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Electric Transportation and Rate Designs at SCE

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Electric Rate Design

- Electric rates include:
  - Volumetric energy charges (cents per kWh, varying by time of use)
  - Demand charges ($ per kW, some varying by time of use, some based on highest demand regardless of time, based on highest 15-minute usage during a billing period)
  - Fixed customer charges ($ per month)
  - Power factor adjustments

- Electric rate schedules are differentiated by maximum demand in a month and by service voltage

- Electric rates are set by the CPUC for investor-owned utilities and by city councils or other public entities for publicly-owned utilities
  - CPUC-authorized rates are supposed to be set based on cost of service with costs allocated among different sets of customers based on marginal costs
  - POUs may use embedded costs

Impact of TOU Pricing & Demand Charges

- SCE's commercial & industrial customers are served on rates with Time-of-Use (TOU) pricing[1/] with volumetric energy charges and demand charges[2/]

- The most important element in determining the cost of electricity for electric vehicle charging is the charging load pattern, which determines TOU energy and demand charges

- SCE is proposing to change its TOU periods substantially by 2019, as proposed in its 2016 Rate Design Window (RDW) Application
  - This change is a result of the changing net load curve, sometimes called the duck curve, where load net of wind and solar drops during the day and peaks in the late afternoon/early evening, in contrast to current TOU periods where the peak is during summer afternoons

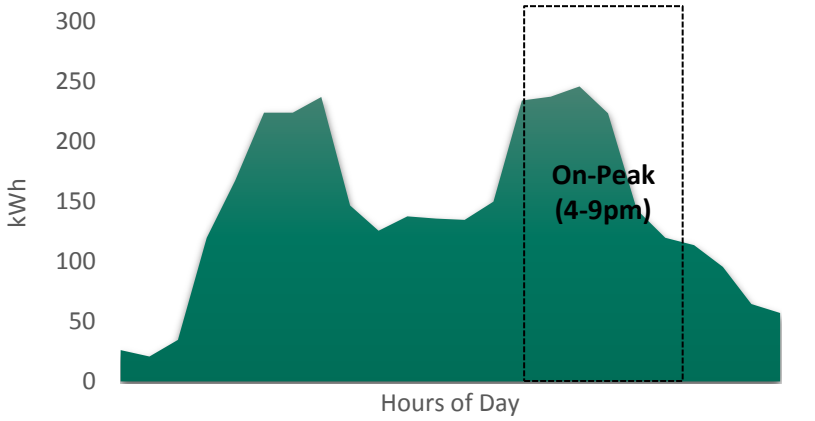
- Due to the unique nature of commercial EV charging load, SCE offers several EV pricing options for commercial & industrial customers

1/ Energy is cheapest at night (when there is low demand) and *typically* most expensive during the day (when there is high demand). Definition is subject to change, pending the California Public Utilities Commission's (CPUC) approval in SCE's 2016 RDW Application (A.16-09-003).
2/ Recovers utilities' fixed costs associated with generation and, in the future, some grid infrastructure required during peak hours.

