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PEV Adoption Rates and Anticipated Grid Impacts

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California Public Utilities Commission

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CPUC Actions to Date

- Phase 1: EV charging services provider *not* a public utility but generally a retail customer – rates subject to PUC, not FERC
- PUC retains broad rate-setting authority to avoid adverse grid impacts and to attain GHG and RPS goals
- Phase 2: PEV Rates and Cost Allocation, Metering, Programs

Phase 2 Decision of President Peevey:
7 Actions for the nascent market until 2013

1	Endorses customer choice for existing TOU rates and metering
2	Treats Res. Distribution upgrades as shared costs, like most other load
3	Affirms most Commercial and Industrial rates for non-res charging
4	Treats service providers as traditional customers
5	Starts process to bill customer-owned meters
6	Directs utilities to file a jointly-filed notification assessment report
7	Limits utility ownership of charging equipment

Load Research

We will target early 2013 to revisit PEV rates:

1. IOUs directed to undertake load research studies
2. Coulomb and Ecotality PEV charging studies will also help us understand installation costs associated with electric vehicle service equipment
3. SB695 restrictions placed on residential rates will have expired, giving us more latitude in authorizing potential rate options

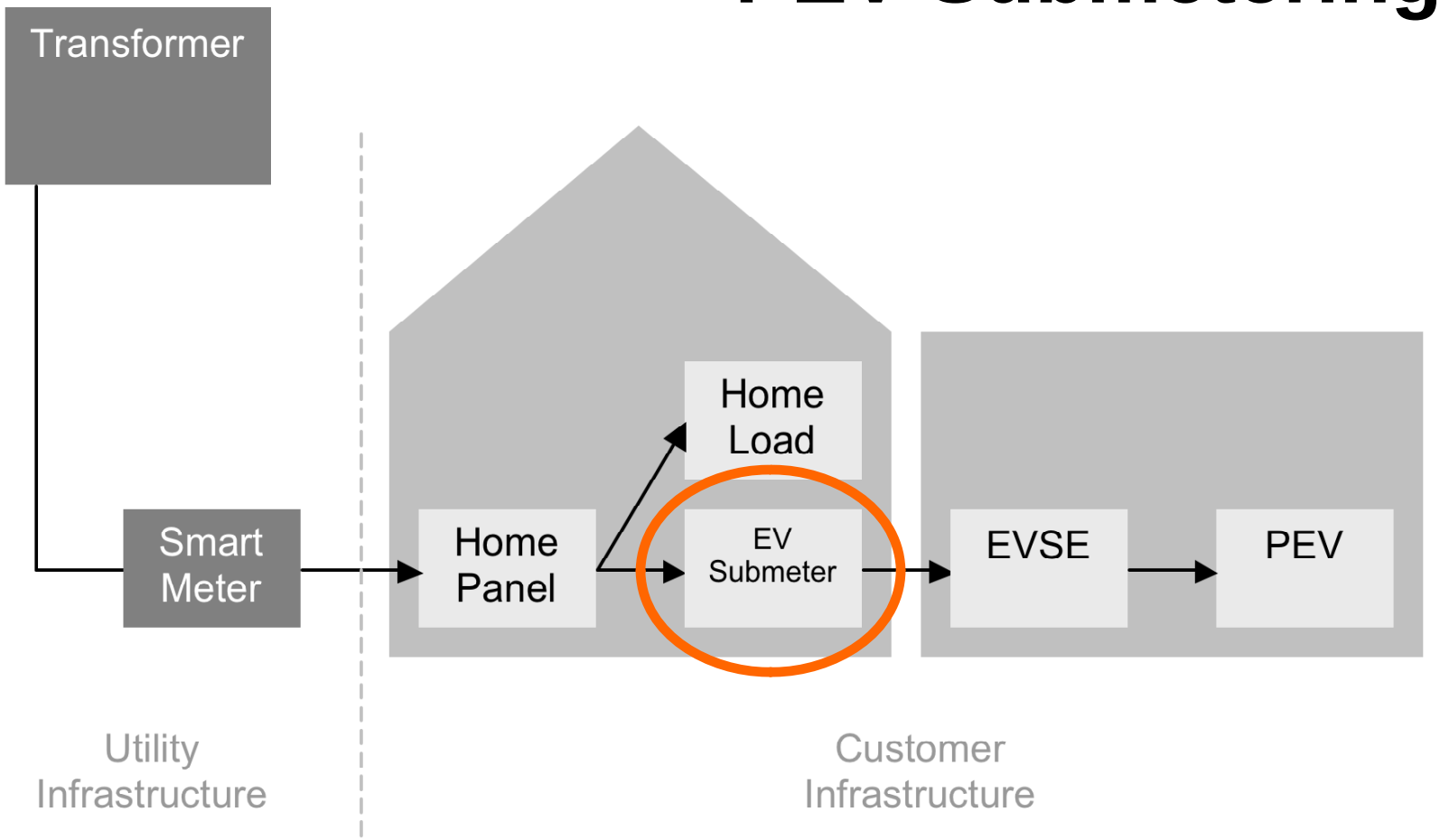
Known Unknowns

- Nature and Extent of Impacts:
  - Types of Costs/Benefits, generated by PEV adoption, on different aspects of the electricity system, are an area which requires further study
  - Cost implications of off-peak versus on-peak charging scenarios are vastly different, and depend on the existing customer service amperage.
    - Distribution upgrade costs to accommodate charging for residential circuits may be as much as five to twenty times greater on-peak as compared to off-peak

Utility Notification

- Within 150 days of the Decision becoming final, utilities must submit a report to the Commission on its progress in getting notification when someone purchases an EV.
- Possible data sources: OEMs, dealers, DMV, installers, local government

PEV Submetering



Utility rules already accommodate single and separate metering for PEVs, not submetering.

Stakeholders must develop submetering rules for:

- **-subtractive billing**
- **-multiple submeters**
- **-data requirements.**
- **-billing disputes**
- **-certification/calibration**

What if charging is at peak? Distribution impacts are time, location dependent

PEV Charging Creates A Significant Increase In Load

Customers will prefer a 240V charge to shorten recharge times → PEV charging is a large load for PG&E customers, comparable to average peak summer load of a single home

