Q1 2019 Clean Transportation Program Advisory Council Meeting

March 27, 2019

Together, Building a Better California

Agenda

Safety/ Introductions	9:00 – 9:15
Meeting Overview / EV Market Update	9:15 – 9:30
EV Charge Network Program Update	9:30 – 10:00
SB 350: Priority Review Projects Update	10:00 – 10:45
BREAK	10:45 – 11:00
SB 350: Standard Review Projects Update	11:00 - 12:00

EV Market Update

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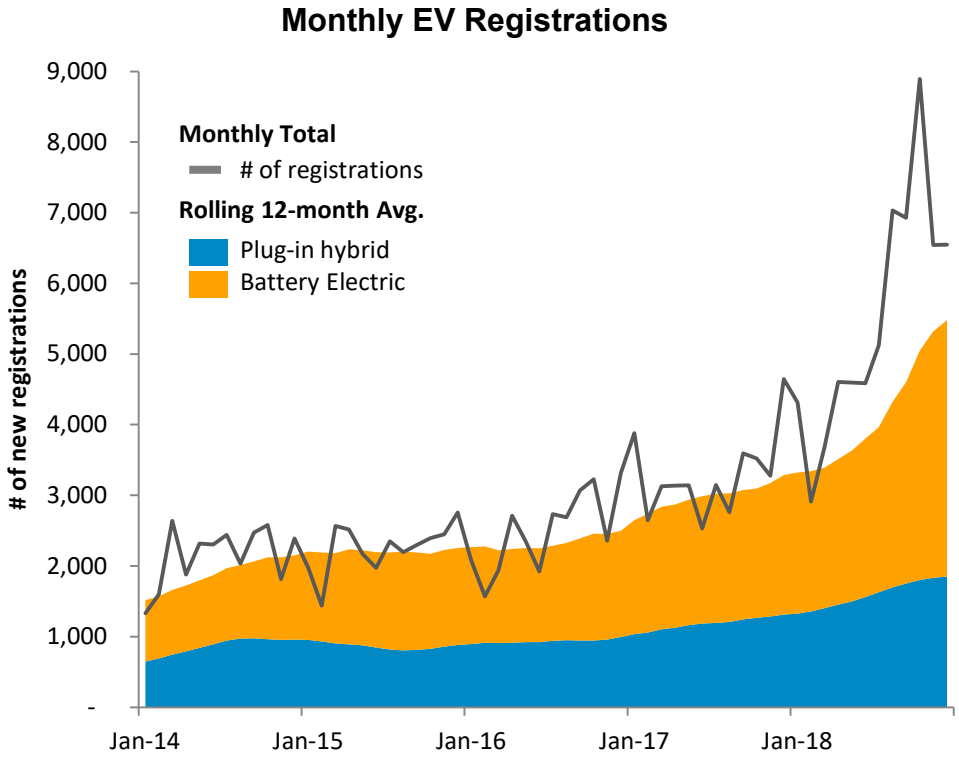
EV registration growth

216,845 **EVs registered** in PG&E service territory, through Q4 of 2018



EV registrations in the PG&E market represented **10% of new vehicles** in 2018. EV sales grew as conventional vehicle sales receded.

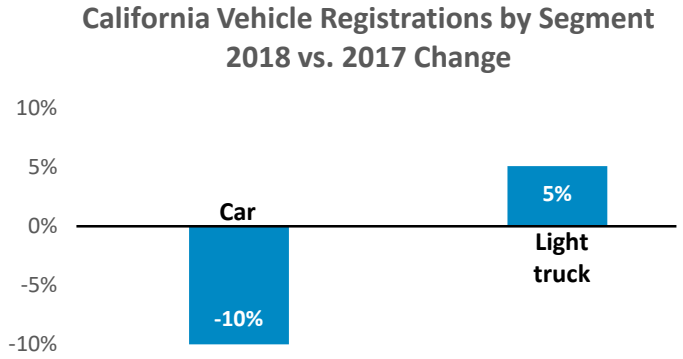
The **66% growth in 2018**, was largely driven by **Tesla Model 3** production, though other OEMs also saw modest growth.

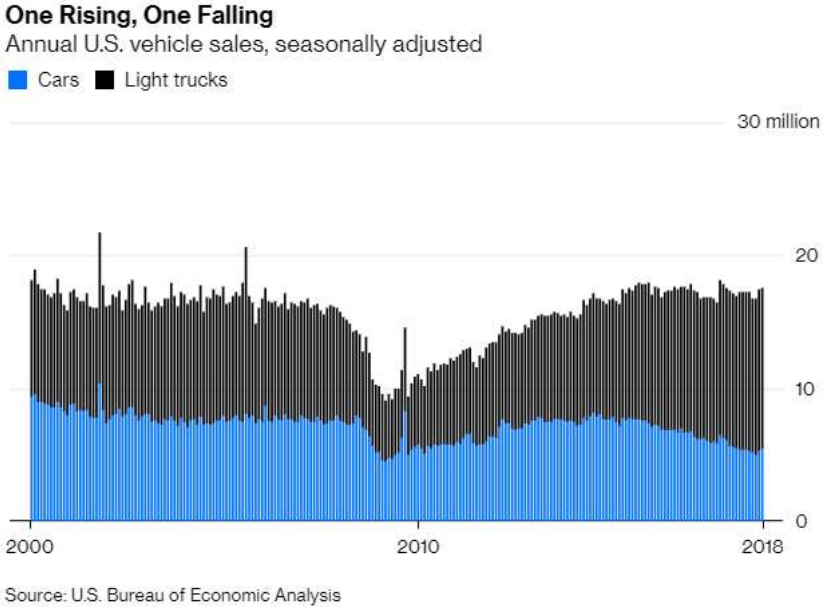
PG&E estimates the actual number of **EVs in operation is approximately 90%** of the total registrations since 2010, due to retirements and out-of-state moves.

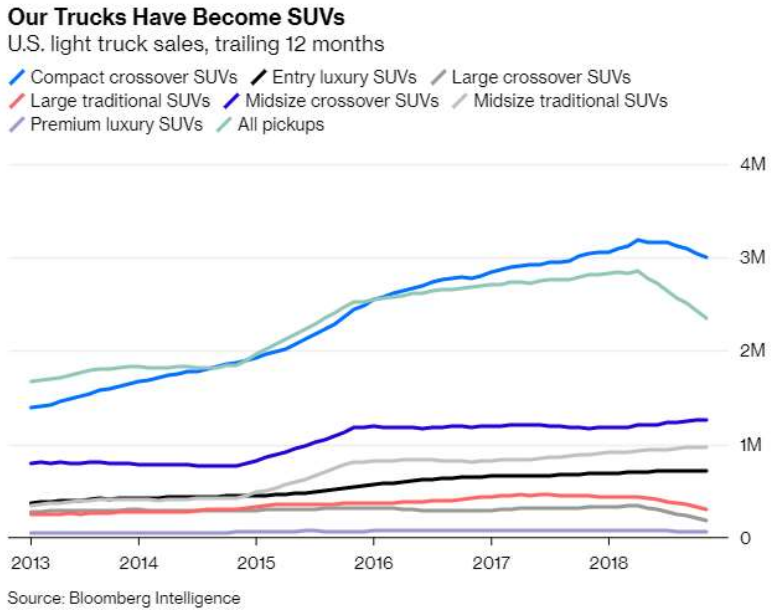
Source: EPRI, Based on external registration data

EV market update – Q1 2019

Give the people what they want:
Ford's F-150 is the most popular car in the U.S., and Americans' car preferences are shifting toward light trucks and SUVs – but this popular segment has remained largely untapped in the EV market.







Sources: Bloomberg Sparklines; California Auto Outlook: California New Car Dealers Association (YTD through September 2018).

EV market update – Q1 2019

2019 will mark the entry of electric crossovers (CUVs) into a growing field of EV options. 2020 might yield the first electric pickups.

Joining the high-end Tesla Model X in the CUV market are a number of **mid-range and luxury** new EVs:

- Hyundai Kona Electric
- Kia Niro EV
- Jaguar I-Pace
- Audi e-tron

Michigan start-up **Rivian** turned heads at December's LA Auto Show with its fully electric **R1T pickup**; which will debut in 2020.

Similar announcements on upcoming models have trickled out from **Ford, Tesla** and startup **Bollinger**

