

# SCE's Vehicle – Grid – Integration Roadmap and Industry Overview

**43rd Annual Utility Energy Forum**

April 25<sup>th</sup>, 2024



Energy for What's Ahead®



# Agenda

## Why VGI

## Overview of VGI

- Definitions, Market Status, and Landscape

## SCE's Approach

- Enabling Customer Participation
- 2045 State of VGI
- Backup Power Market Potential
- Gaps to Address

## Resources

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

### EVs with publicly announced plans for bidirectional charging capability



### And batteries are getting bigger...



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

# 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. EVs will become the largest source of load flexibility and 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 to provide grid reliability and resiliency services without impacting mobility and allowing customers to capture value that their EV provides to the grid. Integrate VGI with DERMS and grid planning to ensure customer vehicles are effectively contributing to grid services, reducing costs, and meeting climate goals.

## Goals

- 1. Increase grid resiliency and customer resiliency<sup>1</sup>**
- 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<sup>2</sup>**

<sup>1</sup> Goals to be developed within new Future Electrification Infrastructure Architecture initiative

<sup>2</sup> Goals to be developed along VGI roadmap

# Definitions for the World of VGI

## 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.

Vision

In-Operation

Pilots

## 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

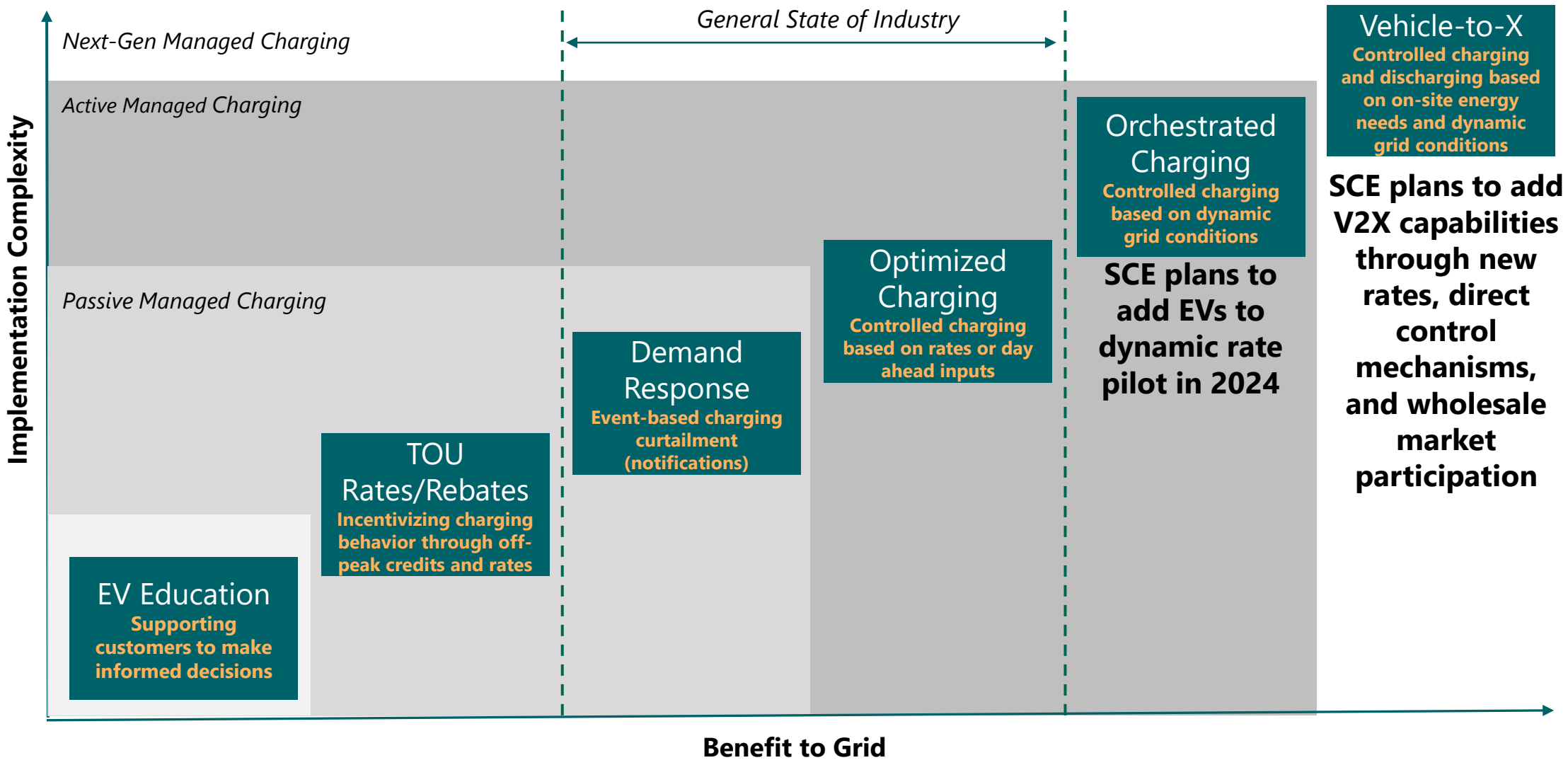
- Vehicle-to-Building transfers power from parked EVs to the building's power management system during peak load times or power outages.

