VIRTUAL MEETING EMERGENCY PROTOCOL

Follow these steps when a virtual or hybrid meeting attendee is incapacitated.

BEFORE THE MEETING STARTS - **ASSIGN ROLES**

- Who will call ESOC? **(626-815-5611)**
- Who will contact the leader?
- Who will stay on the call with the employee?
- Identify the location of employees who may be in transit or out in the field.

1. A medical emergency occurs, or seems to be occurring.
2. If you know the employee's location, call 911.
3. Call Edison Security Operations Center (ESOC) at **626-815-5611.**
4. If 911 has not been called, ESOC will contact 911 to dispatch emergency services to employee's home address.
5. Contact the employee's leader.
6. Remain on the line with the employee until emergency services arrives.

If employee is a supplemental worker, ESOC will contact the vendor to provide known information; if unavailable, 911 will be contacted.

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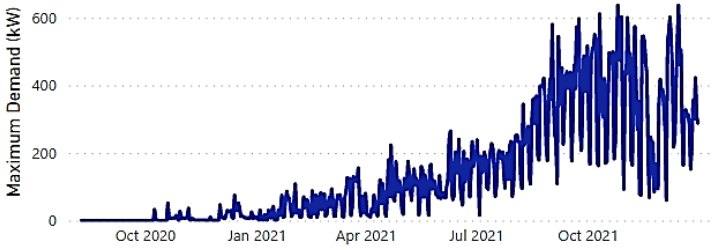
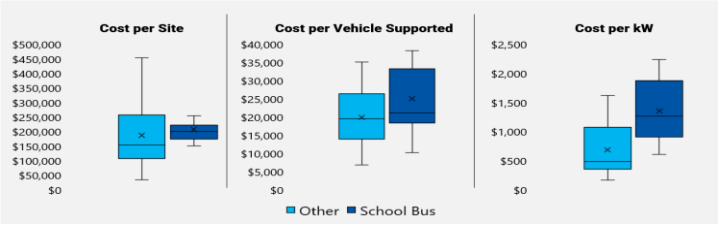
Welcome





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Public Presentation on Evaluation Year 2021

Report on SRPs and AB Pilots

August 23, 2022

ZM ASSOCIATES Environmental Consultants

ASU

DAVENERGY solutions
DEDICATION ALIGNMENT VALUE

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

ITS UCDAVIS
INSTITUTE OF TRANSPORTATION STUDIES

Agenda

- Introduction
- Medium-Duty and Heavy-Duty Fleets
- Schools, Parks and Beaches, and EV Fast Charge
- Vehicle-to-Grid
- Q&A

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Motivation

CPUC decision documents from 2018 and 2019 outline Utility programs and goals

CPUC Decision Documents

See Evaluation Report for Links to decision documents

https://docs.cpuc.ca.gov/DecisionsSearchForm.aspx

Evaluation Year 2021 Report

Link to Evaluation Report: Standard Review Projects and AB 1082/1083 Pilots: Evaluation Year 2021

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Introduction | Programs and Budgets

Total Utility investment: **$765M over four to six years**

	Program	Budget ($Millions)
Liberty	EV Bus Infrastructure Program	$0.2
	Schools Pilot	$3.9
	Parks Pilot	$0.8
Pacific Gas & Electric (PG&E)	EV Fleet (Fleet) Program	$236.3
	EV Fast Charge Program	$22.4
	Schools Pilot	$5.8
	Parks Pilot	$5.5
Southern California Edison (SCE)	Charge Ready Transport (CRT) Program	$342.6
	Schools Pilot	$9.9
	Parks Pilot	$9.9
San Diego Gas & Electric (SDG&E)	Power Your Drive for Fleets (PYDFF) Program	$107.4
	Vehicle to Grid (V2G) Pilot	$1.7
	Schools Pilot	$9.9
	Parks Pilot	$8.8
	TOTAL	**$765**

Introduction | Evaluation Organization

EVALUATION RESEARCH OBJECTIVES

1. Investigate whether the TE investments accelerated the TE market
2. Determine whether the TE investments maximized benefits and minimized costs
3. Integrate learnings from analysis of key market, program, and impact data into program activities

RESEARCH QUESTIONS

THREE BUNDLES OF PROGRAMS

BUNDLE 1
Medium-Duty and Heavy-Duty Fleet Evaluations

BUNDLE 2
Public Charging Infrastructure Evaluations

BUNDLE 3
Vehicle-to-Grid Evaluation

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Introduction | Program Activity

Summary of completed sites as of December 31, 2021

	Program	Utility Construction Completed	Activated	Operational	Closed Out
Liberty	EV Bus Infrastructure	1	0	0	0
	Schools	0	0	0	0
	Parks	0	0	0	0
PG&E	EV Fleet	28	28	26	23
	Schools	0	0	0	0
	Parks	0	0	0	0
	EV Fast Charge	4	4	4	4
SCE	CRT	27	24	19	1
	Schools	1	1	0	0
	Parks	0	0	0	0
SDG&E	PYDFF	2	1	1	1
	Schools	1	1	0	0
	Parks	5	5	4	0
	V2G	1	1	0	0
TOTAL		70	65	54	29

- **Utility Construction Complete:** Utility has completed their scope
- **Activated:** Charging stations are installed and available for use
- **Operational:** Energy usage data has been received from the Utility or EVSP
- **Closed Out:** All financial documentation has been finalized by Utility and rebates have been paid

Introduction | Evaluation Activities

		MDHD Bundle	Public Charging Bundle		V2G Bundle
			Schools and Parks	*EV Fast Charge*	
Data Collection	Program Data and Materials	x	x	x	x
	AMI/EVSP Data	x	x [a]	x	
	Site Visits	x		x	
	Interviews	x	x	x	x
	Surveys	x			
	Delphi Panel	x			
Analysis	EV Adoption		x [a]	x	
	Grid Impacts	x	x [a]	x	
	Counterfactual Development	x	x	x	
	Petroleum Displacement	x	x [a]	x	
	GHG and Criteria Pollutant	x	x [a]	x	
	Health Impacts	x	x [a]	x	
	Total Cost of Ownership	x [c]	x [b]	x [b]	
	Site Visit Findings	x	x [a]	x	
	Co-Benefits and Co-Costs	x			
	Interviews and/or Survey Findings	x	x	x	x
	Market Effects	x			

[a] The team only conducted this work for the SDG&E Parks Pilot, which had operational sites in EY2021.

[b] The team based our findings on a literature review contextual analysis.

