Attachment 1
Question 01-5.d-e:

**Response to Question 01-5.d-e:**

d. SCE projects that it will need to procure additional generation capacity to meet some portions of projected increases in EV load by 2030.

e. SCE is required to meet the 50% Renewables Portfolio Standard by 2030, when it projects that it will need to procure additional generation capacity to meet some portions of projected increases in EV load.
Attachment 2
Identify all policy goals underlying Transportation Electrification (TE) considered by PG&E in developing its Priority Review and Standard Review programs.

a. Are California climate goals limited to the reduction of GHG emissions?

b. Do California climate goals include reduction in NOx levels?

c. Identify other vehicle fuel technologies available to serve the California goals of GHG and NOx reductions.

d. Is it possible that increased EV load will require the Utility to procure additional generation capacity?

e. Will all additional generation capacity procured to serve the increased load be emissions free?

Answer Q007

a. PG&E considers climate goals as being related to GHG emissions as noted in Pub. Util. Code §740.12(b), “reduce emissions of greenhouse gases to 40 percent below 1990 levels by 2030 and to 80 percent below 1990 levels by 2030 and to 80 percent below 1990 levels by 2050.” Assembly Bill 32, the California Global Warming Solutions Act of 2006, defines greenhouse gases as carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride (§38505(g)).
b. PG&E considers climate goals as being related to GHG emissions rather than NOx emissions. NOx is not considered a GHG.

c. This question is outside of the scope of this proceeding, pursuant to SB 350, which only focuses on transportation electrification (See Section 3.4.1 of Assigned Commissioner’s Ruling Regarding The Filing of Applications Pursuant to Senate Bill 350)

d. It is possible, however this question is outside of the scope of this proceeding, pursuant to SB 350, which only focuses on transportation electrification (See Section 3.4.1 of Assigned Commissioner’s Ruling Regarding The Filing of Applications Pursuant to Senate Bill 350). This question is more appropriately addressed within the SB 350 IRP proceeding, where all resources – supply and demand side – are evaluated against a common set of requirements and policy goals.

e. See response to Question D. The IRP proceeding is the appropriate venue to address this question.
Commercial Electric Vehicle Working Group (CEVWG)

Objectives
» Understand MHDV electrification costs, impacts, and barriers
» Identify win-win paths for fleets, tech providers, and utilities

Key Topics
» Infrastructure: Public investment in power supply and EVSE
» Rates: Demand charges and energy prices
» Innovative Approaches: Storage, DG, DR, and control strategies

Participants

1 For background, see: CALSTART (2015). “Electric Truck, Bus Grid Integration: Opportunities, Challenges, and Recommendations”
CEVWG Participants

Valley Transportation Authority
500 buses in Santa Clara County (PG&E)
• 5-10 MHD EVs planned for 2018

Monterey-Salinas Transit (MST)
123 buses in Monterey/Salinas (PG&E)
• 1 MHD EV (trolley)

Santa Barbara MTD
107 buses in Santa Barbara (SCE)
• 14 MHD EVs (trolley)

Foothill Transit
332 buses in SG Valley and downtown LA (SCE)
• 17 MHD EVs

San Diego Airport Parking Company
Urban and long-range shuttle fleet

Frito Lay
Torrance, City of Industry, Sylmar, Manteca, Alameda, San Jose, Brisbane, Fairfield (PG&E & SCE)
• ~100 MHD EVs

UPS
Sacramento, Bakersfield, Ceres, and Fresno (PG&E & SCE)
• ~100 MHD EVs
Background

The business case for Medium and Heavy Duty (MHD) EVs depends on charging rates and infrastructure availability

» Commercial fleet operators face major demand charge and capital investment hurdles

Source: CALSTART. Based on analysis in CALSTART (2015). Electric Truck & Bus Grid Integration: Opportunities, Challenges & Recommendations. Here the diesel price is updated to $2.50/gallon (versus $4.50) and the federal subsidy of $1.00/DGE for CNG price is incorporated.