EV Charge Network Program Update

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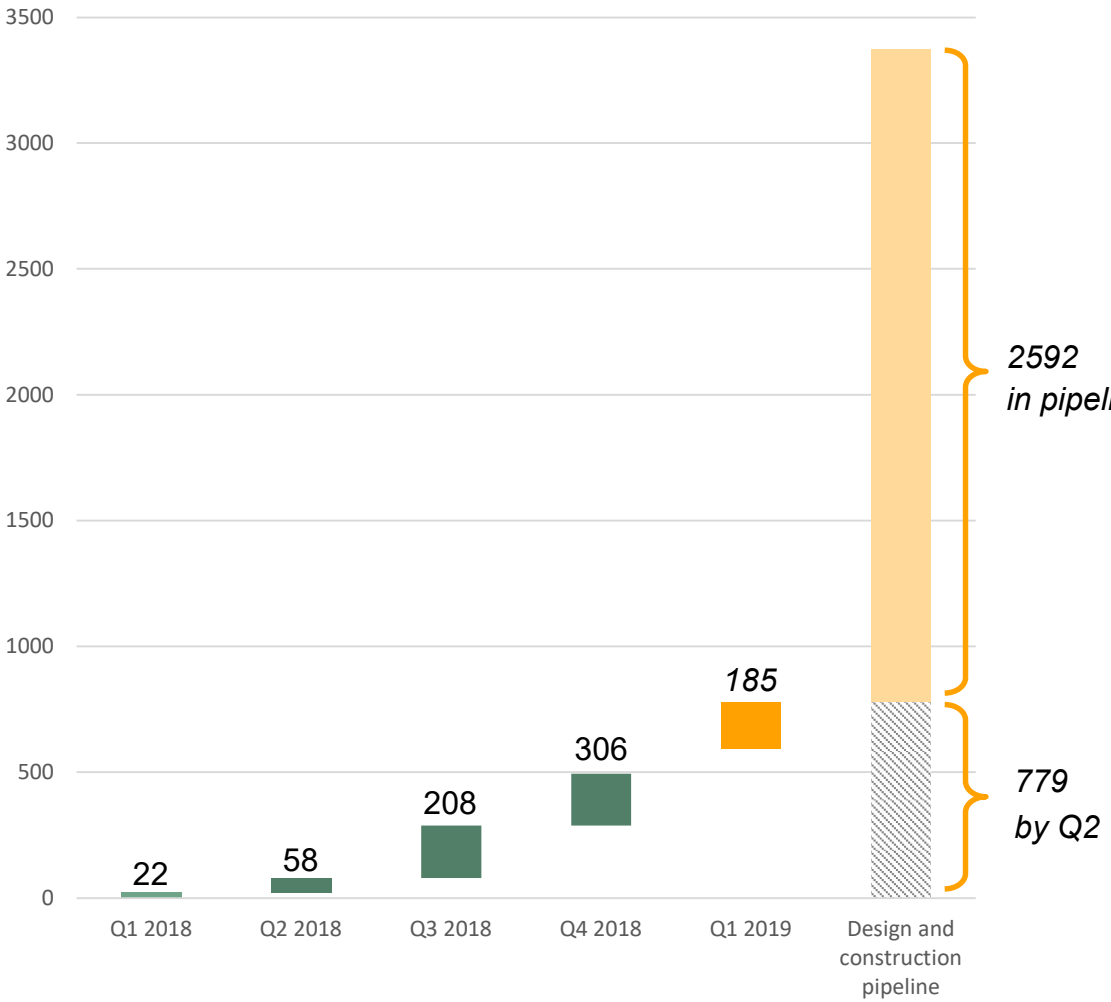
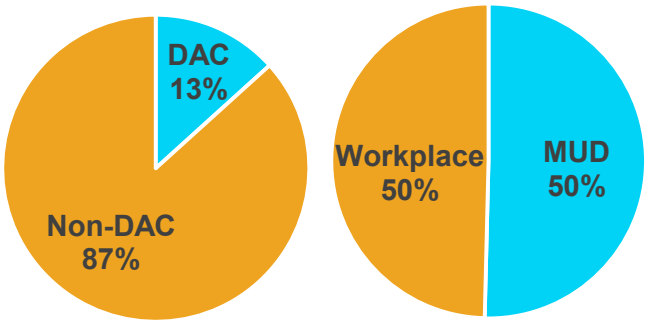
EV Charge Network Program Update

Current charging ports installed or in pipeline



- As of February, **635** ports have been constructed
- Going forward:
  - **1,672** ports are scheduled for construction
  - **1,064** additional viable ports have completed preliminary design
  - Additionally, applications for **~5,200** ports are currently being processed

Installed port portfolio[1]



1 As of March 18, 2019

EV Charge Network Program Update

- Approaching **full subscription** with over >3,330 committed ports and another 5,200 ports in site eligibility
- 2019 construction pipeline is largely scheduled
- Going forward, any newly signed customer agreements will be **scheduled for construction in 2020**

01 Inform all existing applicants of the program status and construction timelines.

02 Institute scoring criteria to optimize remaining portfolio selection process*.

03 Monitor attrition and reach back out to pool when necessary.

Current forecasts:

- ~4,500 ports installed by December 2020

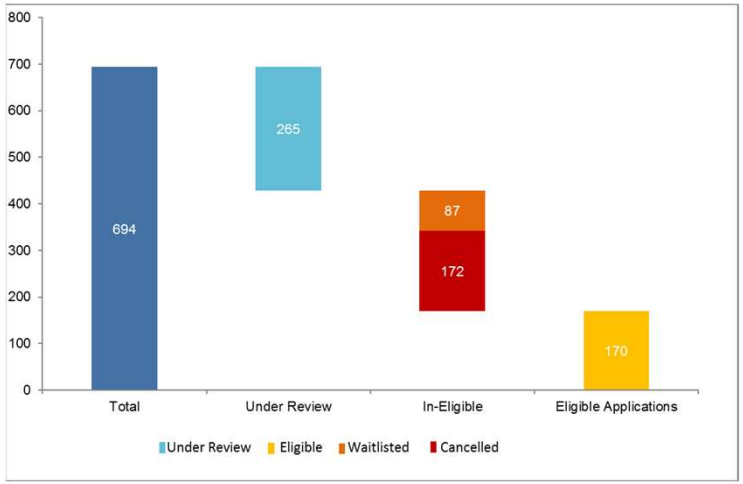
Forecasts contingent on:

- Costs assumptions hold true
- Availability of labor resources
- Steady attrition rates

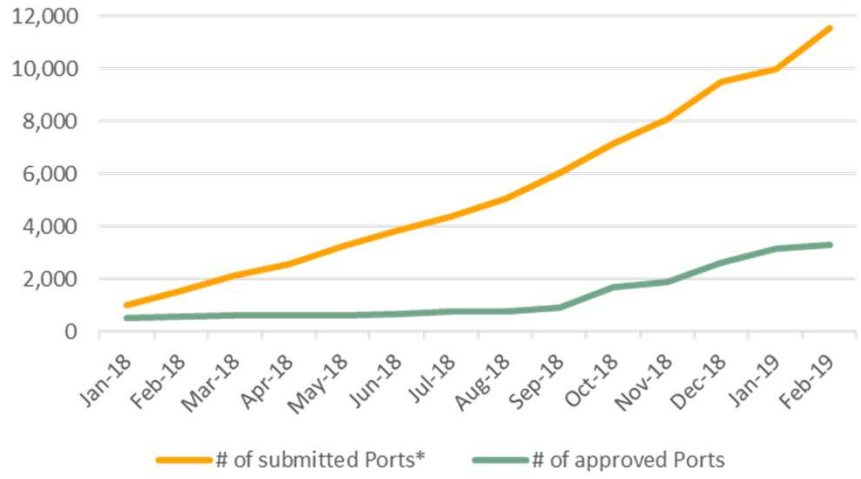
*Key Criteria Parameters: cost, utilization potential, DAC status, geographic location

Customer Acquisition Metrics

Number Applications by Current Phase (2/28/19)



Cumulative Ports Submitted and Approved (2/28/19)



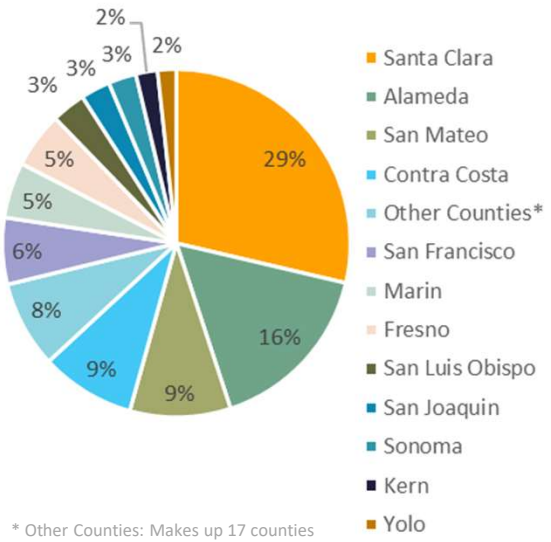
* Submitted ports are conservative rough estimates since not all applications receive precise port counts before cancellation.

Of the 694 applications received thus far, 170 have been approved as eligible sites and are in design, construction, or utilization phases.

Application intake has been driven by PG&E sales reps, with roughly 56% of applications coming in from a sales rep lead.

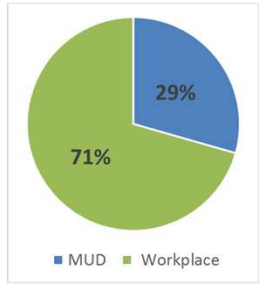
Starting in March 2019, PG&E has stopped actively marketing and selling the program due to high application levels.

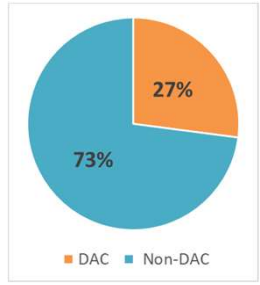
Submitted Application Geography (2/28/19)

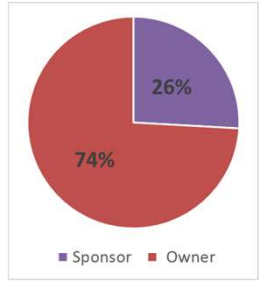


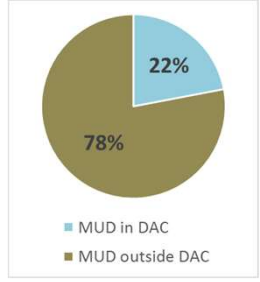
* Other Counties: Makes up 17 counties with less than 10 applications submitted

Site Type Breakdown (of 138 Eligible Applications)