[c] The team conducted this work for three MDHD market segments, largely using secondary (not program-specific) data.

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Bundle 1:
Medium-Duty and Heavy-Duty Fleets

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MDHD | Preliminary Findings

Modest impacts in first year of evaluation; 451 MDHD EVs toward goal of 17,993

Impact Parameter	MDHD Bundle	Public Charging Bundle	V2G Bundle
Population of Activated Sites (#)	53	11	1
Sites Included in Analysis (#) [a]	41	7	0
Ports Installed in Analyzed Sites (#)	262	32	0
Electric Vehicles Supported (#) [b]	451	N/A	0
Electric Energy Consumption (MWh)	3,843	113	0
Petroleum Displacement (diesel gallons equivalent)	406,712	9,962	0
Greenhouse Gas (GHG) Emission Reduction (MT GHG) [c]	3,382	68	0
Oxides of Nitrogen (NO_x) Reduction (kg)	1,902	0	0
Particulate Matter (PM_{10}) Reduction (kg)	34	0	0
Particulate Matter ($PM_{2.5}$) Reduction (kg)	31	0	0
Reactive Organic Gases (ROG) Reduction (kg)	250	6	0
Carbon Monoxide (CO) Reduction (kg)	20,013	203	0

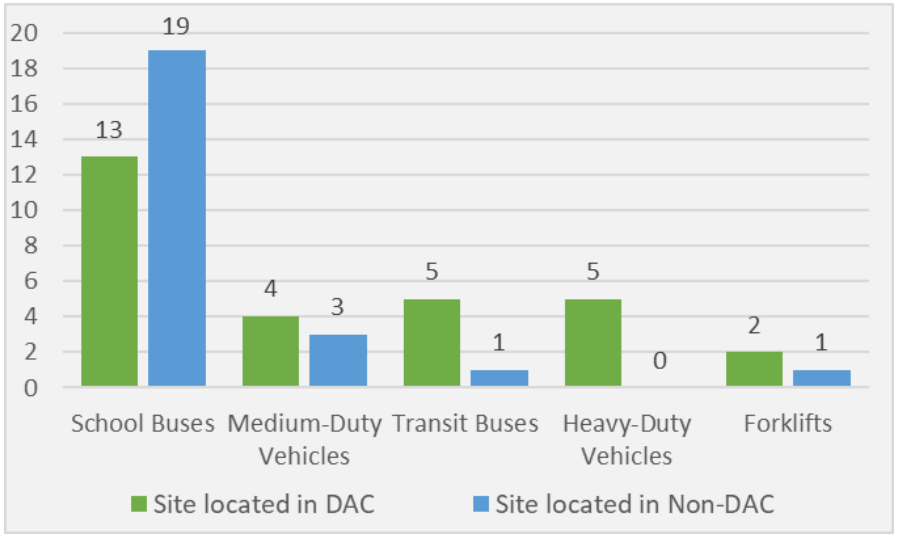
[a] Energy consumption, petroleum displacement, emission reductions, and health benefits are based on annualized data. The number of sites included in the analysis differs from the population of activated sites because some sites were only activated for a short period during EY2021 (such as one or two months).

[b] The team derived the EVs supported value for MDHD programs from applicants' vehicle acquisition plans. This value represents the maximum number of vehicles expected to be supported by the charging infrastructure.

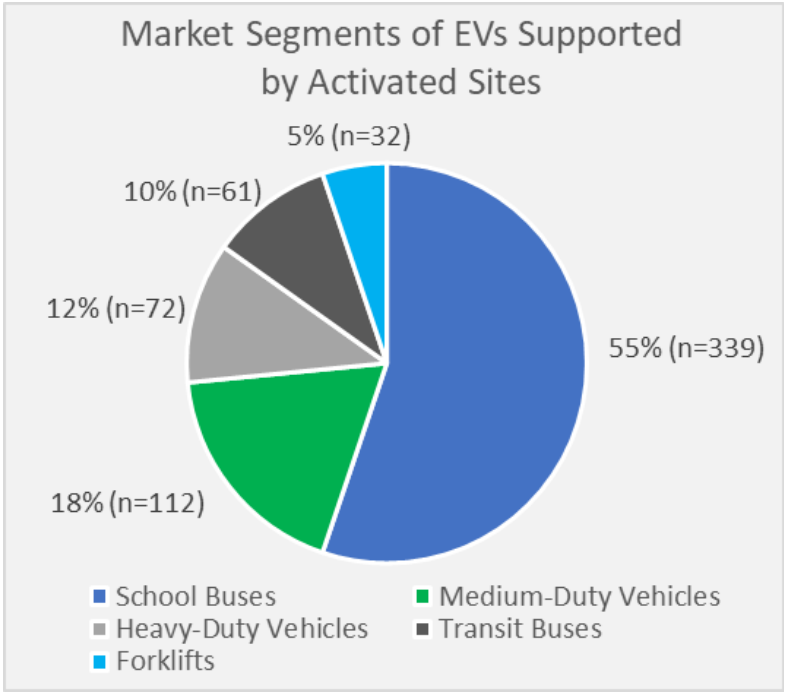
[d] GHGs include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) multiplied by their respective global warming potentials as defined by the Intergovernmental Panel on Climate Change's published fifth assessment (see the Evaluation Methodology section for more details).

MDHD | Site and EV Types

School buses were the most common site and the most common EV type in the MDHD bundle for EY2021



The majority of activated sites (29 of 53) were in DACs



Five of the nine major EV market segments had activated sites

- Applications in for port trucks, TSE, TRU
- No applications for airport GSE in EY2021