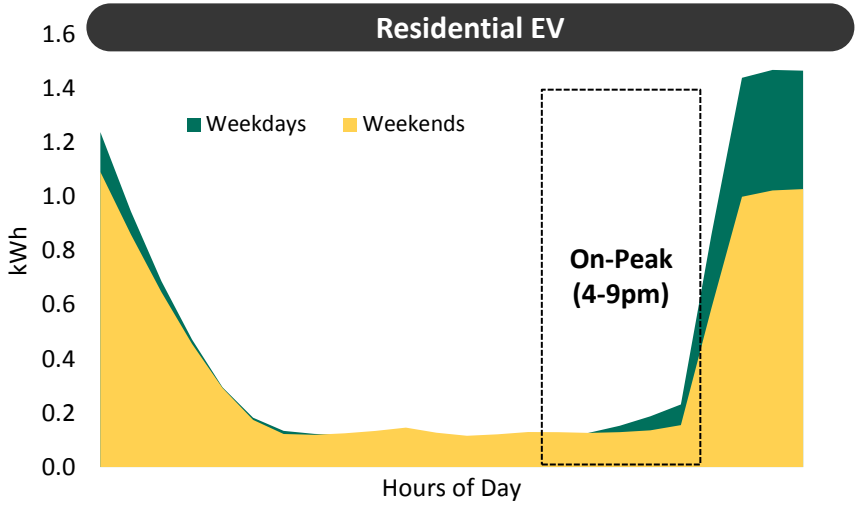
Different Charging Load Patterns

- Illustrative

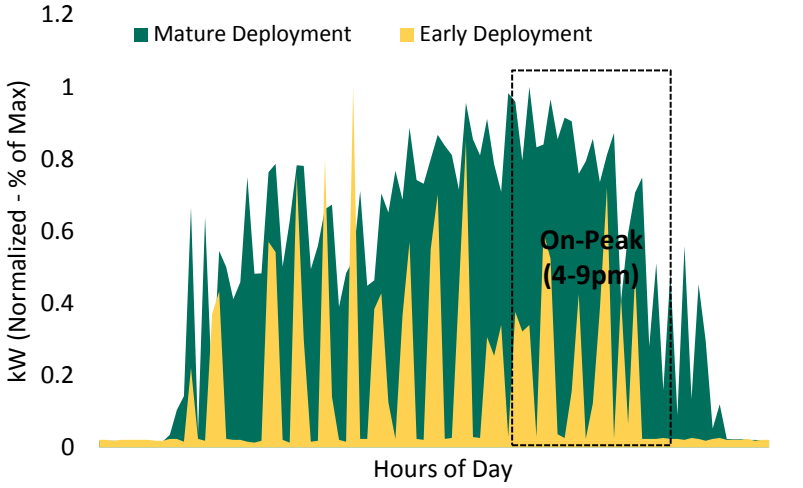
Rail



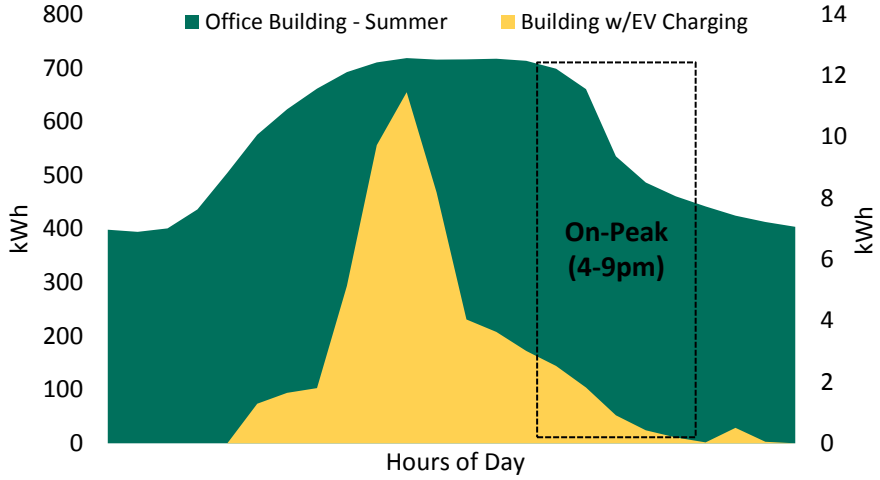