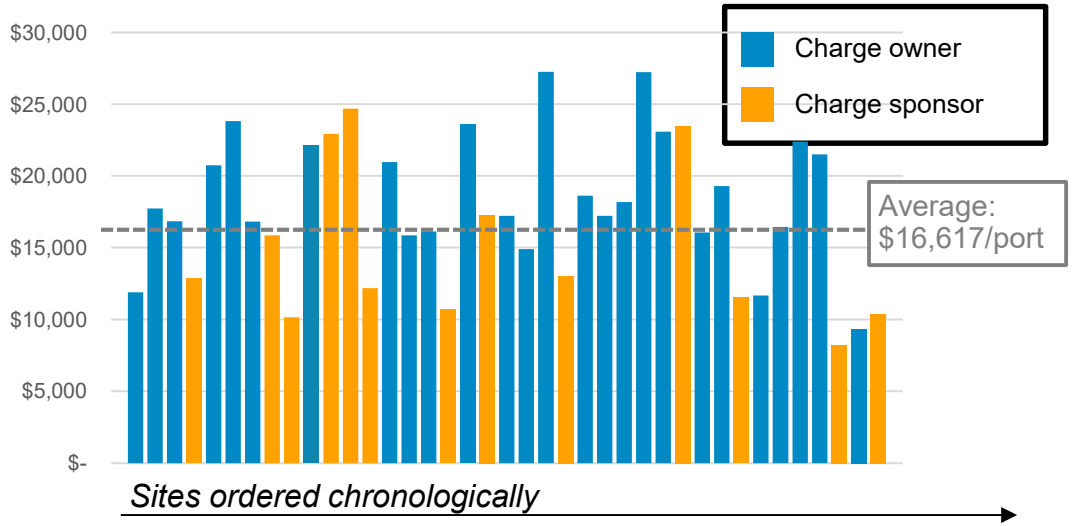






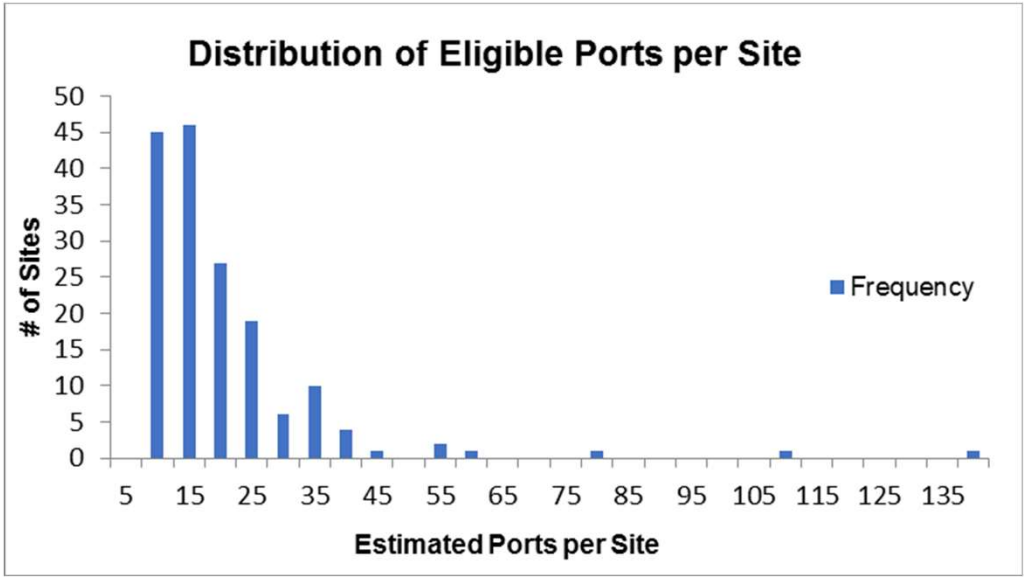
EVCN Construction

Construction cost per port at constructed sites[1]



PG&E's per port construction costs include

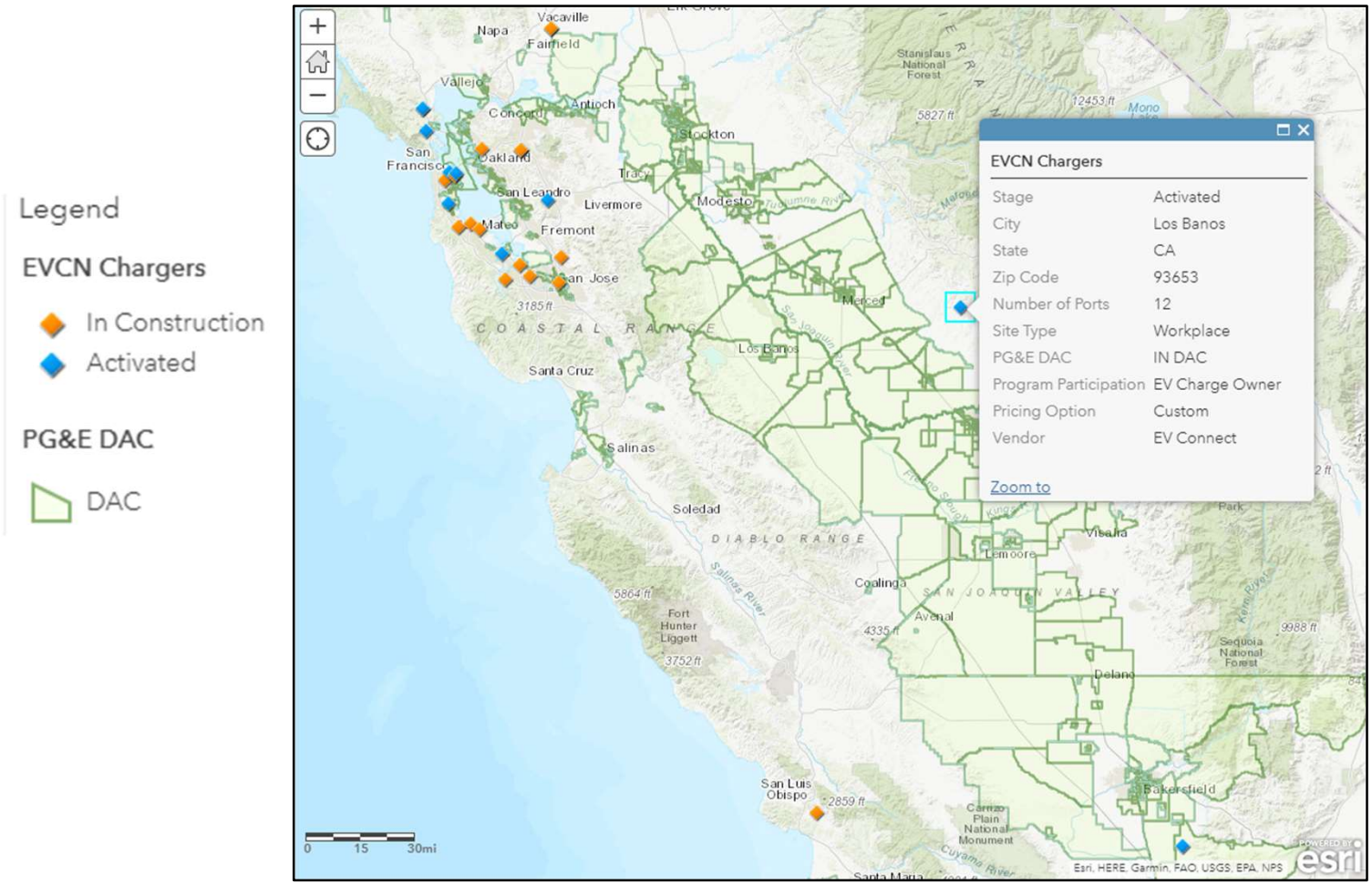
- Design engineering
- Permitting fees
- Materials
- Behind-the-Meter and To-the-Meter labor
- For sites where PG&E owns the charger: cost of the charger less participation payment from the site host
- For sites where the site host owns the charger: rebate
- Overhead associated with PG&E labor working on the site's construction



1 Sites for which construction actuals have been finalized as of March 19, 2019

EVCN Construction and Activation Map

- Activated sites and sites in construction will be visible on a public map
- Sites are summarized by zip code to maintain site host anonymity
- Map will go live in Q2 2019



SB 350
Priority Review Projects

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PG&E SB350 Priority Review Projects

High-level Project Status:

1. Electric School Bus Renewables Integration

   Chargers Activated

2. Idle Reduction Technology

   Design Phase Completed

3. Medium/Heavy Duty Fleet Customer Demonstration

   Construction Complete

4. Home Charger Information Resource Pilot

   Platform Design Underway

Electric School Bus Renewables Integration

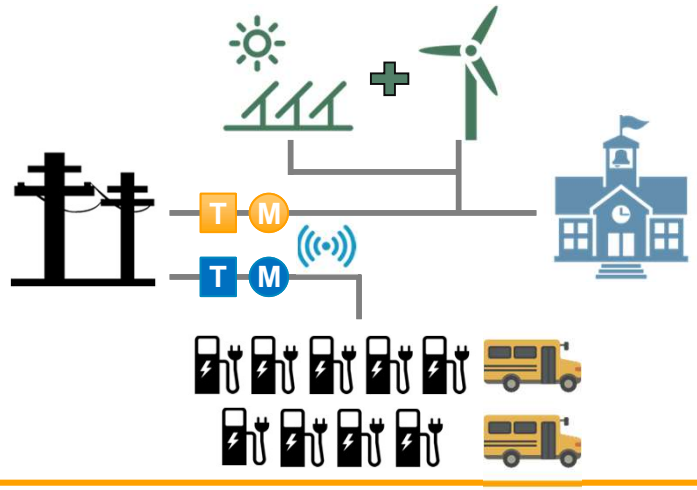
Project Partner

Pittsburg Unified School District

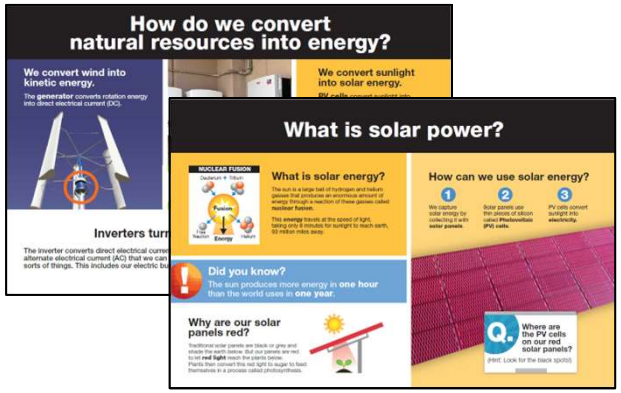
- K-12 school district, serving 13 school sites, including 8 elementary schools
- Serves a **Disadvantaged Community**
- PV solar arrays generate ~50% of energy needs across all sites
- Adding **9 electric buses** to fleet of 24 at bus depot at administration building
- Installing **~200KW onsite wind and solar renewable generation,** at the same location, coming online Spring 2019

Project Scope

- Installing **9 Level 2 Chargers**
  - At 19kW each, about ~180kW total load
- Charge management software and platform to **optimize charging** for economics and GHG reductions
- Architecting **novel communications design** to integrate onsite renewables



Electric School Bus Key Project Updates

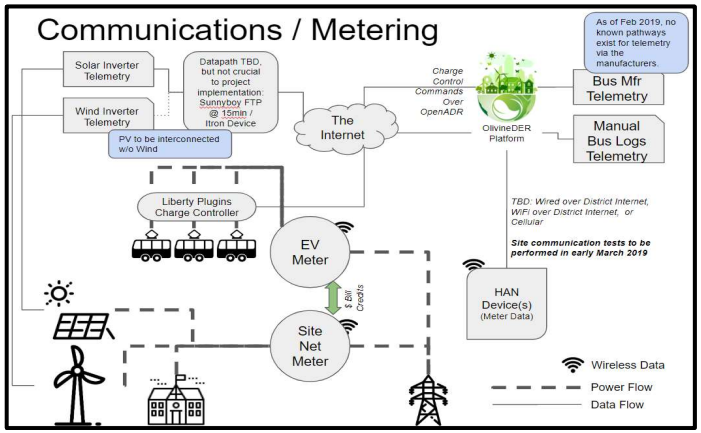


Learning Center & Curriculum Development

- Engaging teachers and students to develop curriculum for 4th, 6th and 9th grade students
- Constructing viewing and experimentation zones with signage explaining renewable energy and electric vehicles
- Pittsburg won the 2019 Acterra awards for sustainability, highlighting this project in final presentation