Survey Overview

1. Scope of survey is MHD electrification plans in California over the next 5 years (see categories above)
2. Participants include seven fleets: Four transit agencies, two goods movement fleets with last mile delivery, and one private shuttle bus company
3. Participants are fleets that are actively pursuing MHDV electrification expansion in California
Survey Findings

Charging Infrastructure

<table>
<thead>
<tr>
<th>Areas of Agreement</th>
<th>“Asks” for Utilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Lack of “power to the building” is a key barrier (5/7 respondents)</td>
<td>1. Reduce charging infrastructure installation costs and streamline deployment</td>
</tr>
<tr>
<td>• Cost of infrastructure varies from $3k to $450k+ based on charging speed, location within site, and local available grid capacity</td>
<td>2. Have a “build it and they will come” approach for beachhead technologies through early adoption</td>
</tr>
<tr>
<td>• The process of evaluating and managing new infrastructure construction is time-consuming</td>
<td></td>
</tr>
</tbody>
</table>

Bottom line:
Ratepayer-funded programs are needed to promote timely MHD electrification, with focus on streamlining power supply upgrades in varied settings.

Copyright 2016 CALSTART
Survey Findings

Stationary Energy Storage

Areas of Agreement
• Commercial storage offerings exist to help with peak demand shaving
• However, most fleets have little practical experience with storage
• Current EV deployment levels remain relatively low
• Peak demand shaving services are not standardized

“Asks” for Utilities
• Pilots for storage combined with onsite DG, software, and novel rate structure—with partial goal of creating better case study data
• Programs to standardize second-life batteries (creating open-source solutions)

Bottom line
Charging times could be managed more effectively. However, EV deployment levels remain relatively low, so there is little experience with peak shaving strategies generally and for large charging loads specifically.
## Survey Findings

### Rate Structures

<table>
<thead>
<tr>
<th>Areas of Agreement</th>
<th>“Asks for Utilities”</th>
</tr>
</thead>
<tbody>
<tr>
<td>• All fleets (7 of 7) perceived demand charges as a barrier to significantly increasing MHD electric vehicle adoption</td>
<td>• TOU or Real-Time pricing that encourages energy storage and DG</td>
</tr>
<tr>
<td>• Unlike with ICE fuels, electricity is not the expertise or responsibility of fleets (and ICE fuels are simpler to manage anyway)</td>
<td>• Removal of off-peak demand rates (e.g. 7 or 8 pm to 1 am)</td>
</tr>
</tbody>
</table>

**Bottom line**

Fleets desire rate structures that minimize the risk of high demand charges. However, needs vary by fleet type (see next slide), and a lack of quantifiable data on use cases for storage and peak shaving limit the specificity of recommendations.
# Survey Findings

## Select MHD EV Charging Typologies

<table>
<thead>
<tr>
<th>Ownership</th>
<th>Class</th>
<th>Available Charging Times</th>
<th>Target Charging Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td>People Movement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Urban Transit (e.g. Foothill)</td>
<td>Public</td>
<td>M&amp;H</td>
<td>Long (evening to morning)</td>
</tr>
<tr>
<td>2. Urban + Rural Transit (e.g. MST)</td>
<td>Public</td>
<td>M&amp;H</td>
<td>Long (evening to morning)</td>
</tr>
<tr>
<td>3. Shuttle (e.g. SD Airport Parking)</td>
<td>Private</td>
<td>M</td>
<td>Short, unpredictable; high utilization around the clock</td>
</tr>
<tr>
<td>Goods Movement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Last mile (e.g. Frito Lay)</td>
<td>Private</td>
<td>M</td>
<td>Long (evening to morning)</td>
</tr>
<tr>
<td>5. Multi-Source (e.g. Ikea)</td>
<td>Private</td>
<td>H</td>
<td>Long (evening to morning)</td>
</tr>
<tr>
<td>6. Yard (e.g. Port of LA, SFO)</td>
<td>Private</td>
<td>M&amp;H</td>
<td>Short, because of high utilization</td>
</tr>
<tr>
<td>7. Local Highway (e.g. 1-710 drayage)</td>
<td>Private</td>
<td>H</td>
<td>Long (evening to morning)</td>
</tr>
</tbody>
</table>
Survey Findings