### 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.

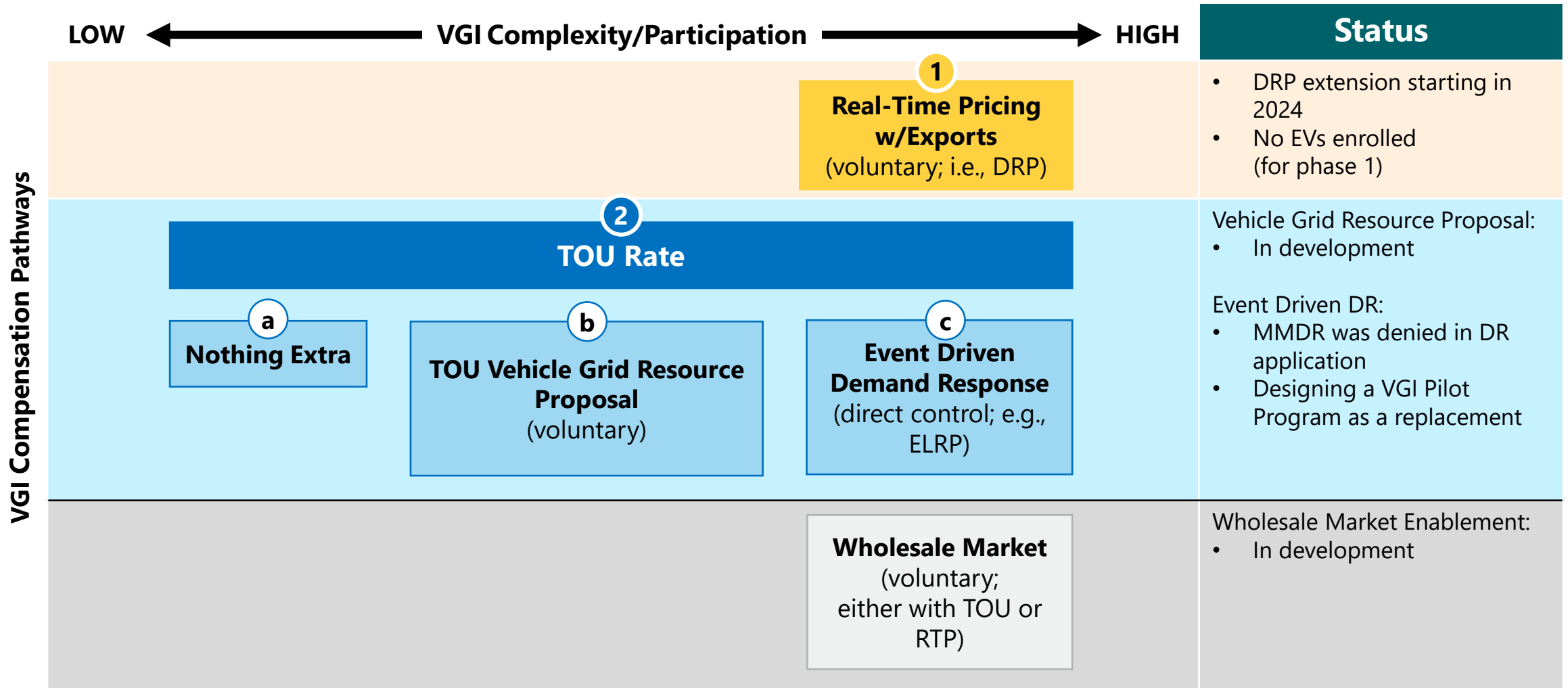
**V2L, V2V, V2F:** Vehicle-to-Load (V2L), Vehicle-to-Vehicle (V2V), Vehicle-to-Farm (V2F)