Software Platform Design (Olivine, Inc)

- Using Rainforest HAN devices to communicate with EV and site smart meters
- Developed software that communicates to Liberty Plugins charger controllers at each Clipper Creek charger
- Software sends 2-day forward looking 15 minute schedules over OpenADR protocol

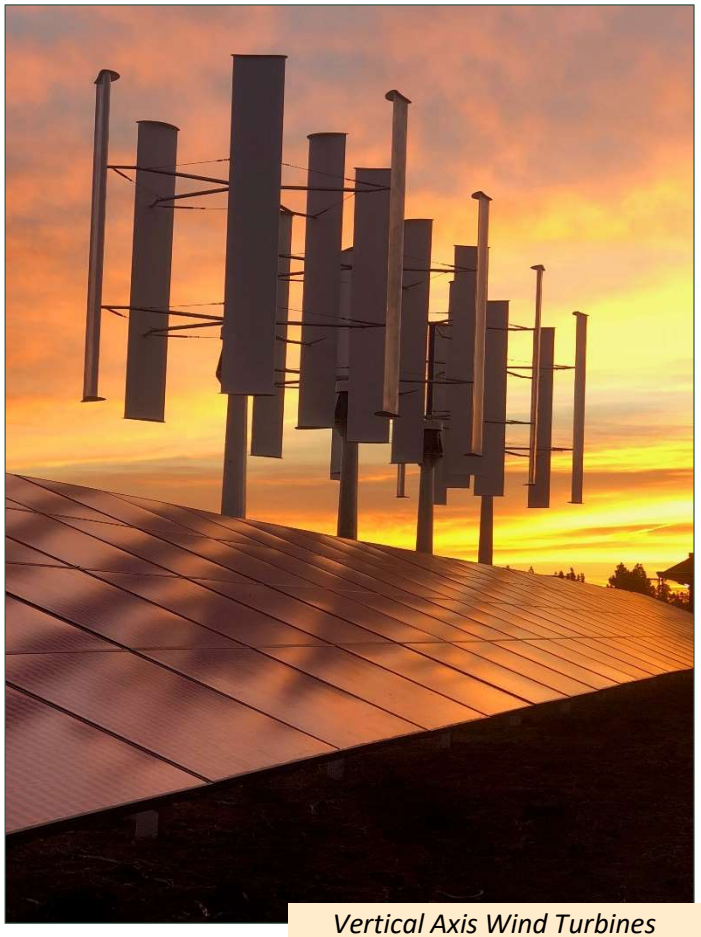


Beta Test Site for Novel Clean Technology

- **2018** Partnerships Initiated
- Design & Construction
- **2019** Construction Complete
- Renewables Interconnect
- Renewables Integration Tests
  - Test Phase 1
  - Test Phase 2
  - Test Phase 3
  - Test Phase 4
- **2020** Final Evaluation and Report
- Ongoing Operations

Novel PV allows veg growth

Optimized electric bus charging



Vertical Axis Wind Turbines

Software Platform Optimizes Cost and Emissions

2018 Partnership Initiated

Design & Construction

2019 Construction Complete

Renewables Interconnect

Renewables Integration Tests

Test Phase 1

Test Phase 2

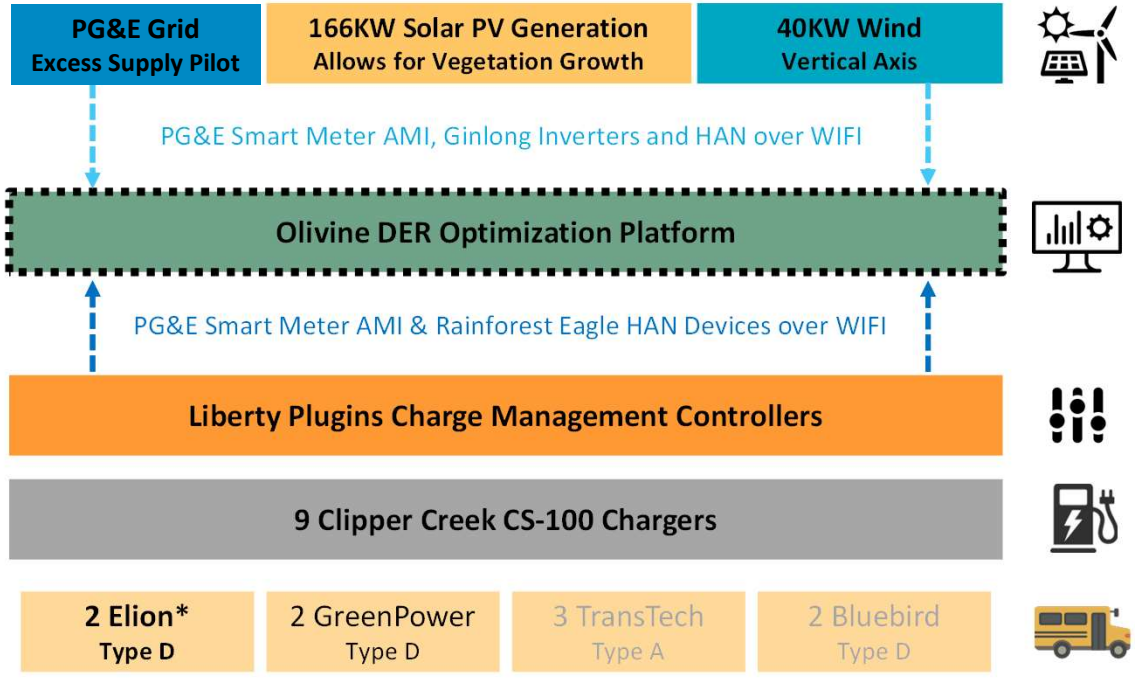
Test Phase 3

Test Phase 4

2020 Final Evaluation and Report

Ongoing Operations

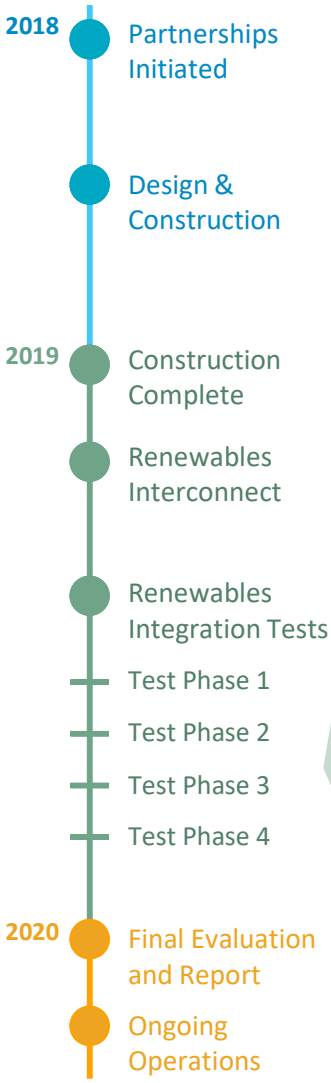
Optimization Platform Architecture



**Bold bus types are on site. Greyed out bus types are planned, not ordered*

Platform optimizes charging based on local and grid renewables while managing costs based on tariffs

Testing Vehicle-to-Grid Integration Use Cases



Test Phase 1
Customer Bill Management

Technical system integration
-
Minimizing customer bill based on rate structure

March 2019 – April 2019

Test Phase 2
Wholesale Overgeneration Mitigation

Technical integration with DR Programs
-
Maximizing value while consuming green energy from the electric grid

May 2019 – June 2019

Test Phase 3
Customer Renewables Integration

Facility energy device HAN integration
-
Minimizing customer bill by maximizing onsite renewables consumption

July 2019 – September 2019

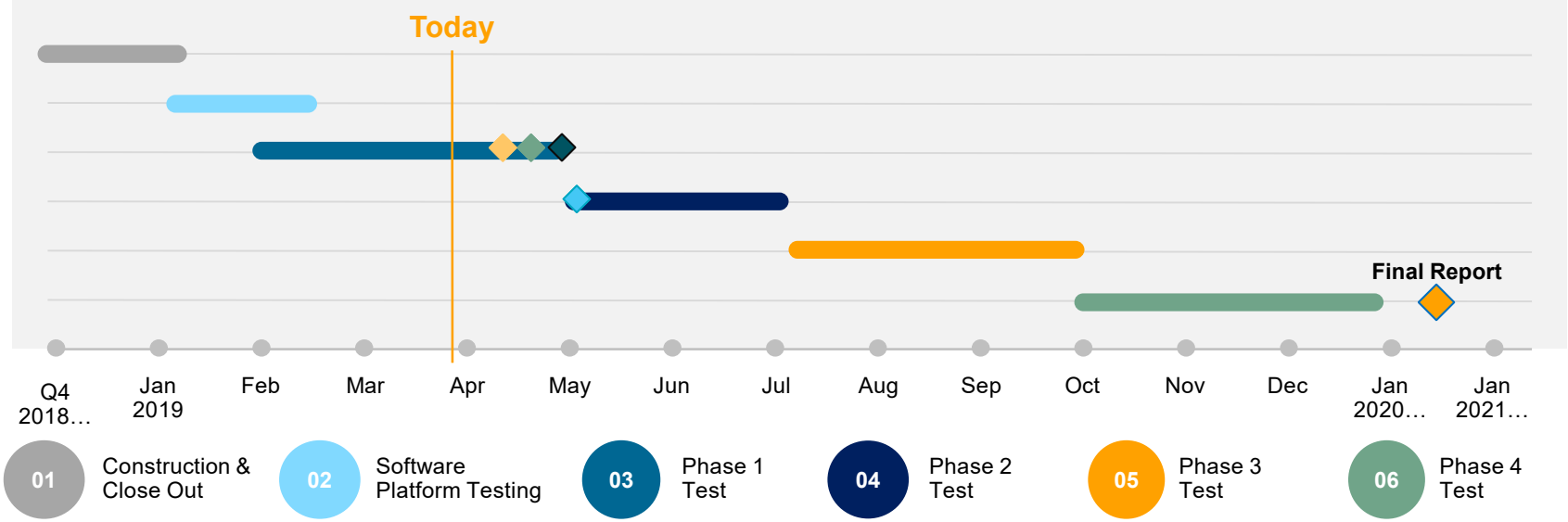
Test Phase 4
Stacked Value Optimization

Bus telematics data integration
-
Stacking cost reduction and value creation via smart charging optimization