Miscellaneous Survey Comments

1. We don’t want to be the guinea pig with new technologies (without appropriate reward/return)
2. Electrification is complicated by general fleet needs changing—e.g. replacing Class 6 vehicles with combo of larger and smaller sizes
3. EV manufacturing is immature. Would like to find a solid partner to try up to 10 vehicles and grow to 25 – 50 pilot units for a trial, but there is a shortage of full service OEMs that don’t live off of grants
4. LCFS helps, but currently is not dependable, and therefore not a good revenue source. Also, with LCFS, we lose ownership of credit for reporting
5. Charging speeds are limited to charging speed capacity of vehicle
6. We would like utilities to be more active partners with the fleets beyond just filing with CPUC and making fleets operate within their parameters
7. Public transit agencies should perhaps get special rates
Findings

High-Level Conclusions

1. The six fleets in the survey have dived into pilots and are optimistic about the potential to scale up.
2. However, they indicate that infrastructure and rate structures stand in the way.
3. Charging needs and barriers vary based on duty cycles (see “typologies” diagram) as well as individual site circumstances.
4. In order to invest in higher penetration levels, fleets need to anticipate charging solutions to accommodate future EV volumes that are larger than what they have empirical use cases for now.
5. Fundamentally, the needs are about financing, and who pays and who carries the risk.
6. Individual fleets need to go through their own piloting before they can scale up, so “accelerating” TE for fleets beyond the seven here will require working with fleets that are less actively involved.
## Lessons Learned

<table>
<thead>
<tr>
<th>What We Have Heard</th>
<th>Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Infra-structure</strong></td>
<td>Public investment and utility-supported programs to install sufficient power supply are needed to promote timely MHD electrification in accordance with California’s climate goals.</td>
</tr>
<tr>
<td>In order for fleets to electrify MHD vehicles, they <strong>require significant new power supply upgrades</strong> that can cost tens or even hundreds of thousands of dollars, which most fleets are not equipped to finance.</td>
<td></td>
</tr>
<tr>
<td><strong>Demand Charges (DC)</strong></td>
<td>In order for electrification to be cost-effective for fleets, DCs need to give fleets some combination of a lower ceiling on DCs, turnkey solutions to manage DCs, and/or bigger carrots for smoothing loads and moving off peak.</td>
</tr>
<tr>
<td>Despite the high efficiency of EVs compared to ICEVs, <strong>demand charges (DC) increase fleet electricity costs</strong> by multiple factors; can cause fleets to jump tiers; and bring new complexity, risk, and changes to operations.</td>
<td></td>
</tr>
<tr>
<td><strong>Energy Storage</strong></td>
<td>Active control strategies are typically cost-effective for peak shaving compared to storage, but <strong>opportunities may be limited</strong>; also, and more case study data is needed for using storage with higher-penetration fleets.</td>
</tr>
<tr>
<td>Commercial storage offerings exist to help shave peak demand, but fleet electrification <strong>services are not standardized and have not yet been tested</strong> in the high penetration cases that are called for by SB 350.</td>
<td></td>
</tr>
</tbody>
</table>

1 CALSTART synthesis of survey and discussions with CEVWG members. Does not represent endorsements.
## Potential Solutions

### Electric Utility Regulation

**CPUC & CEC**
- Allow **comprehensive rate-basing** (public investment) for MHD electrification up to the meter
- Provide **additional rebates/ incentives for EVSE** behind the meter
- Eliminate or minimize **demand charges outside of peak hours** (~4-9 pm)—or provide a comparable benefit
- Provide **rate incentives that are responsive** to specific MHD duty cycles

### Vehicle/Fuel Regulation & Incentives

**ARB & CEC**
- In addition to addressing charging issues, continue to provide **incentives that decrease the first cost of vehicle purchases**
- Continue and expand **incentive funding for the “beachhead” MHD EV sectors**, namely, transit, shuttle, last-mile, MSF, and yard
- Continue, increase, and stabilize support for **incentives like LCFS that defray operating costs** (distinct from capital costs), which is especially important for transit agencies

### All Agencies

- Support **incentive funding for novel demand management and grid-integration** pilots, e.g. with storage and DG for peak shaving
- Support additional power upgrade needs with **private and public finance according to best-fit time horizons and risk profiles**
- Consider establishment of a **private/public “green bank” that lends upfront infrastructure costs** which are paid back over time in line with the recurring operational cost reductions

---

1 Suggestions for discussion based on CALSTART survey and dialogue with CEVWG members. Does not represent endorsement by members.
Issues for Further Consideration

1. The Rate Design principle of “efficiency” promotes energy conservation. However, the use of electricity for vehicles, as opposed to electricity for stationary power, should be encouraged (and treated separately), not discouraged.

