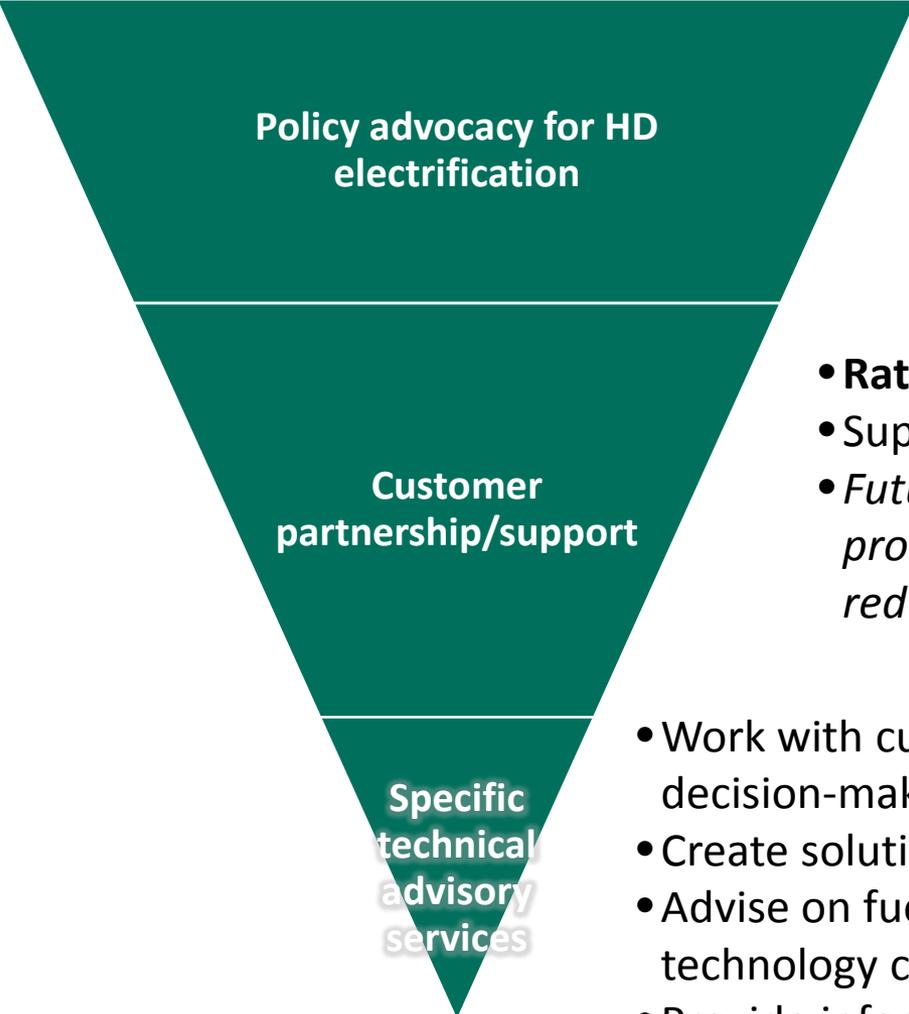




Session 3: Fuels for Advanced Technologies

February 8, 2016

SCE role in HD electrification goes beyond rate design



Policy advocacy for HD electrification

- Member of CalSTART and CaETC
- Active in legislative and regulatory venues to secure funding for TE (i.e., comments on CCI, Carl Moyer, tax credit for up to 14,000lb, support 2012 AQMP and RTP, LCFS)

Customer partnership/support

- **Rate analysis and rate design**
- Support letters for ARB RFPs
- *Future: SB 350 enables more active role in providing infrastructure to market to further reduce customer costs*

Specific technical advisory services

- Work with customers from early stage to help inform decision-making and increase transparency
- Create solutions to meet customer operations needs
- Advise on fuel and infrastructure costs for different technology choices
- Provide information on available rebates / incentives / grants

Ratemaking for HD electric transportation

- SCE remains technology and business model neutral
- PUC historically approves rates based on the principle of cost causation (costs to the system should be applied to the customers that create them)
 - Costs arise from the infrastructure needed to create and delivery energy when needed and the time-related energy cost itself
- Based on this rulemaking principle, customer usage demand (when, how much and how fast) will have the largest impact on total energy cost
 - For heavy-duty electric vehicles, technology capability and business model flexibility will have the most significant impact on fuel costs (i.e., in-route charging vs depot charging, fleet size, fast charging, tandem vs sequential charging, etc.)
- SCE is in the process of developing and proposing for CPUC adoption, a new Schedule TOU-EV-6 with transit customers explicitly in mind that will be structured to account for their unique load characteristics