October 2019 – December 2019

Electric School Bus Renewables Integration

Pilot Project Construction and Data Collection Schedule



Key Upcoming Milestones

- Learning Center Construction Starts……4/15/2019
- Olivine and PUSD Present at ACT Expo (pending abstract acceptance)……4/23/2019
- Testing Phase 1 Complete……4/30/2019
- Excess Supply Side Integration Begins ……5/01/2019

High Level Pilot Goals

Optimize renewables with low TCO | *Best practices for schools* | *Readiness for EV Fleet Program*

Idle Reduction Technology Project Summary

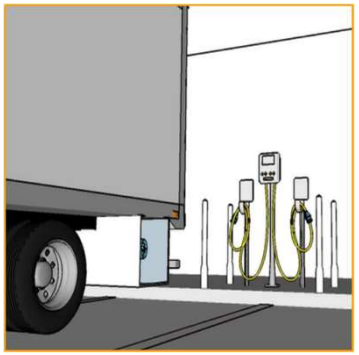
Project Partner

Food Distribution Service Center Facility

- Facility is located in and serves a **Disadvantaged Community**
- Facility is **2.2 million square feet**
- Facility has roughly **313 dock spaces**
- Current fleet
  - Consists of **664 trucks**
  - 232 trucks with eTRU units capable of running on diesel or electricity
- Plan for 550 – 600 **eTRU ports** if pilot is success

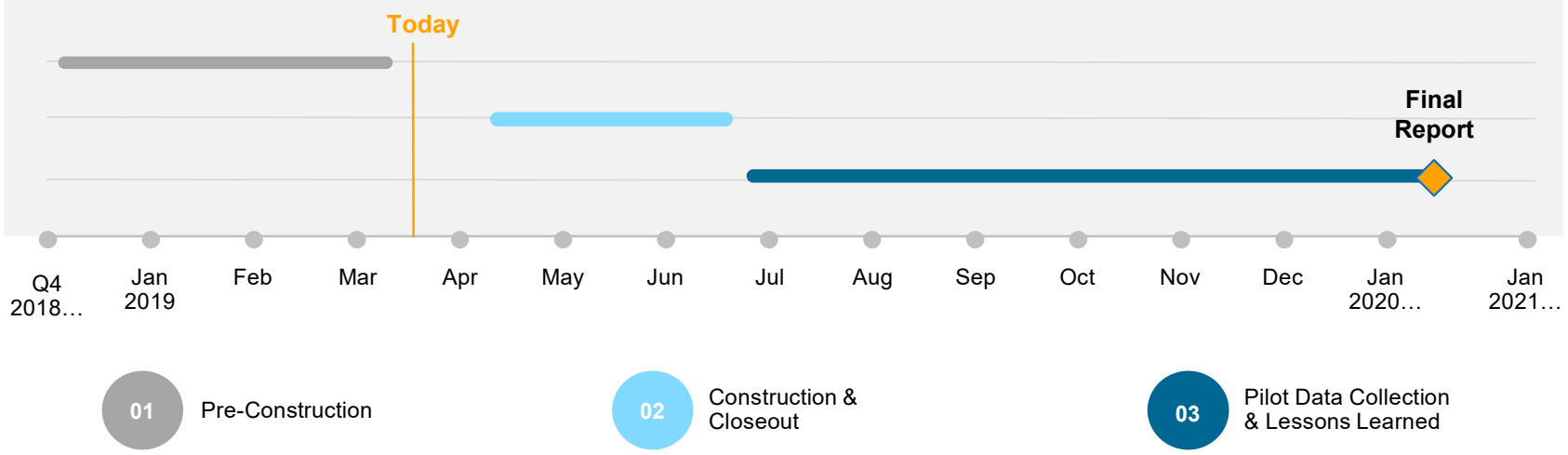
Project Scope

- **Deployment** of 25 electrified receptacles for eTRU connection (each 15-17 kW, adding a total load up to 425 kW)
- Demonstrate building off of customer owned infrastructure
- Demonstrate minimizing fuel costs by reducing diesel idling
- Understand deployment of eTRU technology and impact of site operations



Idle Reduction Technology Project Timeline

Pilot Project Construction and Data Collection Schedule



Key Upcoming Milestones

- **Begin construction of site installation……Q2 2019**
- **Commission charging ports……Q2 2019**

High Level Pilot Goals

eTRU Technology Adoption

Minimizing Fuel Cost

Readiness for Fleet Ready Program

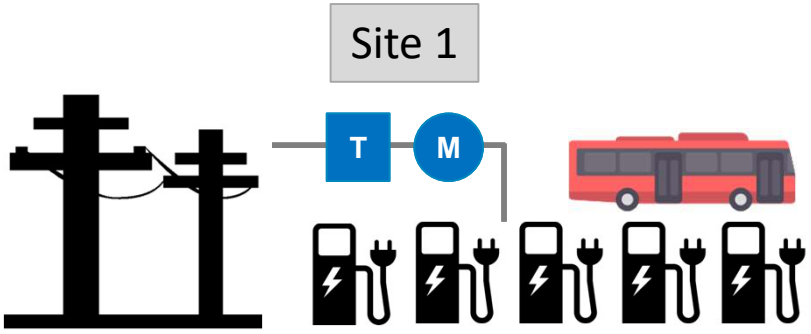
Medium/Heavy Duty Fleet Customer Demo Project Summary

Project Partner

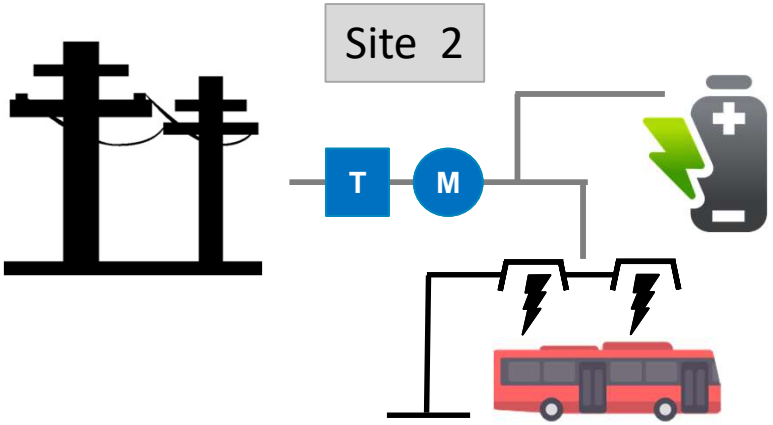
San Joaquin Regional Transit District (SJRTD)

- SJRTD is located in and serves a **Disadvantaged Community**
- Total fleet of **17 electric buses**
  - 12 original buses charged using two overhead **extreme fast chargers**
  - Recently added 5 buses which will be charged using the chargers from the PRP
- Plan for **all-electric bus fleet** (~100 buses) by 2025

Project Scope



- **Deployment of five 60 kW** overnight depot chargers



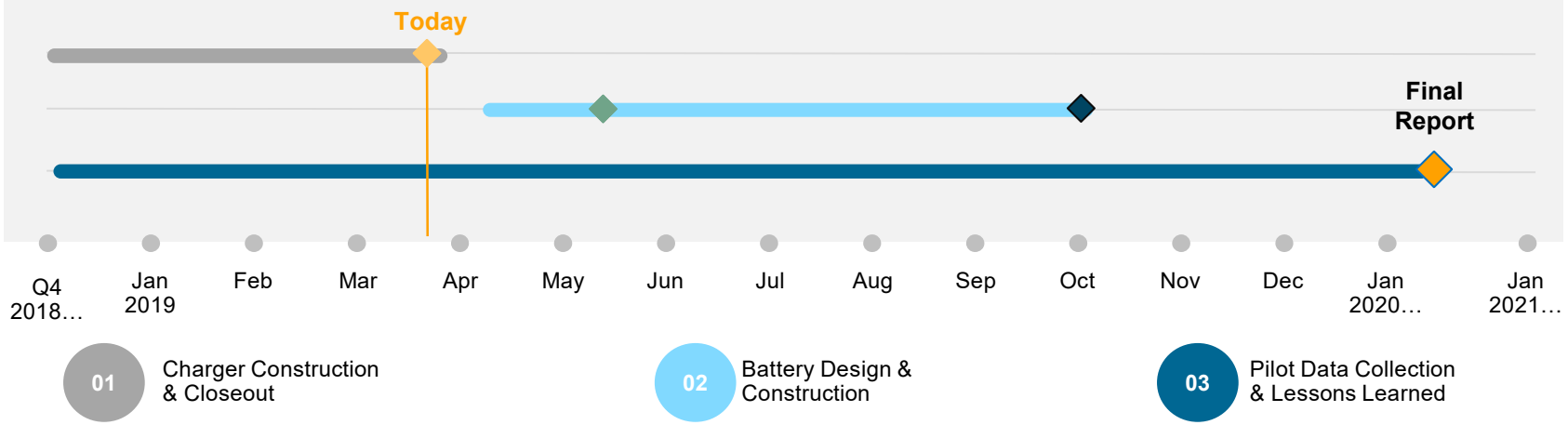
- **500 kWh* battery storage system** paired with existing extreme fast chargers

**capacity in AC at full nameplate power*

Construction Progress at RTD

Medium/Heavy Duty Fleet Customer Demo Project Timeline

Pilot Project Construction and Data Collection Schedule



Key Upcoming Milestones

- **Chargers Commissioned**.....**03/27/2019**
- **Battery Delivered**.....**Q2 2019**
- **Complete Battery Installation**.....**Q4 2019**

High Level Pilot Goals

Transit Operator Electrification | *Battery Storage Integration* | *Readiness for EV Fleet Program*