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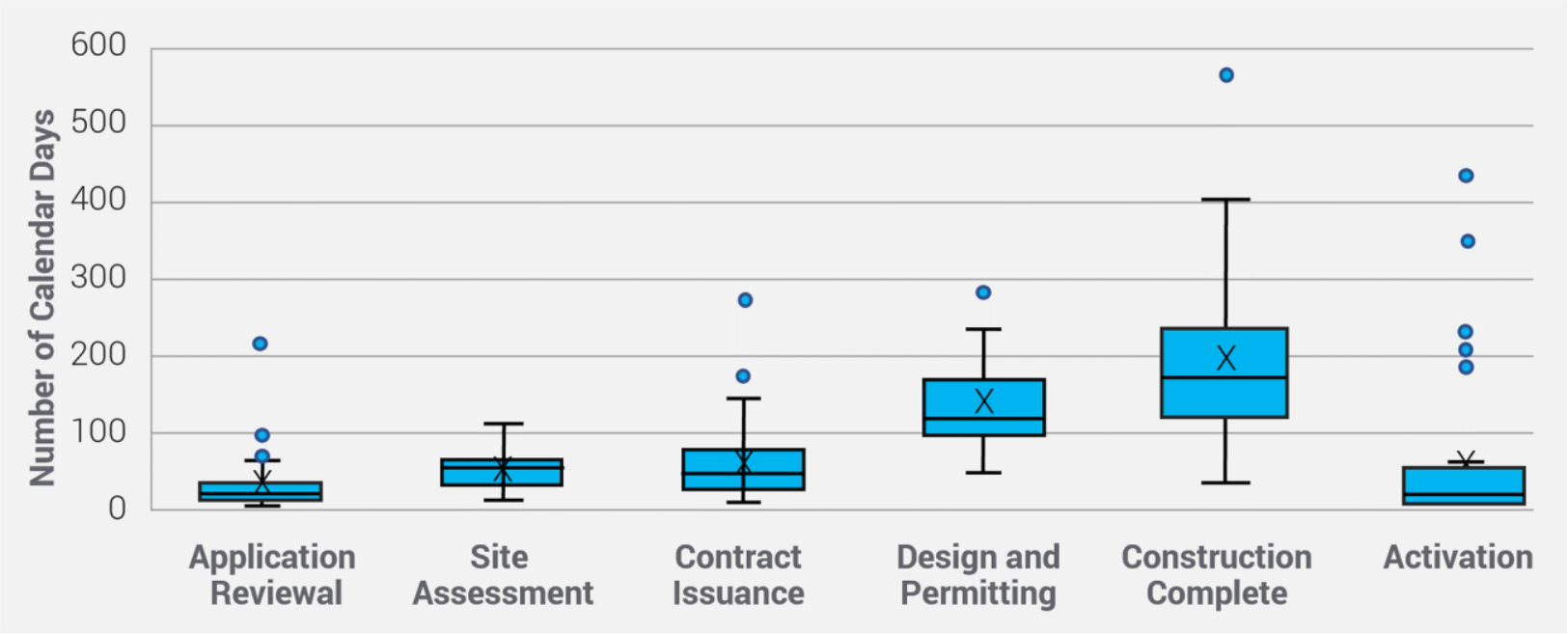
MDHD | Site Timelines

Timelines were generally longer than expected and varied widely by phase

PG&E EV Fleet example

- Median timeline from application to activation was 16 months
- Fourth and fifth program phases took the longest time to complete, with median durations exceeding 100 calendar days

PG&E EV Fleet Summary of Calendar Days Per Phase



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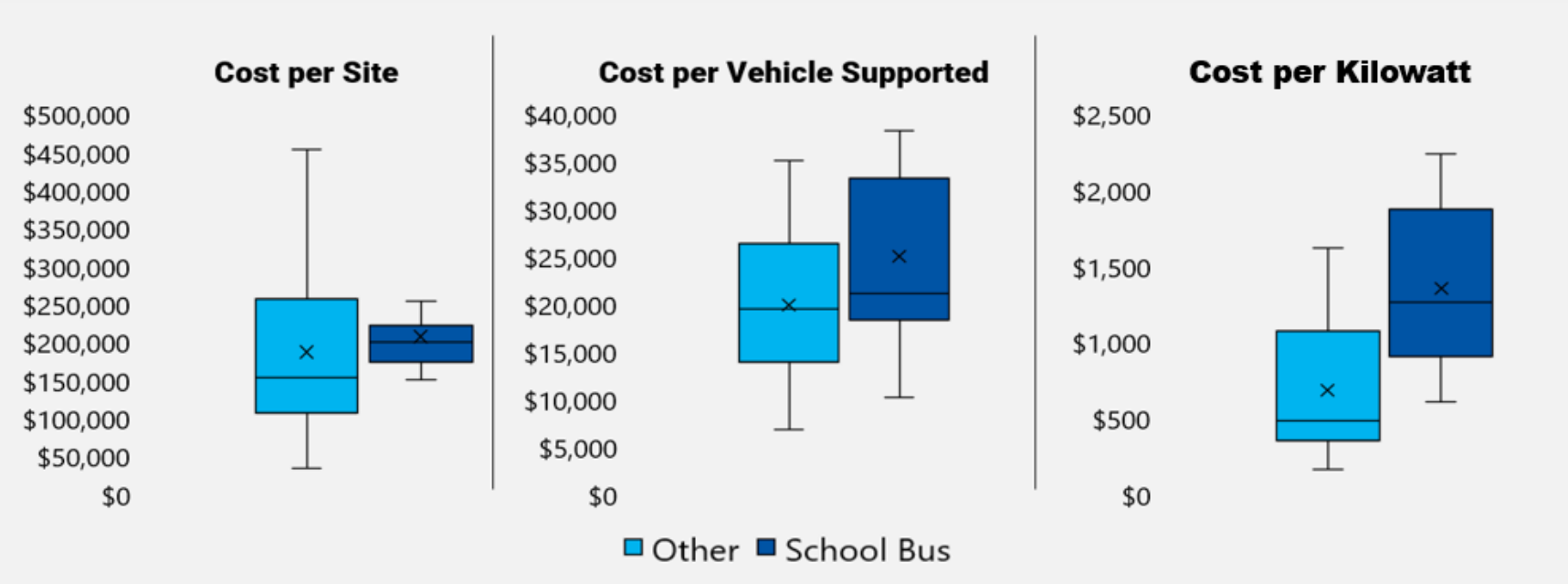
MDHD | Site Costs - PG&E EV Fleet Only



- Cost per site represents Utility costs (TTM plus BTM rebate) – not all site costs
- Cost per site range wider for “Other” sites since those sites were more heterogenous than school bus sites and had more DCFC
- Differences in cost per vehicle supported due to grid upgrades, EV types, charger power levels, incentive and rebate levels, and other variables
- Cost per kilowatt of installed capacity higher for school bus sites due to installation of lower powered charging