Residential EV



Mass Transit



Workplace Charging



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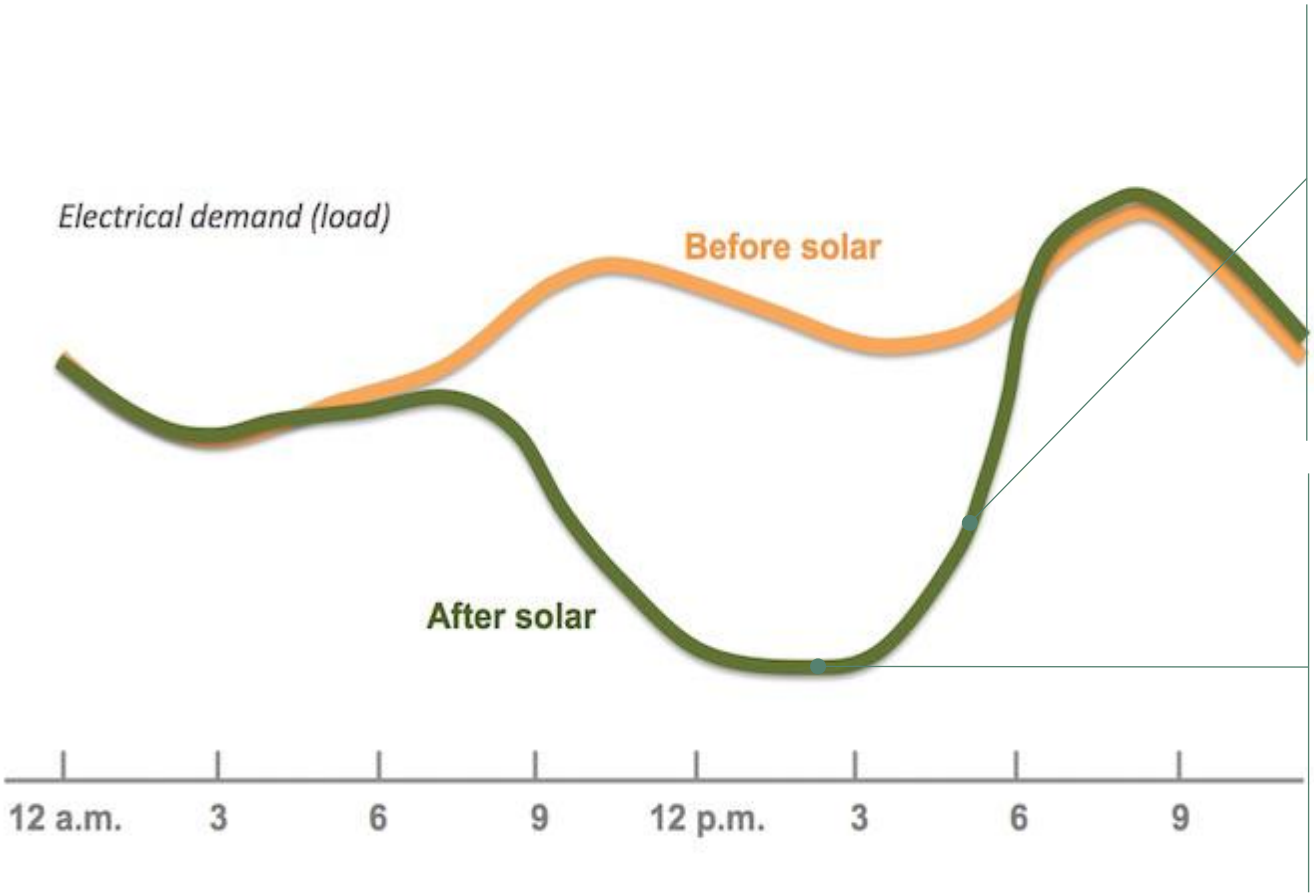
The "Duck Curve"