Quick Stats – RTD Fleet

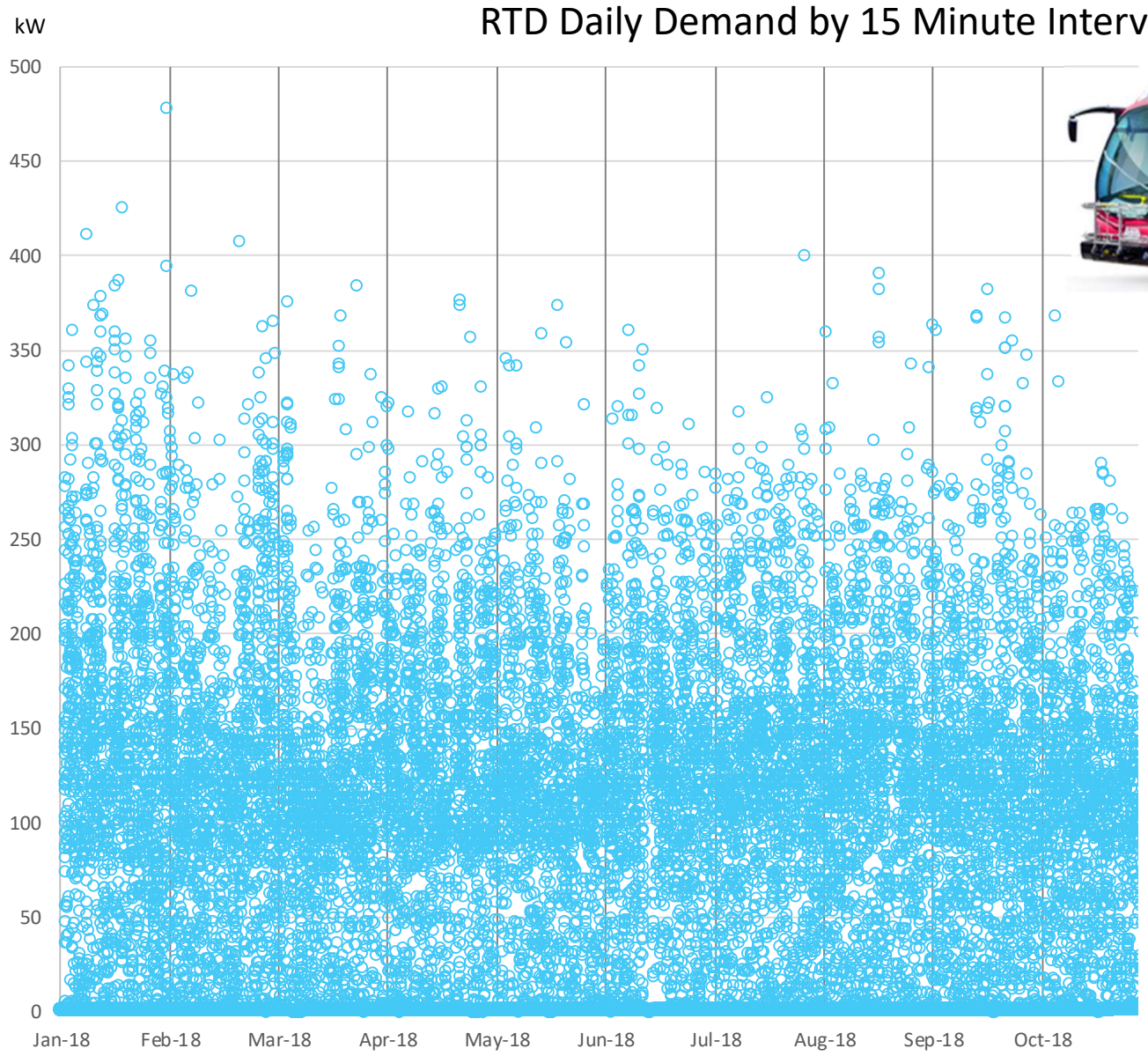
RTD Fleet Operations (as of Q1 2018)

RTD's launch event for its first two electric buses.

12 electric buses	71 diesel hybrid buses	8 conventional diesel	22 unleaded buses
Monthly fleet mileage: ~18,700 miles	Monthly fleet mileage: ~128,780 miles	Monthly fleet mileage: ~41,120 miles	Monthly fleet mileage: ~48,290
Average miles per bus: 1,558	Average miles per bus: 1,814	Average miles per bus: 5,140 miles	Average miles per bus: 2,195 miles

Source: Represents maximum monthly miles traveled from January through April 2018

Early Data Analysis of RTD Charging



2 on-route high-speed 350kW DC fast-chargers

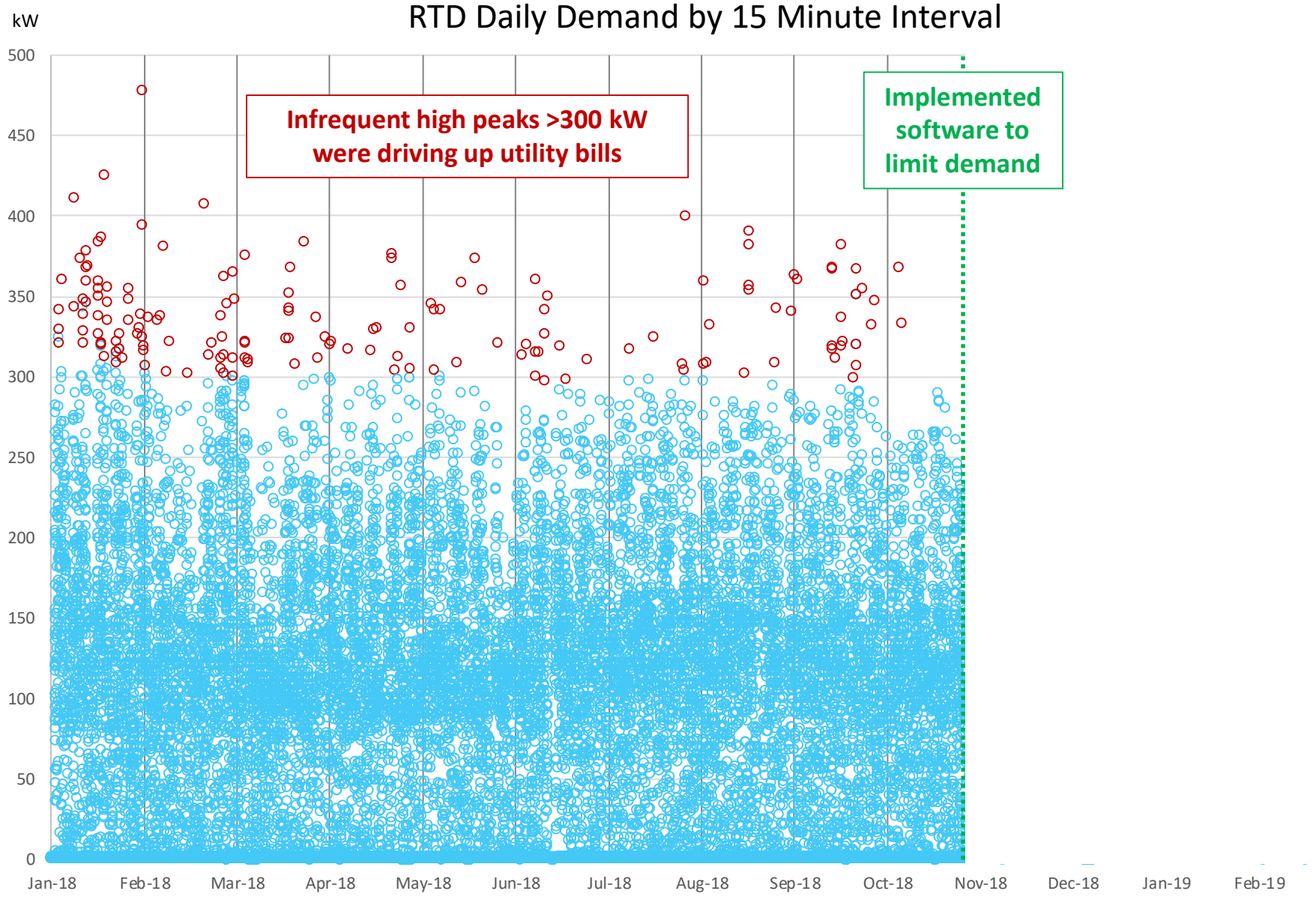
Peak Demand: 479 kW

Utilization rate: 15%

Cost ($) / mile: $0.60 - $0.85

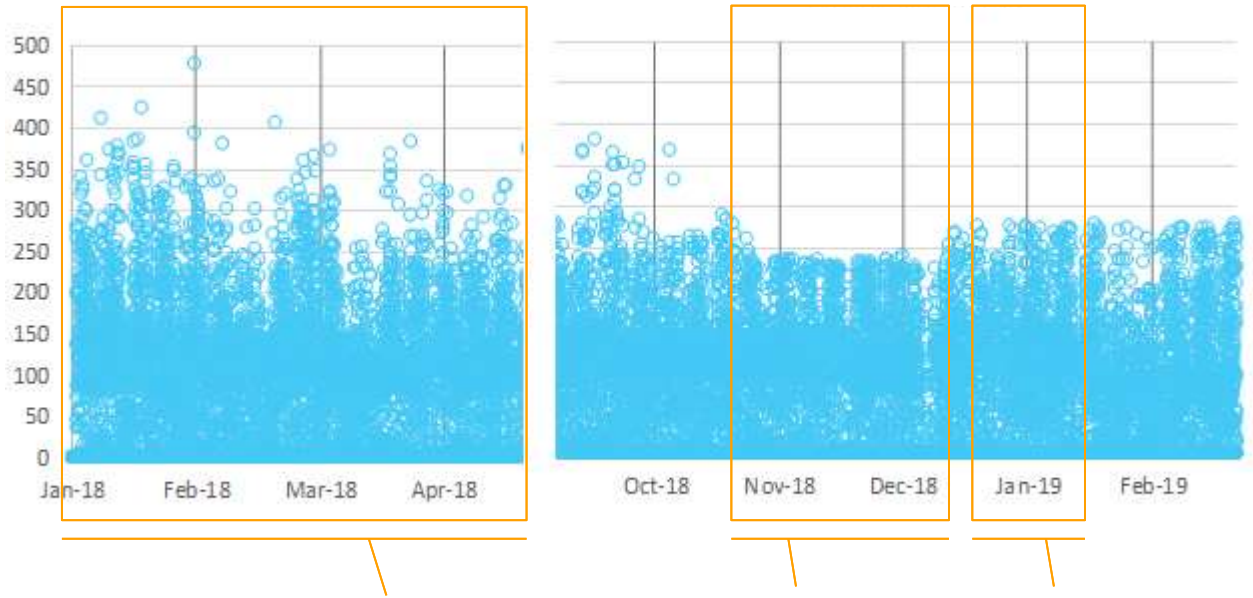
Compare to diesel hybrid fleet cost ($) / mile: $0.36 - $0.40