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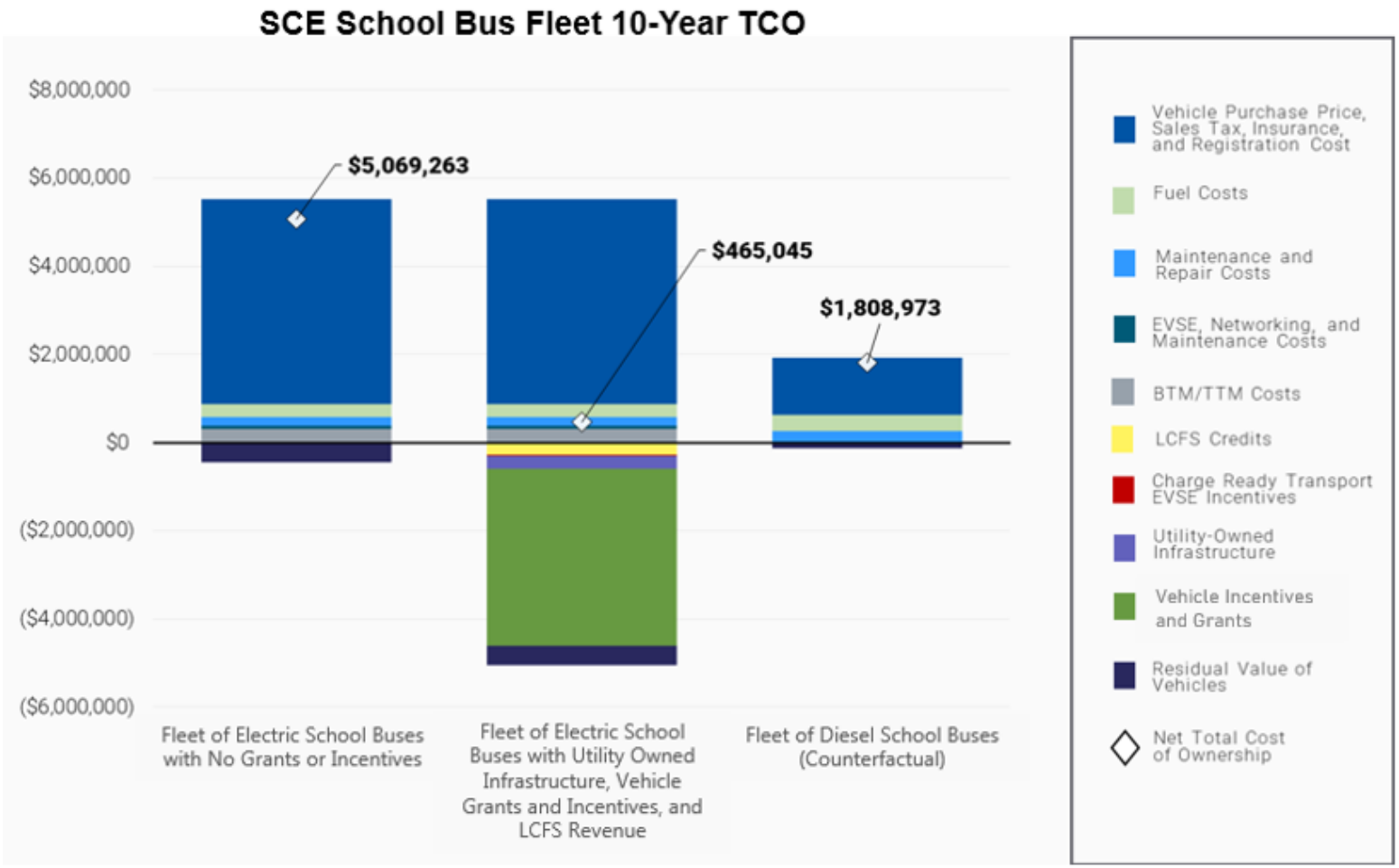
MDHD | Total Cost of Ownership

- Analyzed three fleet types using mostly secondary data
- Vehicle grants/incentives critical to making TCO lower than counterfactual for school and transit buses; TCO not lower for package delivery trucks due to fewer grants/incentives



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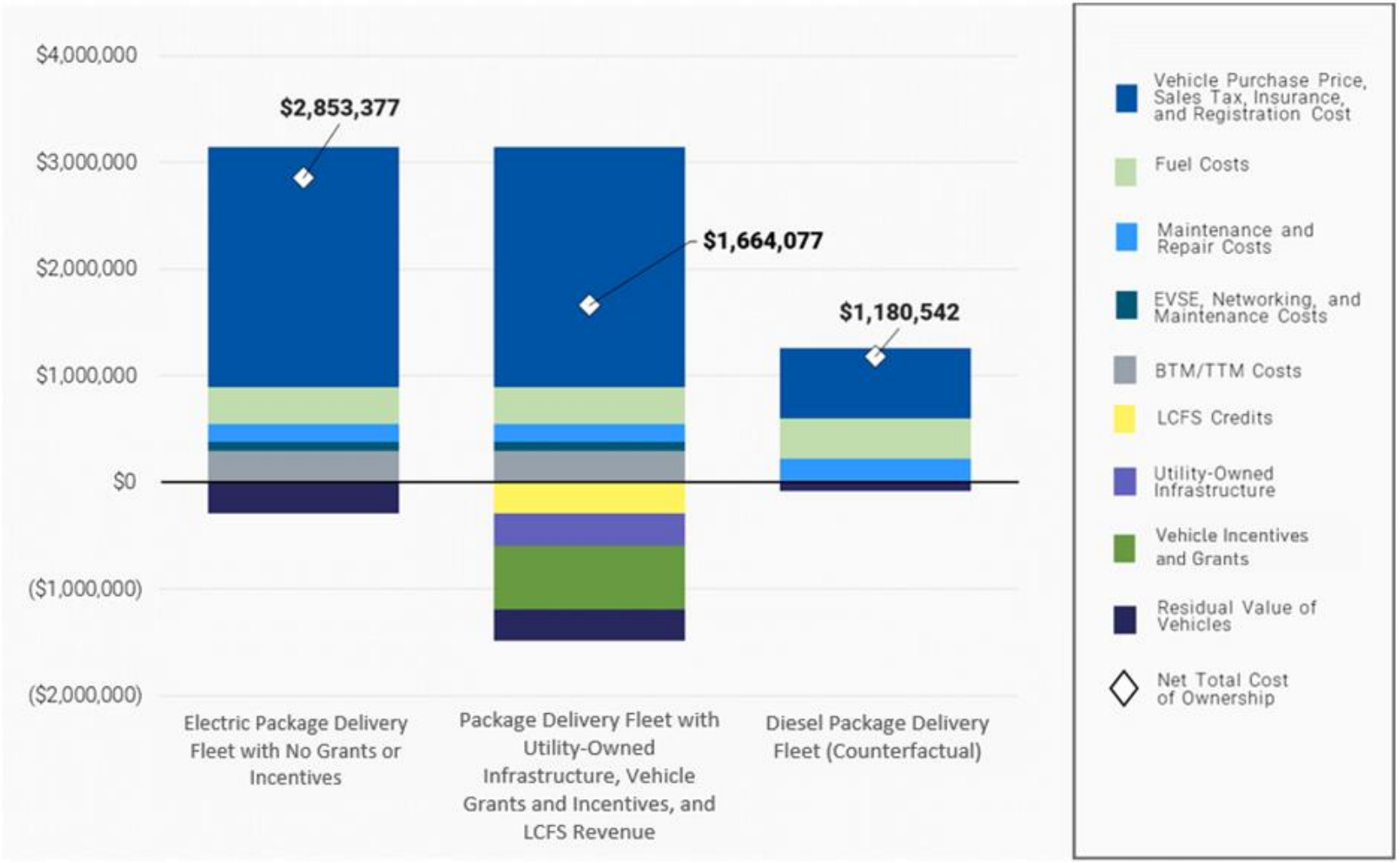
MDHD | Total Cost of Ownership