Source: http://www.nissanusa.com/leaf-electric-car/#/charging, August 14, 2009

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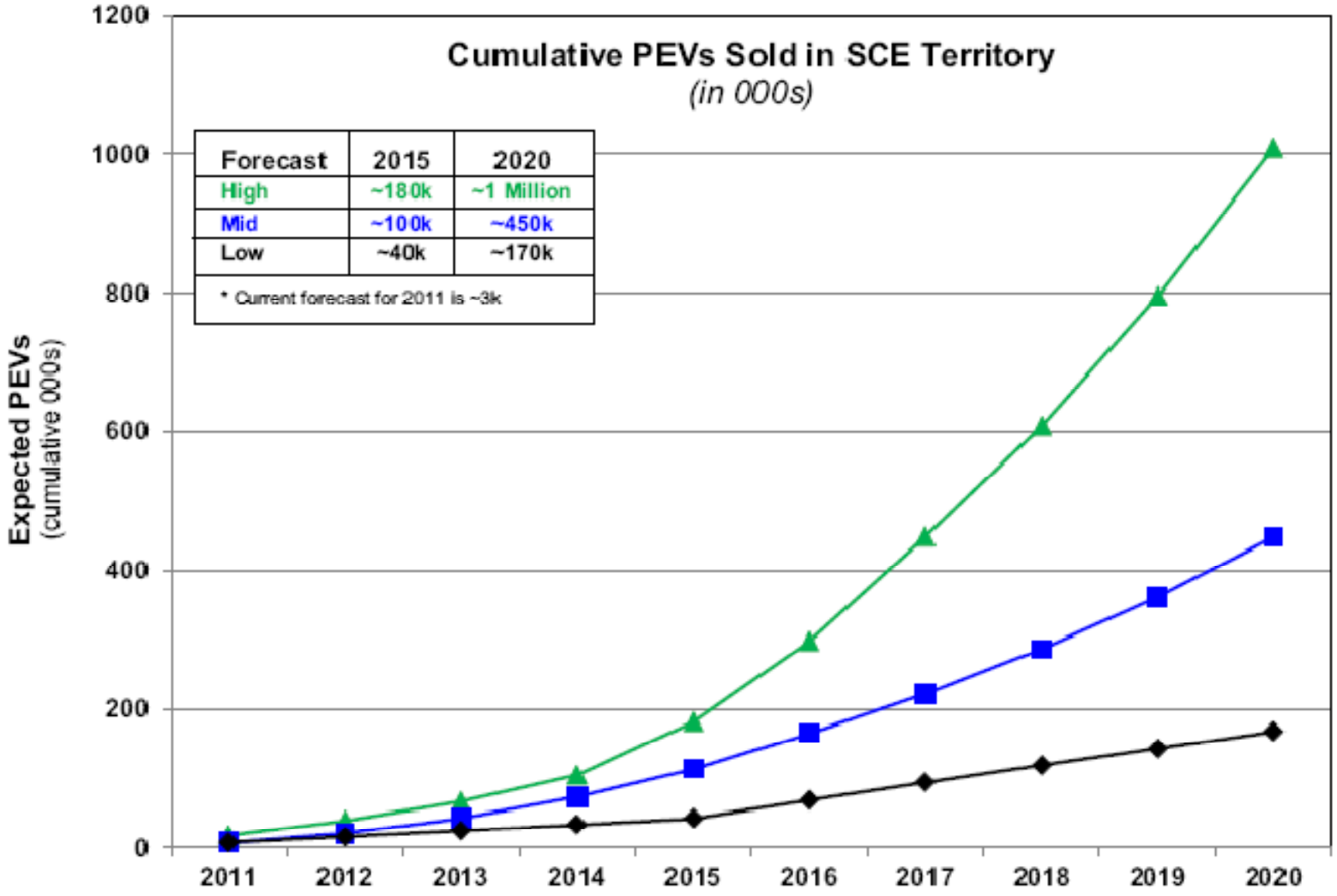
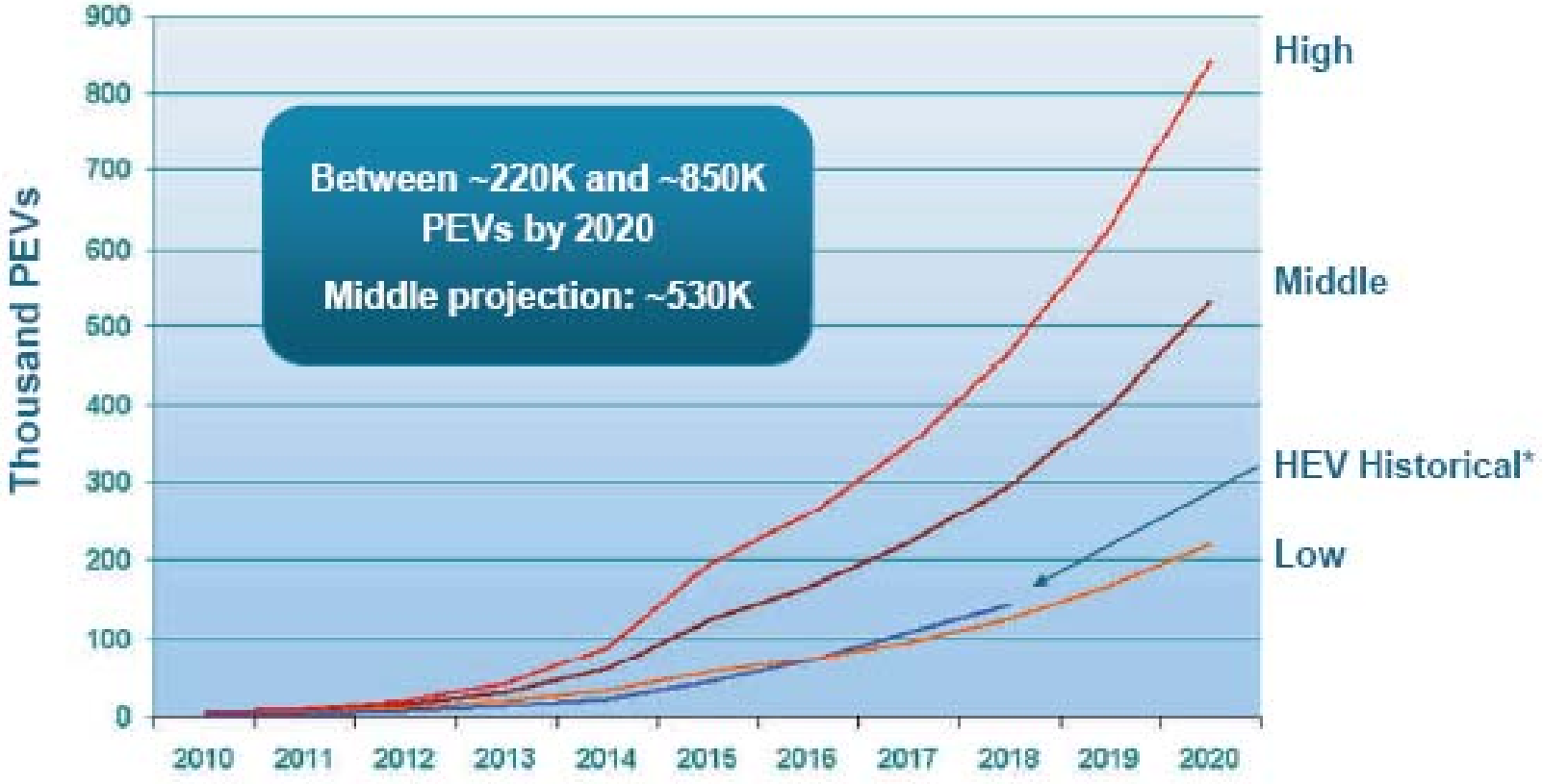
SCE PEV Adoption Estimates