2. The Rate Design principle of “fairness” is often interpreted to mean that costs should be allocated based on cost causation, and hence utilities seek to avoid shifting costs from one customer to another, which appears to constrain options for reducing demand charges.

3. SB 350 and SB 32 call for a migration of MHDVs to electrification at an extremely rapid pace in the context of CPUC rulemaking. Success with MHD EV regulations will depend on the timely rollout of major new programs.

---

1 Suggestions for discussion based on CALSTART survey and dialogue with CEVWG members. Does not represent endorsements by members.
Contact

Ryan Schuchard, Policy Director
CALSTART
rschuchard@calstart.org
+1 626-744-5606
Attachment 4
Please specify the carbon intensity (MT/MWh) and average NOx emissions of PG&E’s system generation in 2016 for the following periods:

Please reference the Question to view the table

Answer Q008

PG&E does not have average carbon intensity (MT/MWh) emissions of PG&E’s system generation available. The following table represents the marginal GHG emission rate in metric tons per MWh(t/MWh) by season, time period and year for the period April 27, 2010 through April 3, 2017 for the entire California ISO footprint. The data is the table below are from the Marginal Generation Cost/CAISO energy price model developed for PG&E’s 2017 GRC Phase II application, updated with data through April 3, 2017.

<table>
<thead>
<tr>
<th>Year</th>
<th>Season</th>
<th>12a-4p</th>
<th>4p-9p</th>
<th>9p-12a</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>Winter</td>
<td>0.338</td>
<td>0.435</td>
<td>0.373</td>
</tr>
<tr>
<td>2010</td>
<td>Summer</td>
<td>0.321</td>
<td>0.472</td>
<td>0.367</td>
</tr>
<tr>
<td>2011</td>
<td>Winter</td>
<td>0.285</td>
<td>0.414</td>
<td>0.328</td>
</tr>
<tr>
<td>2011</td>
<td>Summer</td>
<td>0.284</td>
<td>0.459</td>
<td>0.320</td>
</tr>
<tr>
<td>Year</td>
<td>Season</td>
<td>Value 1</td>
<td>Value 2</td>
<td>Value 3</td>
</tr>
<tr>
<td>------</td>
<td>----------</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>2012</td>
<td>Winter</td>
<td>0.345</td>
<td>0.461</td>
<td>0.373</td>
</tr>
<tr>
<td>2012</td>
<td>Summer</td>
<td>0.355</td>
<td>0.616</td>
<td>0.385</td>
</tr>
<tr>
<td>2013</td>
<td>Winter</td>
<td>0.365</td>
<td>0.465</td>
<td>0.400</td>
</tr>
<tr>
<td>2013</td>
<td>Summer</td>
<td>0.374</td>
<td>0.512</td>
<td>0.402</td>
</tr>
<tr>
<td>2014</td>
<td>Winter</td>
<td>0.354</td>
<td>0.496</td>
<td>0.409</td>
</tr>
<tr>
<td>2014</td>
<td>Summer</td>
<td>0.380</td>
<td>0.525</td>
<td>0.431</td>
</tr>
<tr>
<td>2015</td>
<td>Winter</td>
<td>0.337</td>
<td>0.493</td>
<td>0.402</td>
</tr>
<tr>
<td>2015</td>
<td>Summer</td>
<td>0.378</td>
<td>0.583</td>
<td>0.443</td>
</tr>
<tr>
<td>2016</td>
<td>Winter</td>
<td>0.277</td>
<td>0.464</td>
<td>0.361</td>
</tr>
<tr>
<td>2016</td>
<td>Summer</td>
<td>0.322</td>
<td>0.546</td>
<td>0.395</td>
</tr>
<tr>
<td>2017</td>
<td>Winter</td>
<td>0.216</td>
<td>0.435</td>
<td>0.321</td>
</tr>
</tbody>
</table>

PG&E does not have average NOx emissions of PG&E’s system generation available.