Early Data Analysis of RTD Charging



Early Data Analysis of RTD Charging

RTD Daily Demand by 15 Minute Interval



Average Demand Charge:	$4,660
Average Utilization Rate:	15%
Average Electric Fleet Mileage:	16,109
Average # of Buses in Operation:	12
Average $/mile (Electric Fleet):	$0.70
Average $/mile (Diesel Hybrid Fleet):	$0.38

Recent Lessons Learned

1	Wide variability in MD/HD charging equipment available
2	Idle reduction remains an untapped opportunity
3	Each site requires custom analysis and design to best suit the customers' needs
4	Many schools and transit agencies have received or applied for grants for vehicles
5	MD/HD charging technology is less mature than Light Duty/Level 2 charging
6	Charge management software is still developing and not plug and play
7	Legacy rates can create challenges in implementation
8	Process Improvements Identified for Fleet Ready

9 There is no one-size-fits-all approach to minimizing fueling costs

- Demand management software is effective
- Must be coupled with maximizing overall utilization of the chargers
  - Larger ramp-ups of EV fleets may be more economic if they can overcome minimum utilization thresholds
- Maximizing mileage is essential

10 Customers benefit from greater support by OEMs and Utilities during the transition

- Technology is still in the early stages
  - Downtime of chargers and buses is problematic, so quick resolution is necessary
- No one entity has all the data to optimize on a customer's behalf
  - Utilities, OEMs, and customers need to work together to develop proactive solutions

Home Charger Information Resource Pilot

Pilot Goals

1. **Empower customers to install residential charging through:**
   a) **Updating website and checklists:** Translating these resources into Spanish and Chinese to support DACs
   b) **Installer Tool:** 3rd party tool which empowers customers to find qualified contractors and compare costs with remote bids

Quick Facts

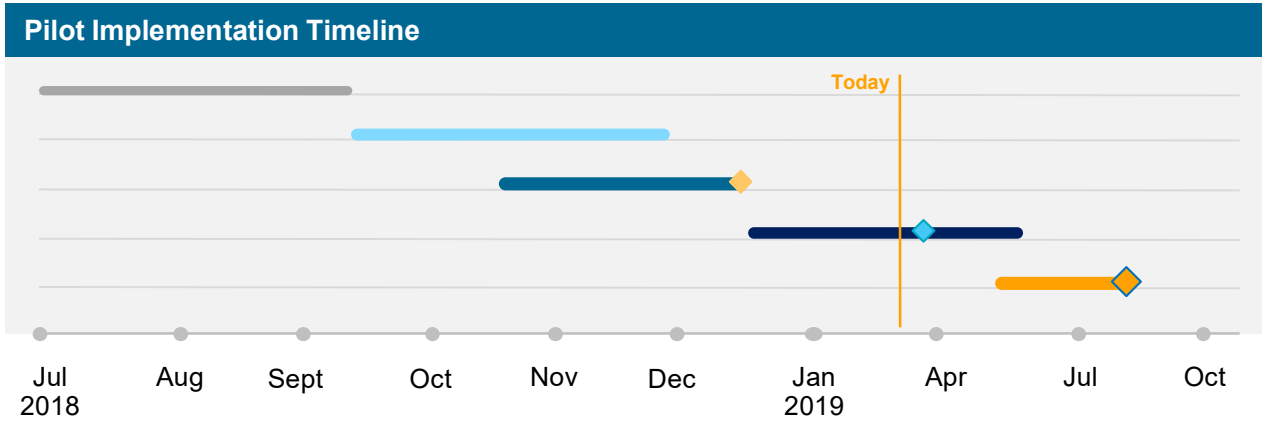
Market Segments
Residential

Implementation
Update website and launch Installer Tool. Increase adoption and spread awareness in 2019 and 2020.

Cost
$500,000

Business Model
Qualified contractors receive referrals from Installer Tool

Home Charger Information Resource Pilot



1. **Additional Scoping and Approval**
2. **Pilot Planning**
3. **Web Content Development**
4. **Platform Design and Development**
5. **Platform Testing and Launch**

Key Upcoming Milestones

- **Finalize scope of work for platform development……04/01/2019**
- **Final platform launch……07/01/2019**

High Level Pilot Goals

- ***Engage disadvantaged and minority communities***
- ***Education on home installation***
- ***Marketplace for qualified contractors***

SB350
Standard Review Program

Together, Building
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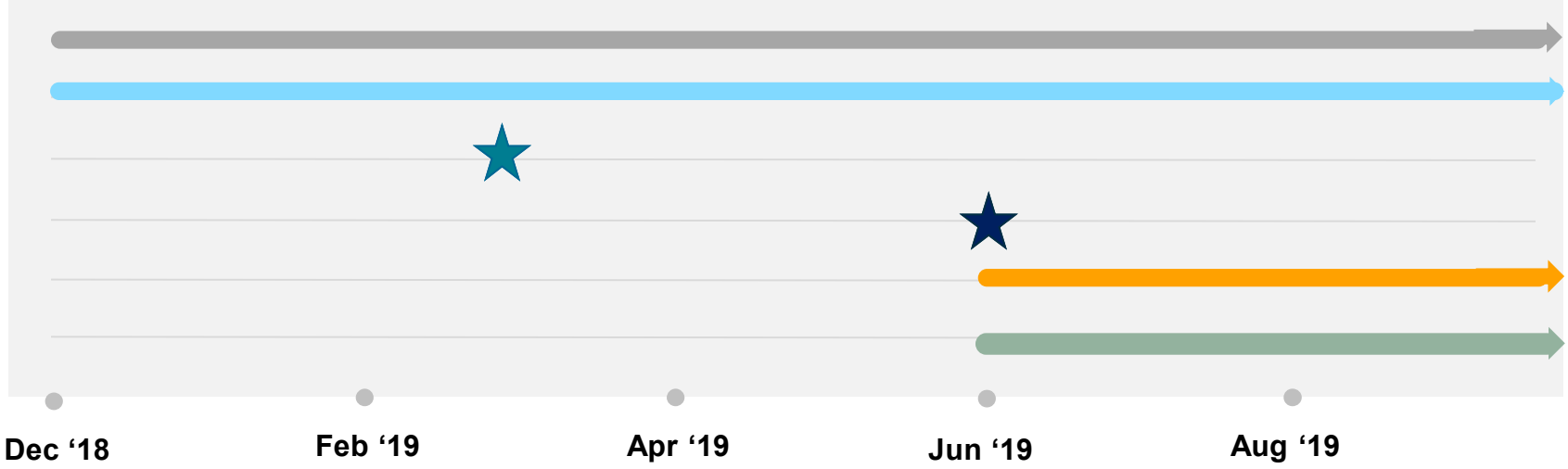
EV Fleet Program Activities and Milestones

EV Fleet Program Timeline



1 Develop OEM Partnerships

- Developed 15 OEM partnerships to date
- PG&E continues outreach to OEMs as a source of program applicants

2 Engage Pre-Launch Customers

- Working with 30 customers to date

3 Launch Program Website

- Website launched end of Feb with program interest form and application

4 Launch Program

- Official program launch early June
- Begin scheduling for construction

5 Marketing and Outreach

- Start formal targeting campaigns through email, webinars, etc.

6 Project Construction

- Focus on pre-launch customer construction through 2019
- Set up 2020 construction schedule with new applicants

EV Fleet Pre-Launch Customers

Metrics to Date

35 pre-launch customers

- **17** school bus sites
- **9** transit bus sites
- **2** municipal sites
- **7** other (e.g. eTRU, local delivery)