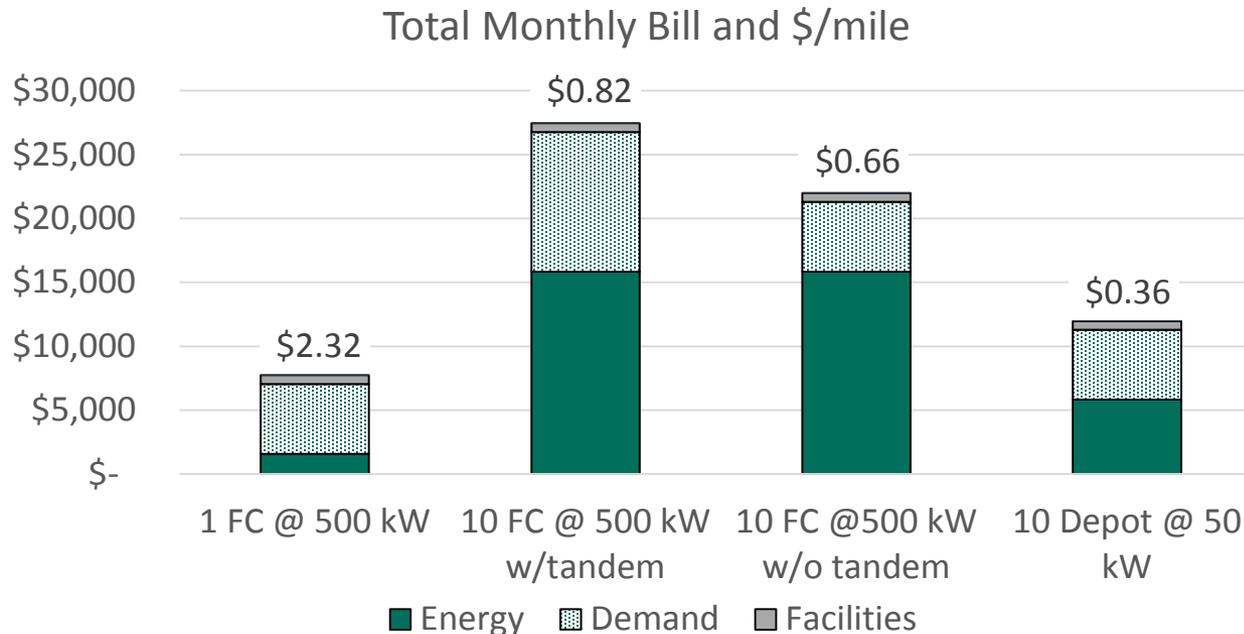
Rate Structure Components

Rate Structure Component	Typically Expressed in...	Rate Design Concepts
Energy Rate	¢/kWh	Designed to recover a portion of costs for delivery service and generation.
Customer Charge	\$/day or \$/month	Designed to recover all or a portion of marginal customer-related distribution costs, such as customer hookup facilities (cost of final line transformer, service drop) and revenue cycle services (metering, billing), which do not vary with energy usage.
Demand Charge (Facilities - FRD) (Time Related - TRD)	\$/kW FRD: Applied to the greatest amount of registered demand. TRD: Applied to the greatest amount of registered demand in the on-peak and mid-peak seasonal periods	FRD: Designed to recover costs for the installed transmission and distribution facilities (i.e., transformers, circuits, substations, etc.) required to serve the customer's highest demand. TRD: Designed to recover part of higher costs of providing Generation Capacity during the high-demand summer season
Time-of-Use (TOU)	\$/kWh (Energy Rate)	Rate charged for energy is variable throughout the day in accordance with demand. As a result, energy is cheapest at night (when there is low demand) and typically most expensive during the day (when there is high demand).

SCE's Current & Proposed EV Rates

Rate	Applicability
TOU-EV-1	<ul style="list-style-type: none"> • Applicable exclusively to the charging of electric vehicles on a separate meter • Provided for Single Family Dwellings concurrently served under a Domestic schedule
TOU-EV-3	<ul style="list-style-type: none"> • Applicable solely for the charging of electric vehicles on a premise or public right of way where a separate SCE meter to serve electric vehicle (EV) charging facilities is requested and the total charging demand is less than or equal to 20 kW • Most favorable charging during off-peak hours (11 p.m. – 8 a.m.) • This schedule includes demand charges (Option B) where the TOU-EV-3 account is only charged incremental FRD charges when the account registers a demand greater than the primary account
TOU-EV-4	<ul style="list-style-type: none"> • Applicable for businesses that own and operate electric vehicles with a maximum charging demand of 500 kW or less solely for the charging of electric vehicles, on a premise or public right of way where a separate SCE meter to serve electric vehicle (EV) charging facilities is requested • Most favorable charging during off-peak hours (11 p.m. – 8 a.m.) • This schedule includes demand charges where the TOU-EV-4 account is only charged incremental FRD charges when the account registers a demand greater than the primary account
TOU-EV-6 <i>(Expected to be filed in Q1 2016 for Commission approval)</i>	<ul style="list-style-type: none"> • Proposed to be applicable to businesses that own and operate electric vehicles with a maximum charging demand of more than 500 kW solely for the charging of electric vehicles on a premises or public right of way where a separate SCE meter to serve electric vehicle (EV) charging facilities is requested • <i>Subject to Commission approval</i>, TOU periods will be updated to reflect the "Duck" curve and reduced FRD charges based on contribution to cost of service • Most favorable charging would be during the super off-peak hours (proposed to be 10 p.m. – 8 a.m.) • On-peak period is expected to be 2 p.m. – 8 p.m. • This schedule, if adopted, would include demand charges where the TOU-EV-6 account would be charged incremental FRD charges only when the account registers a demand greater than the primary account