Industry is adopting managed charging, with most peers either having a pilot or program. A few peers are talking about to V2X, but no robust programs exist today.



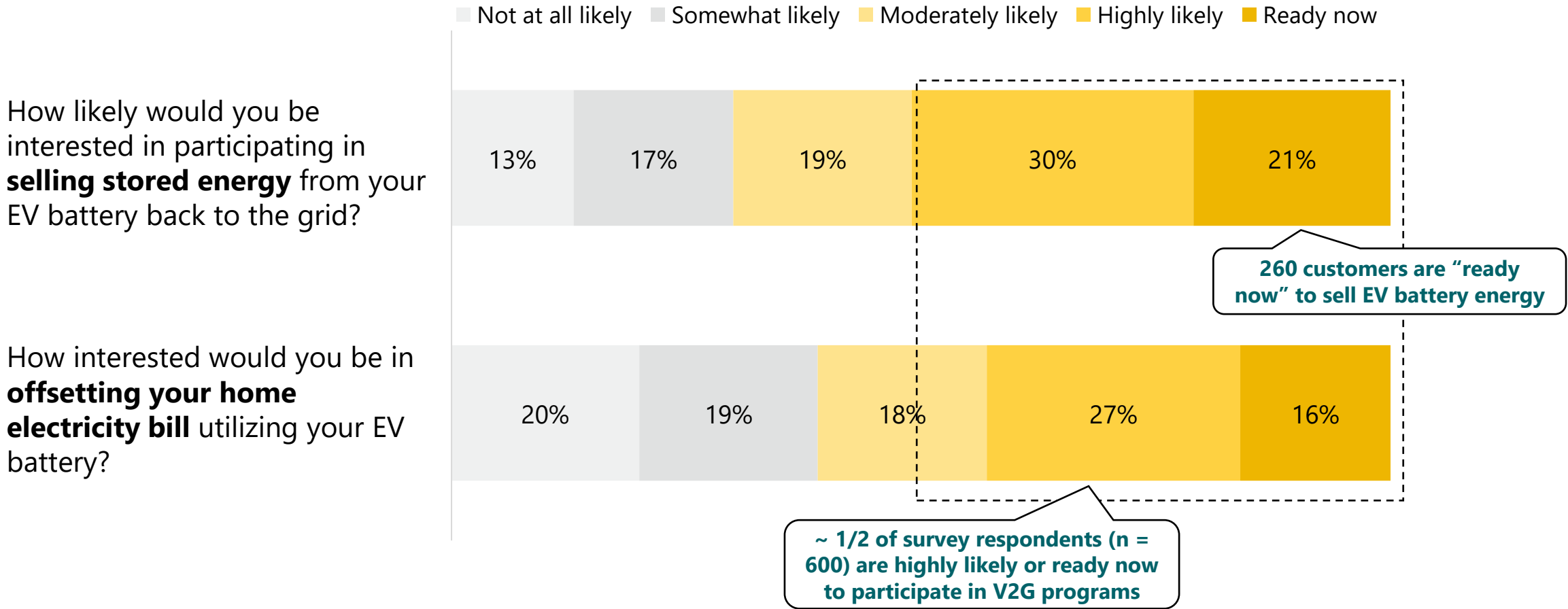
Source: Darcy Partners Managed Charging Benchmark