SCE Package Delivery Truck Fleet 10-Year TCO

Grants and incentives do not offset upfront vehicle costs



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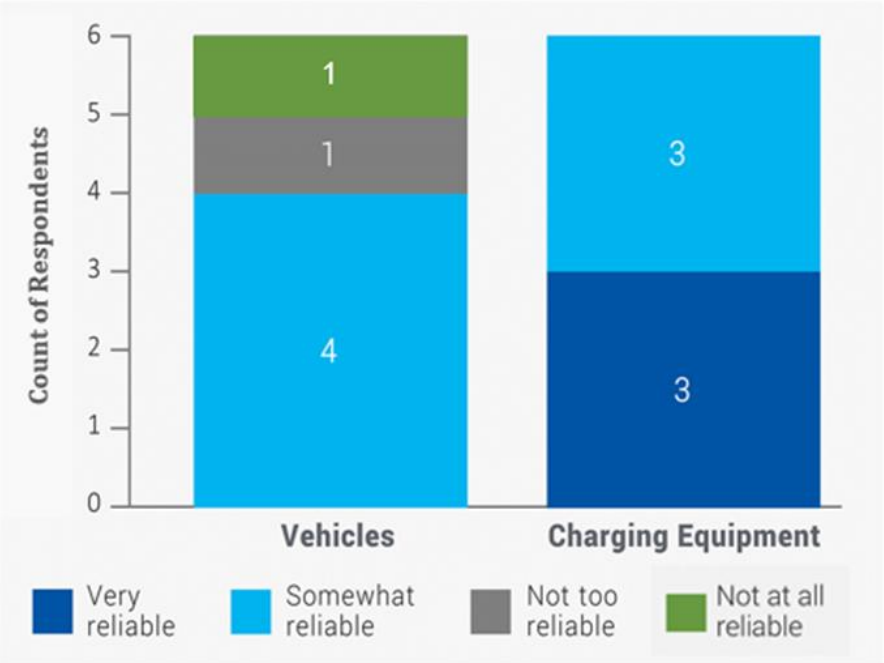
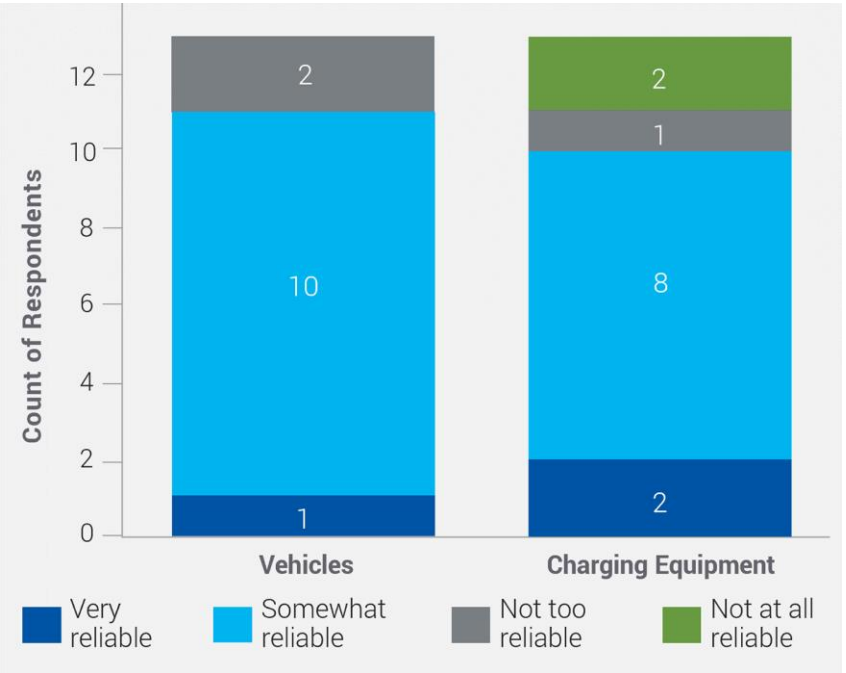
MDHD | Survey Findings: Reliability

Most respondents found their vehicles and charging equipment to be reliable, but experiences varied with different operational challenges

SCE



PG&E



Respondents cited charger failures, vehicle recalls and repairs, range limitations, and insufficient charger size/electrical capacity as contributors to reliability issues

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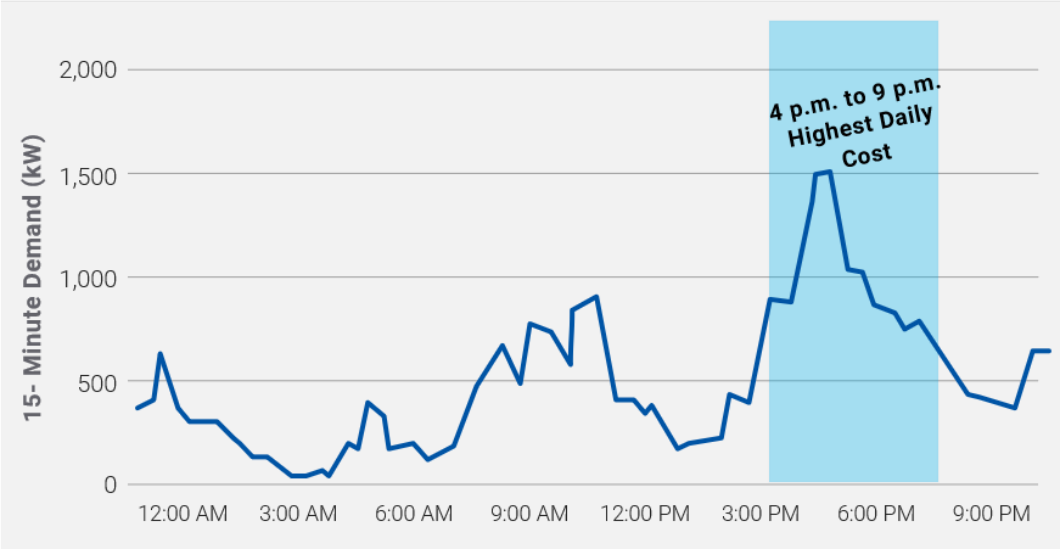
MDHD | Grid Impacts