Duck's Neck

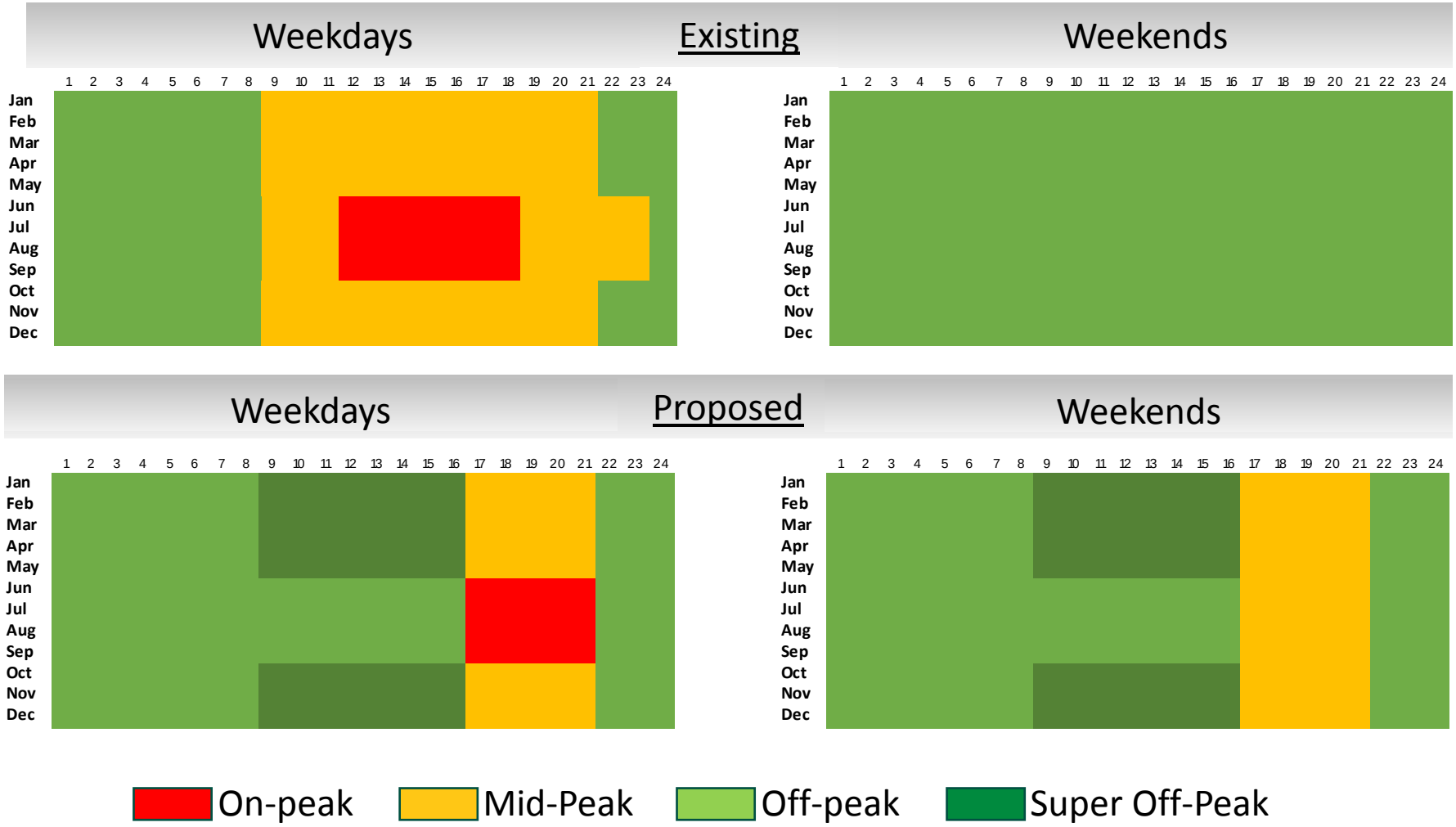
- In the late afternoon / early evening hours, the net load curves quickly *ramps* up to produce an "arch" similar to the neck of a duck
- Ramp (aka flexible generation capacity) is attributed to demand peaks when the sun goes down and solar generation tapers off
- As more renewable resources come online, the ramp gets steeper

Duck's Belly

- In Spring, the net load curves produce a "belly" appearance in the mid-afternoon
- Due to low demand and the influx of renewables, oversupply results which can lead to overgeneration
- During oversupply times, wholesale energy prices can be very low and even go negative

Consistent with Grid Conditions

- SCE's Pending Time-of-Use (TOU) Period Proposal *



* On May 22, CPUC issued a Proposed Decision which adopted SCE's new TOU periods in its entirety

Electric Bus Charging Pilot

Background

- In 2012, CPUC ordered SCE to launch a special pilot rate for government transit agencies for the purpose of charging zero emission electric buses.
- The pilot rate offered an energy-only rate (with no demand charges) for a period of three years.
- CPUC determined that temporarily eliminating demand charges for a defined period balanced the goal of encouraging electric bus adoption while not unduly providing an advantage to any particular electric transit battery technology or energy storage strategy.

Lessons Learned

- During the pilot, SCE worked with the customer to refine their operations (*e.g.,* test different charging load patterns), expand fleets, and adopt new technologies and demand management strategies in order to minimize their demand charges.
- SCE also leveraged lessons learned from this pilot to design new EV rates for its Electric Transportation (TE) Application (A.17-01-021).