Providing customers choice from a variety of load management options, ranging from simple TOU rates to hourly changes in appliance management



# SCE customers are ready to participate in V2G now

## Survey Responses from EV Owners in SCE's Service Area<sup>1</sup>



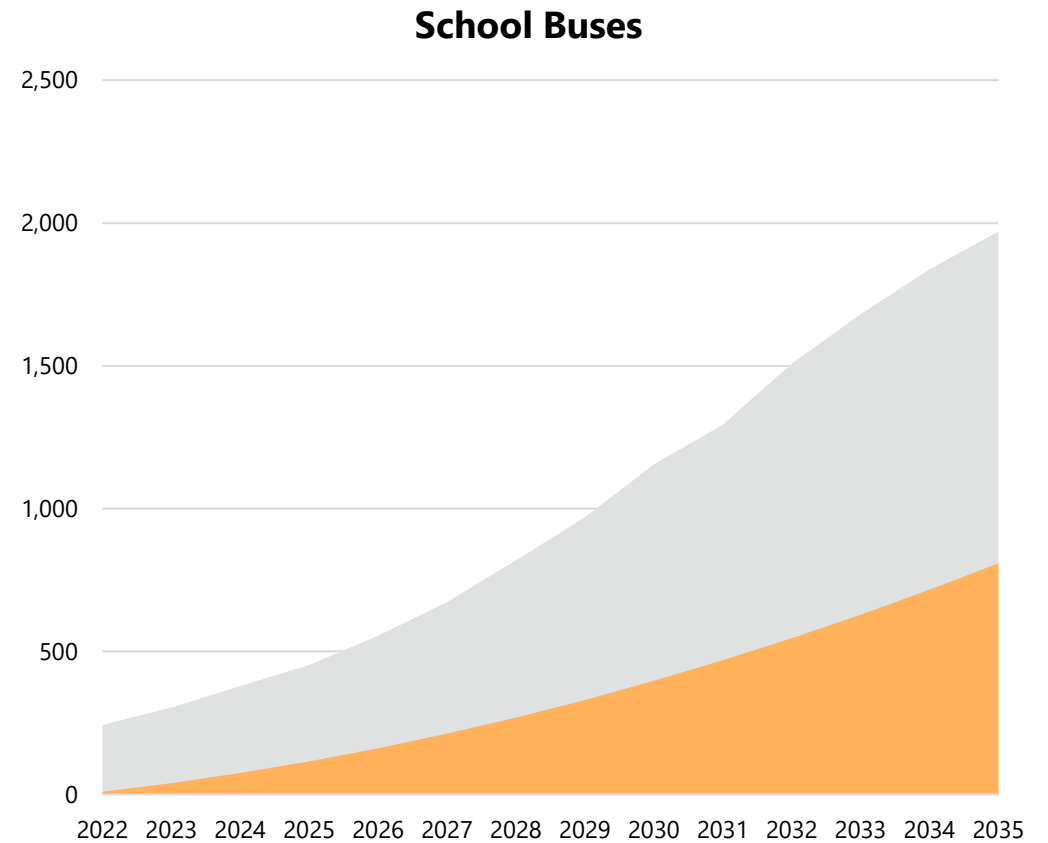
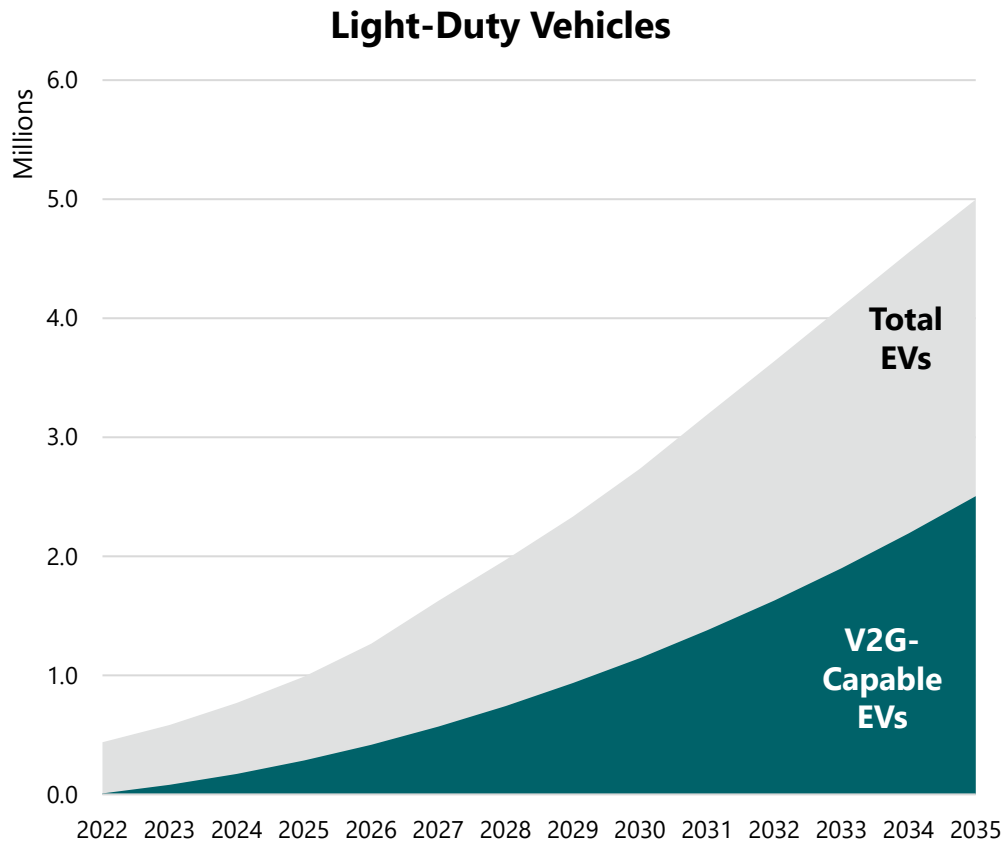
N= 1240 (2% sample size)