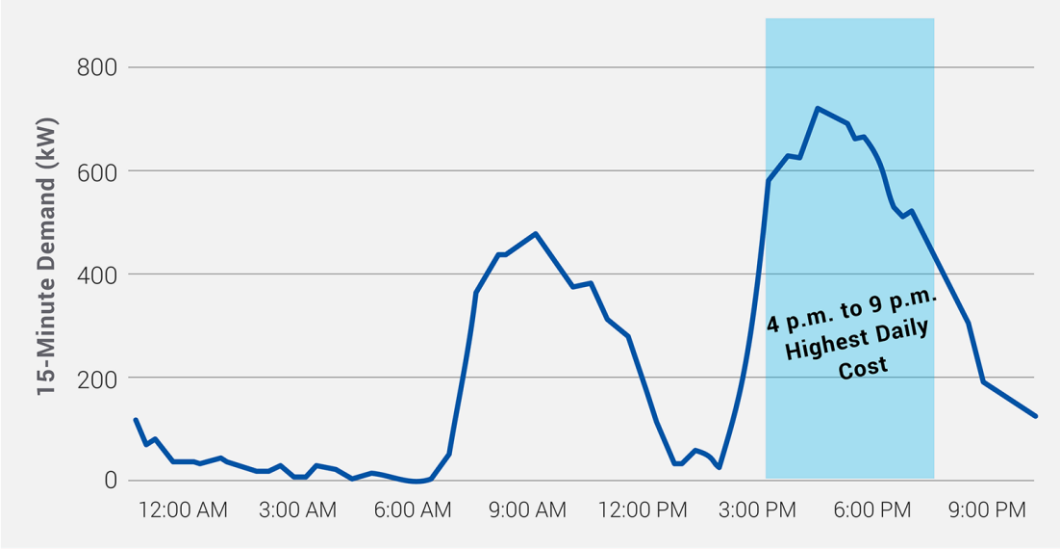
- **Load shape heavily influenced by school bus fleets, despite other MDHD fleets**
- **Loads highest (or nearly as high) during peak pricing periods as other times of day**

Example

PG&E EV Fleet Overall Charging Load Curve, September 28, 2021



PG&E EV Fleet School Bus Charging Load Curve, September 28, 2021



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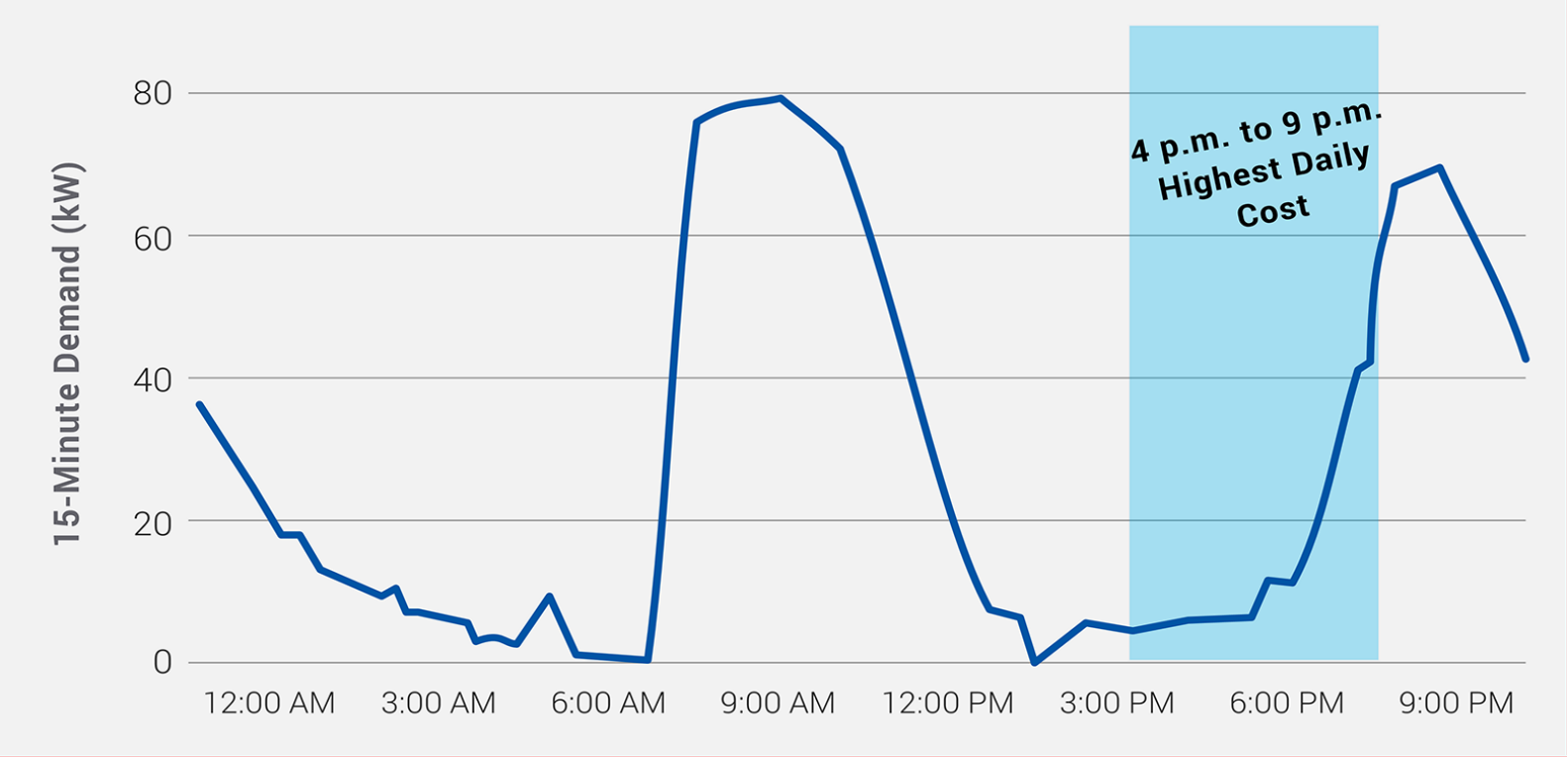
MDHD | Grid Impacts

Few fleets managed charging - many opportunities for load management

- More than one-third of on-peak energy use appears to have two+ hours of charging flexibility
- Access to data (utility bills, EVSP portals) and training needed to implement load management

Example of PG&E School Bus Customer with Load Management
Once load management implemented, <15% of charging took place between 4-9 p.m.