Fleet size and charging style impact on cost



Illustrative

Fleet size and charging speed are the largest factors impacting \$/mile fuel cost

- As more buses are added there are more kWhs to spread the fixed and demand charges across
- Larger batteries have more flexibility to take advantage of TOU rates
- Tandem charging incidents greatly increases demand costs

Assumptions: 17 hours per day (5am-10pm), 100,000 kWh per year, draft Schedule EV-6 approved, 4 minutes per charge @ 500 kW nine times per day, \$11/kWh demand charge

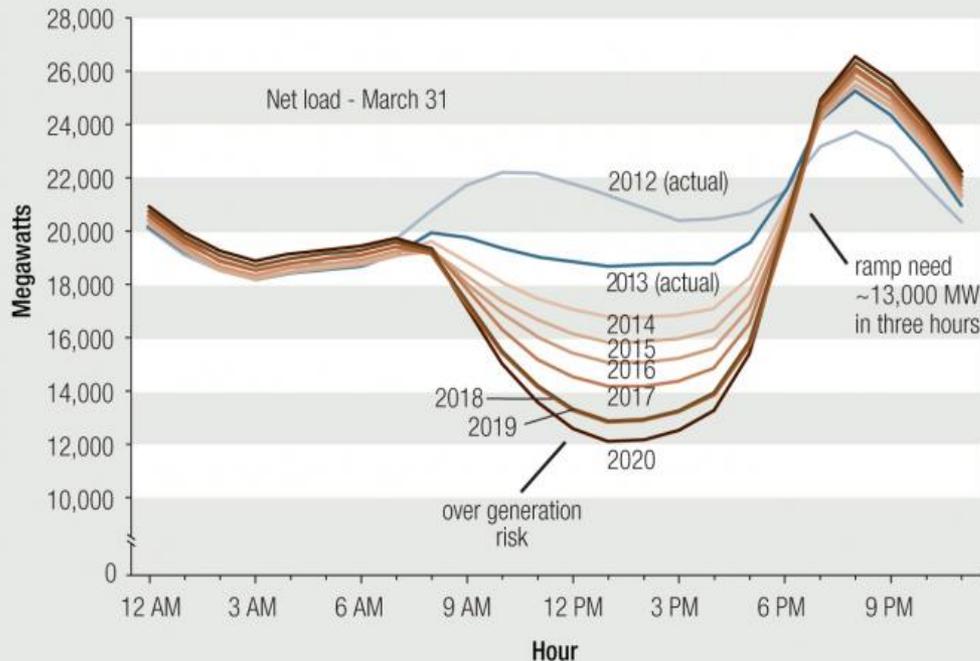
Future solutions to high fuel costs

- Heavy-duty electric vehicles should be assessed on their full lifecycle costs
- SCE is actively working on lowering fueling costs for these beneficial vehicles
- SCE is striving to make sure that these type of zero-emissions vehicles come to fruition
- Several tools in the future may be useful in lowering life-cycle costs
 - Customer shifting technology and/or operations
 - On-site generation (solar) and/or storage,
 - Vehicle range extenders (bigger batteries or IC engines),
 - Low Carbon Fuel Standard (LCFS) credits
 - Advisory services to help find grants,
 - Utility owned charging and propulsion infrastructure (SB 350)

Impact of Renewables Portfolio Standard

Fig. 1 CALIFORNIA'S DUCK CURVE

Trends in resource development are leading toward a growing need for flexible generating capacity starting in 2015.



Source: Net load curves for March 31, from 2012 to 2020, based on analysis by CAISO.

Rate Structure Component	Impact
Time-of-Use Periods	<ul style="list-style-type: none"> In general, the highest cost period is expected to shift to later in the day, with low cost periods during the day time in the Spring months
Demand Charge	<ul style="list-style-type: none"> Peak generation capacity charges expected to shift later in the day Flexible capacity charge may be reflected during the ramp Distribution demand charges may reflect some time dependency
Energy Rates	<ul style="list-style-type: none"> Highest prices expected to shift later in the day Potential "Matinee" pricing during the middle of the day in Spring months Continued low pricing in super off-peak hours