<sup>1</sup> Current response rate not yet representative of population (survey sent Nov. 2022)



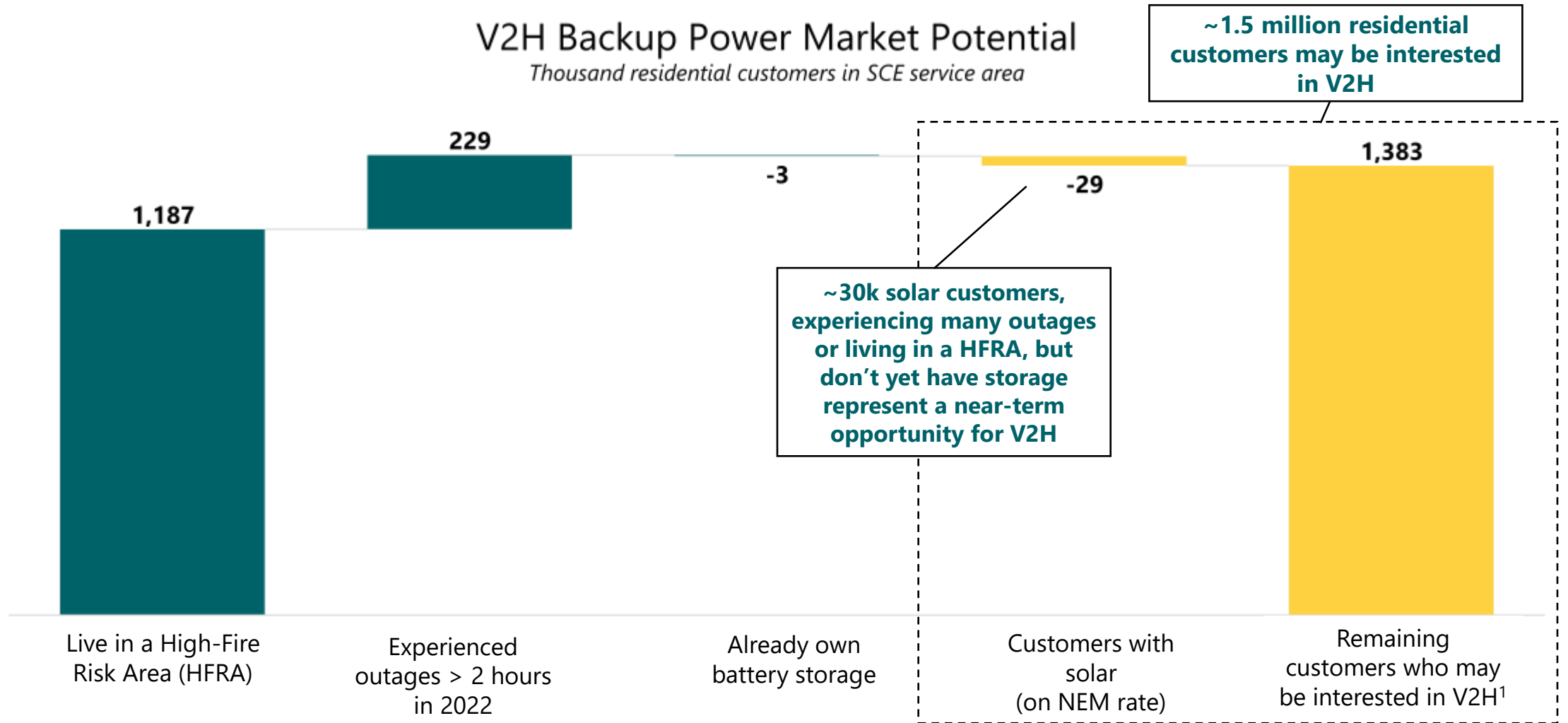
About half of electric vehicles may be V2G-capable by 2035, representing 2.5 million LDVs and 800 school buses in SCE service area

### V2G Capable Vehicles in SCE Service Area



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

About 1/3 of residential SCE customers may be interested in backup power; the trade off between backup power vs. grid hardening is being explored

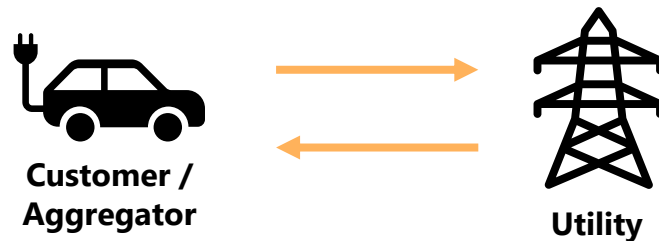


Source: SCE customer database, pulled March 2023

<sup>1</sup> Some customers may already have fossil fuel back-up generators and therefore may not be interested in V2H

SCE is enabling VGI participation by adjusting interconnection studies and creating ways to compensate customers

- 1 Purchase equipment that meets SCE standards
- 2 Submit interconnection application (or notification for V2B)
- 3 Participate in SCE offerings to provide services



- 4 **Conduct Interconnection Study**
  - a) Modify Rule 21 and 18 forms to allow aggregation for wholesale markets
  - b) Create a Distribution Service Agreement with aggregators participating in wholesale markets to ensure study is required and associated costs are covered by customer
  - c) Create new Rule 21 form to allow V2G for SCE compensation
  - d) Include new standards and enforce standards
- 5 **Compensate Customers**
  - a) Develop method(s) to compensate customers for grid services
  - b) Conduct pilots and studies to answer questions determined in goalsetting (e.g., customer surveys, real-time pricing pilots, direct control pilots, etc.)
  - c) Launch programs building on pilots and evolving VGI landscape
  - d) Enhance SCE billing and credit system to automatically track participation and compensate customers for grid services

 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

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- 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

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- Advance DERMS capabilities
- Implement advanced DERMS

The 2045 state of VGI includes programs designed to adjust site load and provide power to the grid using both market-based and direct control methods