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MDHD | Liberty Utilities EV Transit Bus Project

Customer's changing needs increased scope, budget, and timeline

Scope: From two 60 kW DCFC, added two 450 kW overhead fast chargers (pantographs) and associated infrastructure to support >1 MW of new load to operate three transit buses

Budget: From $223k to $876k for line extension, new transformer, and 3,000-amp switchgear

Timeline: Supply chain issues led to change in spec on pantographs (different footprint), which led to a design change from the California State architect; there was also staff turnover at the bus/charger company and restrictions on construction in winter

Crane installing transformer behind bus stop (left) and the installed transformer and switchgear (right)

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MDHD | Lessons Learned

Findings based on limited operational data from 41 fleets, five market sectors:

- Activation timelines were longer than expected and varied by phase
  - Additional customer support can help but budgets would be impacted
- Cost per site, per vehicle, and per kilowatt varied widely (PG&E only)
  - Differences in site infrastructure needs, charger and EV types, incentive/rebate levels
- Programs addressed most of participants' top barriers to fleet electrification
  - Cost of EVs remained a top barrier and requires non-Utility funding to address
- Vehicle grants and incentives are critical to making the TCO of EVs lower than the counterfactual for school and transit buses
  - Lower levels of grants and incentives for package delivery trucks lead to higher TCO
- EVs and EV charging equipment were generally found to be reliable
  - Participants experienced some quality and performance challenges
- Most operators did not manage charging, resulting in increased operating costs
  - Flexibility in charge times provides opportunities for improved grid integration and further electrification; educating operators is key.

Bundle 2:
Public Charging

Public Charging | Summary Findings

Impact Parameter	MDHD Bundle	Public Charging Bundle	V2G Bundle
Population of Activated Sites (#)	53	11	1
Sites Included in Analysis (#) [a]	41	7	0
Ports Installed in Analyzed Sites (#)	262	32	0
Electric Vehicles Supported (#) [b]	451	N/A	0
Electric Energy Consumption (MWh)	3,843	113	0
Petroleum Displacement (diesel gallons equivalent)	406,712	9,962	0
Greenhouse Gas (GHG) Emission Reduction (MT GHG) [c]	3,382	68	0
Oxides of Nitrogen (NO_x) Reduction (kg)	1,902	0	0
Particulate Matter (PM_{10}) Reduction (kg)	34	0	0
Particulate Matter ($PM_{2.5}$) Reduction (kg)	31	0	0
Reactive Organic Gases (ROG) Reduction (kg)	250	6	0
Carbon Monoxide (CO) Reduction (kg)	20,013	203	0

[a] Energy consumption, petroleum displacement, emission reductions, and health benefits are based on annualized data. The number of sites included in the analysis differs from the population of activated sites because some sites were only activated for a short period during EY2021 (such as one or two months).

[b] The team derived the EVs supported value for MDHD programs from applicants' vehicle acquisition plans. This value represents the maximum number of vehicles expected to be supported by the charging infrastructure.

[c] GHGs include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) multiplied by their respective global warming potentials as defined by the Intergovernmental Panel on Climate Change's published fifth assessment (see the Evaluation Methodology section for more details).

Public Charging | Program Overview

Utility	Program /Pilot	Target
Liberty	Schools	• 17 schools • 56 L2 and 2 DCFC charging stations
	Parks and Beaches	• 3 sites • 5 dual-pedestal charging stations with 2 charging ports each
PG&E	Schools	• 40% DAC • 22 K-12 schools • 4 or 6 L2 charging ports per location
	Parks and Beaches	• 25% DAC • 15 state parks and beaches • 40 L2 and 3 DCFC charging ports
	EV Fast Charge	• 25% DAC • 52 sites • 234 DCFCs
SCE	Schools	• 40% DAC • 40 K-12 schools • 250 L1 and L2 charging stations
	Parks and Beaches	• 40% DAC • 27 state parks and beaches • 120 L2, 10 DCFC, and 15 mobile charging stations
SDG&E	Schools	• 40% DAC • 30 schools • 184 L2 and 12 DCFC charging stations
	Parks and Beaches	• 50% DAC • 74 charging stations at 12 state parks and beaches • 66 charging stations at 10 city and county parks (100% DAC)

Public Charging | Lessons Learned

All Public Charging Programs

Unexpected market impacts and site design requirements resulted in higher-than-expected site costs and limited participation.[1]

- COVID-19 had unprecedented economic impacts across nearly every market, driving up costs for materials and labor and disrupting supply chains.
- These changes were so substantial that estimates the Utilities had created for Decision 19-11-017 and Decision 18-05-040 did not reflect the actual costs for implementation.
- These expenses were compounded by inadvertent inaccuracies in design estimations.

[1] For SCE, this lesson can only be applied to the Schools Pilot, as limited activity occurred in EY2021 for the Parks Pilot.

Public Charging | Lessons Learned, Cont.

Schools and Parks

Staffing constraints contributed to conflicting priorities from site hosts, which resulted in site delays or withdraws.

- Participating in either Pilot requires the site host to make a commitment that often spans several months.
- Across all Utilities, staff reported that site hosts of both Pilots had staffing constraints that either delayed or ultimately prevented participation during EY2021.
    - Staff turnover at the California Department of Parks and Recreation had the greatest impact on the Parks Pilot.
    - While turnover was less of an issue for the Schools Pilot, Utility staff did notice that Schools Pilot site host staff were constrained by the available bandwidth of current staff, which was exacerbated by COVID-19.