Commercial EV Rates to Support Transportation Electrification

	Rate Schedule	Maximum Demand (Voltage Level)	TOU Periods (Summer: Jun – Sept; Winter: Oct – May)	Demand Charge Features	TOU Periods Reflect RPS Duck Curve
CURRENT	**TOU-EV-3**	≤ 20 kW	<u>On-Peak</u> 12noon – 6pm weekdays except holidays <u>Mid-Peak</u> 8am – 12noon; 6pm – 11pm weekdays except holidays <u>Off-Peak</u> 11pm – 8am	Waives demand charges for EV charging *if* the EV demand does not exceed the demand of the associated facility.	
	TOU-EV-4	21 -500 kW			
	TOU-EV-6	> 500 kW (Secondary, Primary, Subtransmission)	<u>On-Peak</u> 2pm – 8pm <u>Super Off-Peak</u> 10pm – 8am <u>Off-Peak</u> All other hours		
PROPOSED *	**TOU-EV-7**	≤ 20 kW	<u>On-Peak</u> 4pm – 9pm weekdays <u>Mid-Peak</u> 4pm – 9pm summer weekends 4pm – 9pm winter all days <u>Off-Peak</u> All except 4pm – 9pm summer all days 9pm-8am winter all days <u>Super Off-Peak</u> 8am-4pm winter all days	**Yr1 – Yr5**: Energy only; No Demand Charges **Yr6 – Yr10:** Phase-in Demand Charges **Yr11+:** Return to Energy and Demand Charges **	
	TOU-EV-8	21 -500 kW			
	TOU-EV-9	> 500 kW (Secondary, Primary, Subtransmission)			

* As proposed in SCE's Electric Transportation (TE) Application (A.17-01-021) for implementation in early 201

** The distribution grid component after the 10-yr period will reflect only 60% (rather than 100%) of distribution costs, with the balance of distribution costs recovered through energy charges.

Residential EV Rates to Support Transportation Electrification

	Rate Schedule	Target Customer	TOU Periods (Summer: Jun – Sept; Winter: Oct – May)	TOU Periods Reflect RPS Duck Curve
CURRENT	**TOU-EV-1**	Electric vehicle owners with a separate meter	On-Peak 12noon – 9pm all year, every day Off-Peak All other hours - all year, everyday	
CURRENT	**TOU-D-B**	High energy users (more than 700 kWh/month) Features lower peak rates, but a higher daily basic charge and no baseline credit.	On-Peak 2pm – 8pm weekdays except holidays Super Off-Peak 10pm – 8am Off-Peak All other hours	
PROPOSED *	**TOU-D-C**	"Whole-House" rate designed for high energy users + EV charging Features favorable day- and night-time pricing for EV charging	On-Peak 4pm – 9pm weekdays Mid-Peak 4pm – 9pm summer weekends 4pm – 9pm winter all days Off-Peak All except 4pm – 9pm summer all days 9pm-8am winter all days Super Off-Peak 8am-4pm winter all days	

* As proposed in SCE's 2018 General Rate Case Phase 2 Application (A.17-06-030) for implementation in early 2019

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Appendix

Consistent with Grid Conditions

- SCE's Pending Time-of-Use (TOU) Period Proposal *

	Season *	Existing	Proposed
On-Peak	Summer	Weekdays: 12:00 p.m. - 6:00 p.m.	Weekdays: 4:00 p.m. - 9:00 p.m.
Mid-Peak	Summer	Weekdays: 8:00 a.m. - 12:00 p.m.; 6:00 p.m. - 11:00 p.m.	Weekends: 4:00 p.m. - 9:00 p.m.
	Winter	Weekdays: 8:00 a.m. – 9:00 p.m.	Weekdays and Weekends: 4:00 p.m. - 9:00 p.m.
Off-Peak	Summer	Weekdays: 11:00 p.m. – 8:00 a.m. Weekends: All hours	Weekdays and Weekends: All hours except 4:00 p.m. – 9:00 p.m.
	Winter	Weekdays: 9:00 p.m. - 8:00 a.m. Weekends: All hours	Weekdays and Weekends: 9:00 p.m. - 8:00 a.m.
Super Off-Peak	Winter	N/A	Weekdays and Weekends: 8:00 a.m. – 4:00 p.m.

Summer: June – September; Winter: October – May

- Peak periods shifted to later in the day.
- Establishes new flexible generation capacity cost component (aka "ramping", all days).
- Introduces a "peak" time varying component in distribution rates.
- Super off-peak energy prices occur in the middle of winter weekdays/weekends.

* On May 22, CPUC issued a Proposed Decision which adopted SCE's new TOU periods in its entirety