**RELIABILITY:** *daily*

**RESILIENCY:** *occasional*

**UNMANAGED:**

**MANAGED:**

**OFF-GRID/BACKUP POWER:**

TOU Rates

		LOAD SHIFTING + EXPORTS		LOAD SHEDDING + EXPORTS	
		Market-Based <sup>1</sup>	Direct Control <sup>2</sup>	Market-Based	Direct Control
Site Load		<ul style="list-style-type: none"> <li>RTP</li> <li>TOU</li> </ul>	<ul style="list-style-type: none"> <li>ELRP</li> <li>TOU</li> </ul>	<ul style="list-style-type: none"> <li>RTP</li> </ul>	<ul style="list-style-type: none"> <li>ELRP</li> </ul>
	Grid Exports	<ul style="list-style-type: none"> <li>RTP</li> <li>Wholesale participation</li> <li>TOU rate exports</li> </ul>	<ul style="list-style-type: none"> <li>ELRP</li> </ul>	<ul style="list-style-type: none"> <li>RTP</li> <li>Wholesale participation</li> <li>TOU rate exports</li> </ul>	<ul style="list-style-type: none"> <li>ELRP</li> </ul>

TBD...  
Existing backup programs may include bidirectional chargers (device-agnostic)

<sup>1</sup> Behavioral changes to price signals (through automated technology or manual changes)

<sup>2</sup> Obligatory changes based on SCE-decided signals (through a default/opt-out option)

To refine and achieve these goals, more information is needed from what we know today about customer participation

**Proposed Solutions**

Gaps / Questions	STUDIES		PILOTS				
	Internal	External	DRP <sup>123</sup>	DR / LCFS <sup>123</sup>	EPIC <sup>123</sup>	TOU Rate Export <sup>3</sup>	Wholesale <sup>3</sup>
<b>1 Compensation</b> What is the compensation amount to motivate customers to participate? What is the best method of compensation, frequency, etc.	Survey <sup>123</sup>	UCI <sup>123</sup>	✓	✓			✓
<b>2 Participation</b> What is the participation rate? Customers (segment, NEM), kWh, weekly, seasonality, circuit, charge vs discharge, etc.		EnerNex <sup>12</sup>	✓	✓		✓	✓
<b>3 Dependability</b> What is the dependability of participation?			✓	✓		✓	✓
<b>4 Technology</b> What's the best technology to communicate with customers?			✓	✓	✓	✓	✓
<b>5 Program Method</b> How do different customers respond to market signals vs direct control? What is SCE's preference?			✓	✓		✓	✓
<b>6 Signals</b> What should the signals be based on?				✓			
<b>7 Public Charging</b> How interested are public/DCFC charging owners in V1G? If interested, what is impact on customers experience?	Survey <sup>123</sup>						
<b>8 Charge vs Discharge</b> Do customers prefer adjusting charging or discharging? How large are battery degradation concerns?	Education <sup>23</sup>		✓				

<sup>1</sup> managed charging  
<sup>2</sup> export to site  
<sup>3</sup> export to grid

**DRP:** dynamic rate pilot  
**DR:** demand response pilot  
**LCFS:** low carbon fuel standard VGI pilot

- Home and Business Area Network
- Savings & Incentives ▲
- Savings By Business Type ▲
- Tools & Resources ▲
- Electric Vehicles for Business —**
- Charge Ready
- Charge Ready Transport
- Pilot Programs
- TE Advisory Services
- Tools & Resources
- Generating Your Own Power ▲
- Consulting Services ▲
- Rates ▲



## Embrace the EV Future

Our Charge Ready Program assists business and property owners with deploying the infrastructure and equipment necessary to support electric vehicle (EV) charging stations at their locations. This program helps by providing financial incentives, infrastructure, and technical support to facilitate the installation and maintenance of EV charging stations.

With greater ease and affordability, our business customers can now meet the growing demand for clean energy charging options from their customers, employees, communities, and/or tenants.

### Why go electric?

Questions?

Blake Heidenreich  
Strategic Advisor, SCE Program Design & Development  
[blake.heidenreich@sce.com](mailto:blake.heidenreich@sce.com)

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