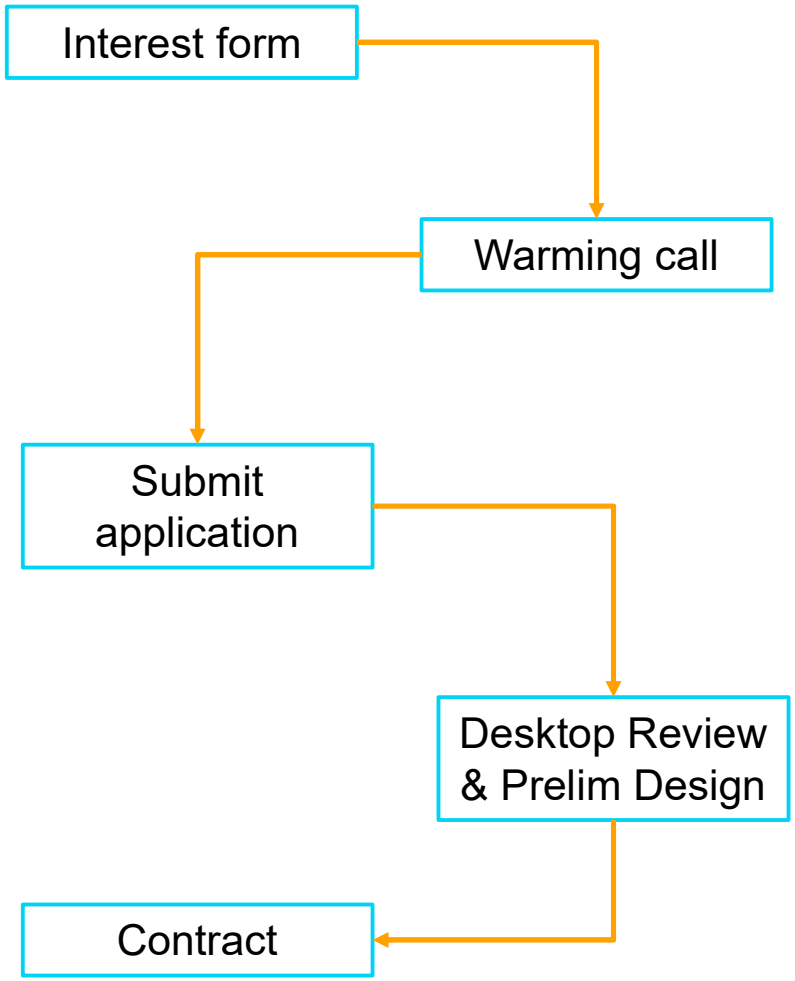
815 total electric fleet vehicles

Pre-launch customer sources

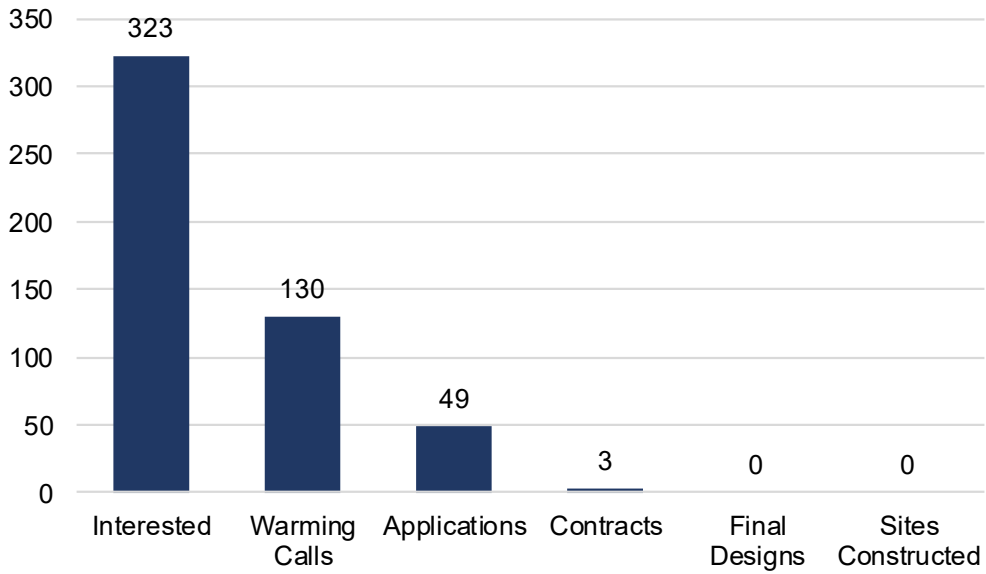
- External funding partnerships and grants (i.e. CEC School Bus Program)
- Regulatory compliance (i.e. Innovative Clean Transit rule)
- OEM partnerships

EV Fleet Operational Metrics

Process overview



Customer interest and progress to date



EV Fleet Website Launch

Two pathways to submit an application…

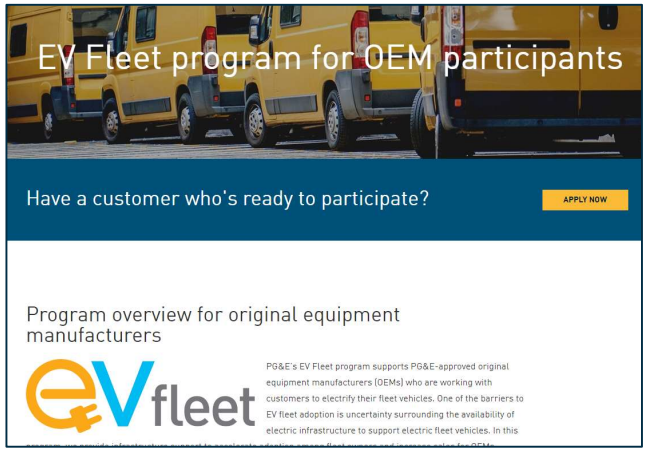
www.pge.com/evfleet

Customer

1. Learn about program and eligibility
2. Submit interest form
3. Connect with PG&E
4. Select OEM
5. Submit application

OEM

1. Become EV Fleet OEM partner
2. Identify eligible customer
3. Submit application on behalf of customer



Customer tools now available:

- Rebate calculator
- Rate calculator
- Infrastructure incentive calculator
- Additional funding filtering tool

EV Fleet Rebate and Incentive Amounts

PG&E EV Fleet EVSE Rebate Amounts

Schools, transit agencies, and sites located in disadvantaged communities are eligible for a rebate of up to 50% of the cost of their EVSE. The EVSE must be selected from the EV Fleet approved vendor list to be eligible for the rebate.

EV Fleet EVSE Rebate Levels

Power output	Rebate for eligible customers
Up to 50 kW	50% of the cost of EVSE, up to $15,000
50 kW to up to 150 kW	50% of the cost of EVSE, up to $25,000
150 kW and above	50% of the cost of EVSE, up to $42,000

PG&E EV Fleet Customer-owned Infrastructure Incentive Amounts

In cases where the customer selects to construct, own, and maintain the behind-the-meter infrastructure, the customer will be eligible for an incentive up to the cap for the vehicle sector, on a per vehicle basis.

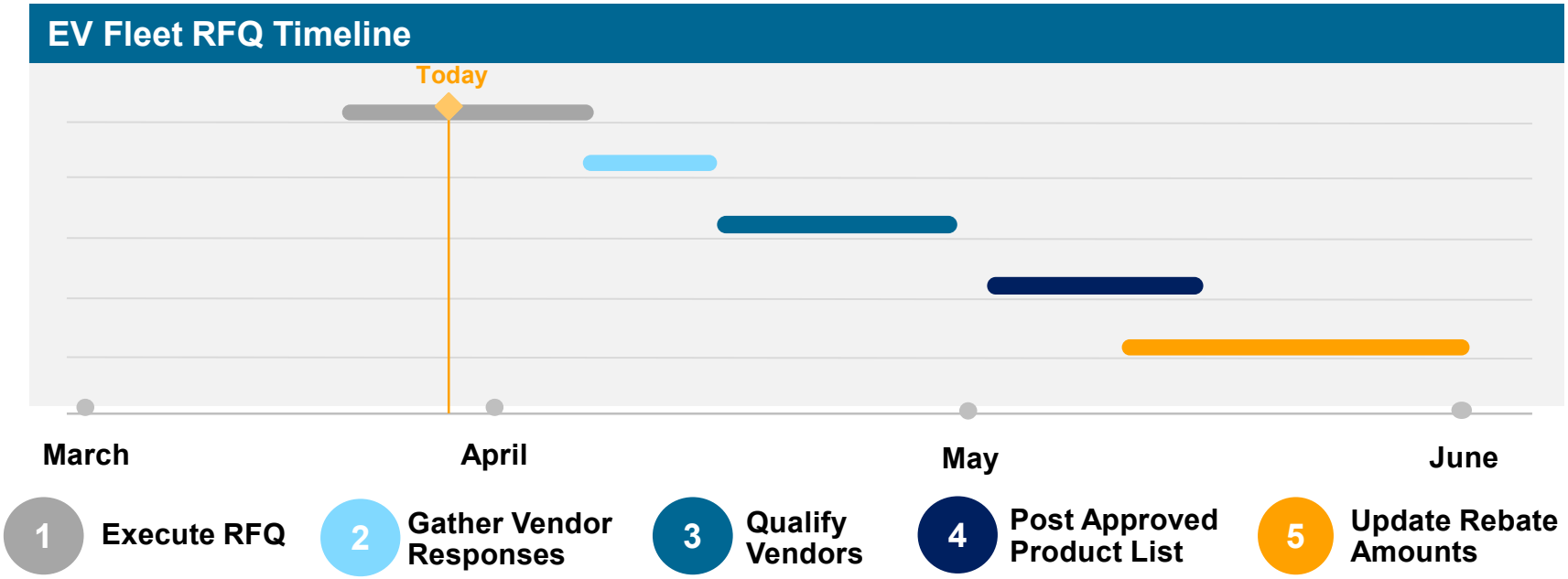
Infrastructure Incentive Cap by Vehicle Sector

Vehicle Sector	Incentive Cap
Transportation refrigeration units, Truck stop electrification, airport ground support equipment and forklifts	$3,000[1] per vehicle
Transit buses and Class 8 trucks	$9,000[2] per vehicle
School buses, local delivery trucks, and other vehicles	$4,000[3] per vehicle

[1] Incentive amount is limited to 50 vehicles per site. Sites with more vehicles to be considered on an individual basis.
[2] Incentive amount is limited to 25 vehicles per site. Sites with more vehicles to be considered on an individual basis.
[3] Incentive amount is limited to 25 vehicles per site. Sites with more vehicles to be considered on an individual basis.

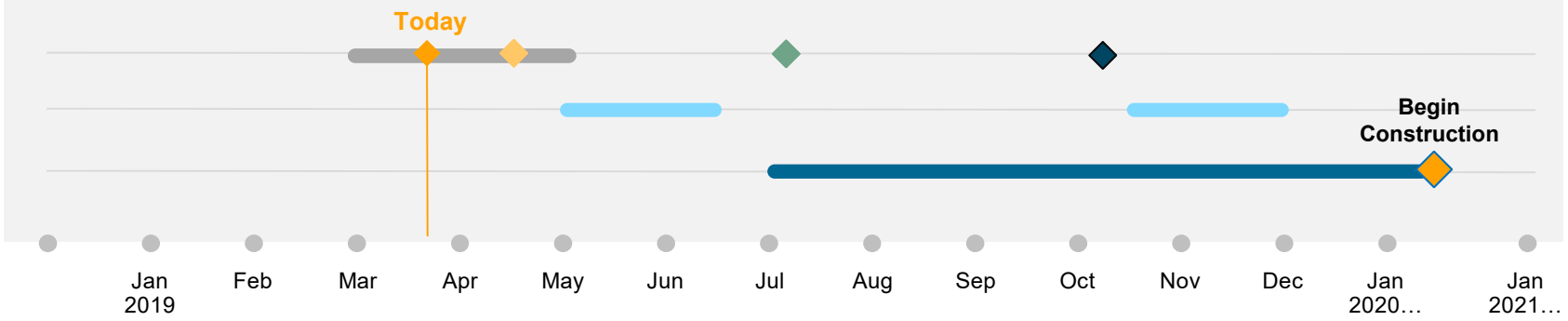
EV Fleet RFQ Update

- PG&E is in the process of conducting an RFQ to qualify vendors for the EV Fleet Approved Product List
- These chargers will be eligible for the EVSE rebate for qualifying sectors (school bus, transit, and DAC)



EV Fast Charge Timeline

Vendor and Site Selection Process



01 Develop and Execute EVSE RFQ

02 Qualify Vendors

03 Execute site acquisition process

Key Upcoming Milestones

- **Release RFQ**……04/15/2019
- **Initiate Site Acquisition Process**…… July 2019
- **First Site Selection Completed**……Oct 2019

Implementation Plan

Execute RFQ every 6 months

Qualified vendors submit applications

Limited number of sites selected Based on criteria each RFQ cycle