Vehicle-to-Vehicle (V2V), Vehicle-to-Farm (V2F)

SCE customers believe they are ready to participate in V2G now

Survey Responses from EV Owners in SCE's Service Area[1]

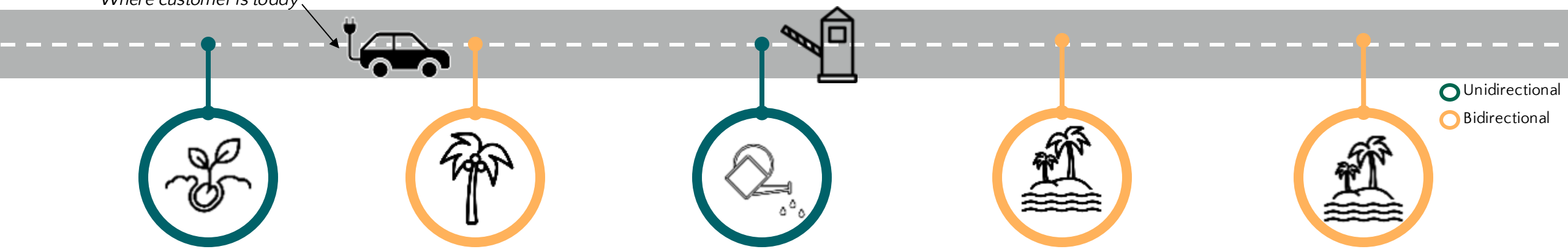


N= 1240 (2% sample size)

[1] Current response rate not yet representative of population (survey sent Nov. 2022)