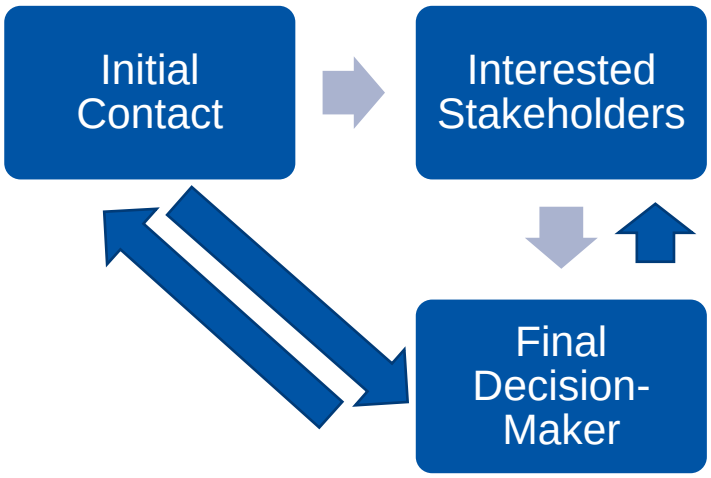
Public Charging | Lessons Learned, Cont.

Schools

Initial contacts at interested Schools sites were not necessarily the ultimate decision-makers, which resulted in site delays and sometimes withdraws.

- SCE and PG&E staff tried to account for multiple layers of approval at the beginning of the enrollment process by providing their primary site contact with example agreement and easement language to share with decision-makers.

- While staff continued to engage with the primary contact and asked for details about the decision-making process, unclear higher-level site host concerns caused delays and, in the worst cases, the site ultimately opted out of enrollment.



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Public Charging | Lessons Learned, Cont.

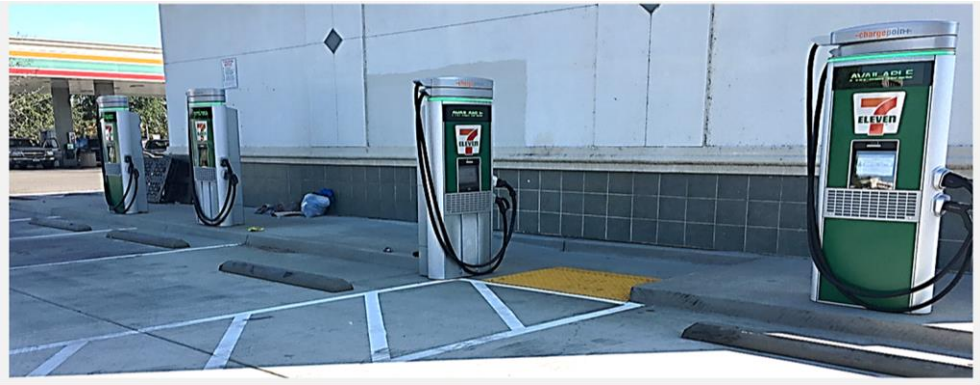
EV Fast Charge

Adaptability in the program enrollment process enabled PG&E to successfully meet customer needs and secure participation in the EV Fast Charge program.

- In addition to setting up procedures to coordinate with other internal departments, EV Fast Charge staff took the time to learn from the sites that went through the application process early in the program.

The lack of a formal commitment in advance of site walks resulted in PG&E starting to invest in uncommitted customers.

- EV Fast Charge participants are not required to sign a formal participation agreement or contribute any funds to the site until the final site design has been completed and agreed upon. Therefore, PG&E accepts a certain amount of risk when investing in planning a site.



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Bundle 3:
Vehicle to Grid

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V2G | Pilot Background

SDG&E selected the Cajon Valley Union School District for the V2G pilot.

- **Pilot team:**
  - **SDG&E:** Site manager
  - **CVUSD:** Site host
  - **Lion Electric:** School bus provider
  - **Nuvve:** Charging provider
  - **Baker Electric:** Construction manager
  - **ViriCiti:** School bus telematics provider
- SDG&E installed six Rhombus 60 kW DCFC bi-directional chargers
- Construction was completed in summer EY2021, but school bus retrofits and interconnection issues delayed commissioning until June 2022

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V2G | Summary Findings

Impact Parameter	MDHD Bundle	Public Charging Bundle	V2G Bundle
Population of Activated Sites (#)	53	11	1
Sites Included in Analysis (#) [a]	41	7	0
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[a] Energy consumption, petroleum displacement, emission reductions, and health benefits are based on annualized data. The number of sites included in the analysis differs from the population of activated sites because some sites were only activated for a short period during EY2021 (such as one or two months).
[b] The team derived the EVs supported value for MDHD programs from applicants' vehicle acquisition plans. This value represents the maximum number of vehicles expected to be supported by the charging infrastructure.
[c] GHGs include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) multiplied by their respective global warming potentials as defined by the Intergovernmental Panel on Climate Change's published fifth assessment (see the Evaluation Methodology section for more details).

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V2G | Pilot Next Steps

During EY2022, SDG&E plans to conduct three V2G test phases.

Test Phase	Description	Timing
1	TOU charging and resiliency testing in the event of a building power shutoff	Summer 2022 and beyond (after commissioning)
2	Emergency Load Reduction Program participation	Summer/fall 2022 (with ELRP events from May 1 through October 31)
3	Critical Peak Pricing participation	Summer/fall 2022 (with CPP events from May 1 through October 31)

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V2G| Lessons Learned

A lack of standards for V2G technologies resulted in vehicle and charger interoperability and grid interconnection challenges, a reduction in potential profit for the site, and Pilot delays.

- The CPUC should work with Utilities to develop a V2G site standard or guidelines for technologies and grid integration to simplify Underwriters Laboratory and SAE International coordination and develop V2G-specific rates to help improve cost-effectiveness for participants.

Pilot delays resulted in minimal vehicle and charger utilization during EY2021.

- Utilities, participants, and vendors should account for potential delays in V2G implementation in site timelines and site management budgets, including supply chain issues with buses and hardware, software commissioning challenges, and challenges with grid interconnection applications.

V2G| Lessons Learned Cont.

The Pilot was designed and the site was selected before considering grid interconnection and technology interoperability requirements.

- Utilities should work directly with all involved standards groups and vehicle manufacturers and EVSE hardware and software vendors early in the Pilot design process to ensure compatibility. All equipment should be selected before design is complete to avoid complications. In this Pilot, construction was almost complete when the SDG&E's standards team requested a taller charger mounting pad to meet their electrical safety standards. Utilities should also consider V2G interconnection requirements and cost-effectiveness with each interested participant during the design phase to ensure that participants receive compatible systems, meet Rule 21 interconnection and safety requirements, and are on V2G-friendly or V2G-specific electric rates.

In memory of Philip Kreycik, team member of Cadmus and PG&E

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Q&A

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Public Charging Lead: Allie.Marshall@Cadmusgroup.com
V2G Lead: Christie.Amero@Cadmusgroup.com