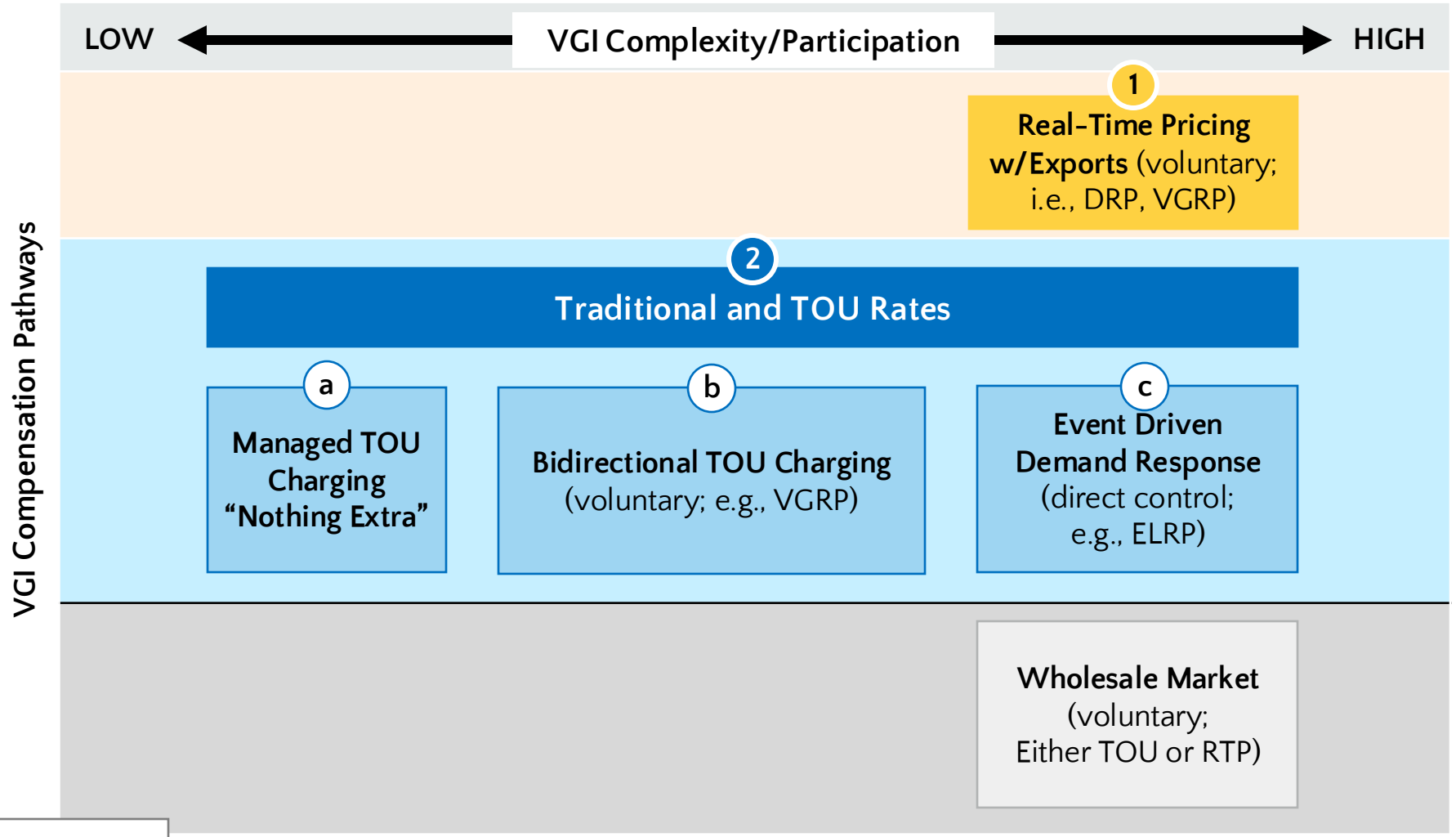
Opportunities

Barriers increase along the customer journey to unlocking the full value of VGI



	Passively Managed Charging (TOU)	V2H – Backup	Active EV Load Management	V2H – Peak Avoidance	V2G
Customer Value	**LOW** • Minimize charging cost	**HIGH** • Resiliency during grid outage	**LOW+** • Minimize charging cost • Program incentive • Charging with renewables	**MED** • Automated Rate arbitrage	**HIGH+** • Automated Rate arbitrage • Pending export credit - up to $1.35k/yr (Res), up to $20k/yr (bus)
Utility Value	**MED** • Static load shift	**LOW** • Customer experience	**HIGH** • Magnitude per customer constrained – scale significant • Enables control of next two	**MED** • Reduce site loads during peak • Service Area coordination – scale up	**HIGH+** • Scale per site possibly limited • Scale over service area large
Barriers	**Negligible** • Unidirectional EVSE • Programable EV / EVSE	**Negligible** • High cost bidirectional EVSE • Qualifiers – islanding and limited product availability	**Moderate** • Customer willingness • Vendor contract • DERMs / ADMS Integration	**Considerable** • High cost bidirectional EVSE • Bidirectional EV • Potential panel upgrade • Interconnection approval • Vendor contract	**Considerable+** • High cost bidirectional EVSE • Bidirectional EV • Potential panel upgrade • Interconnection approval • Vendor contract • Export rate / Compensation
Availability	• Now	• Now	• Now – limited providers • <1 year Utility coordination	• 1 - 2 years	• 2 - 4 years

SCE envisions creating a market by providing customers choice from a variety of load management options



DRP: Dynamic Rate Pilot
ELRP: Emergency Load Reduction Program
VGRP: Vehicle Grid Resource Proposal

Enabling participation and integrating with utility tools involves removing technological, regulatory, and other barriers from both the customer and utility side

Enable, then Increase Customer Participation

- Modify **interconnection** forms & rules
- Enhance internal **billing systems**
- Develop **compensation** mechanism
- Advocate for **standards** for safety and scaling
- Enhance and scale programs

Build, then Implement DERMs

- Incorporate into planning processes
- Advance DERMS capabilities
- Implement advanced DERMS

Questions?

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