Figure 6 – Forecast of PEVs in SCE's Service Territory



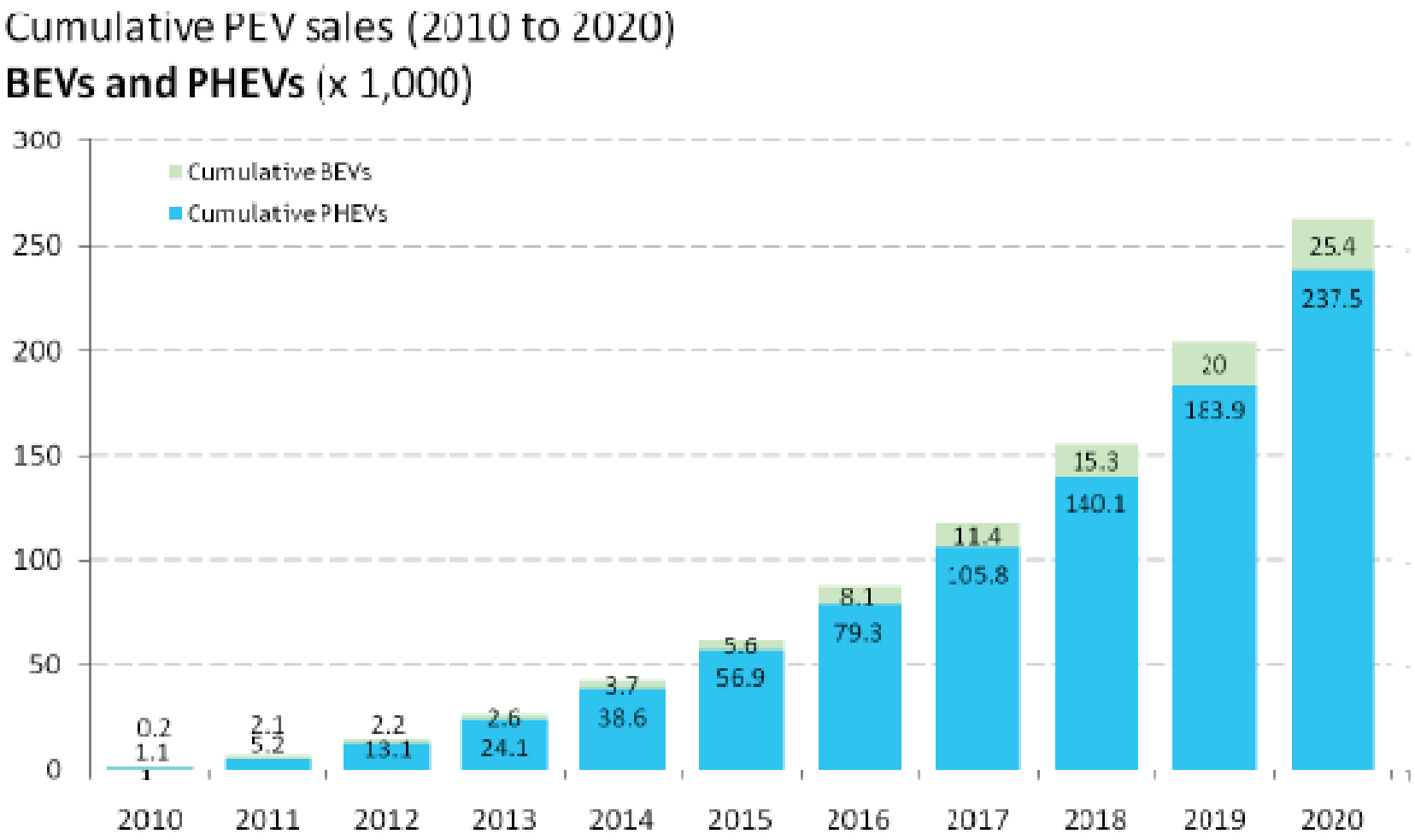
PG&E PEV Adoption Estimates



Cumulative PG&E Service Territory PEV Market Adoption Scenarios

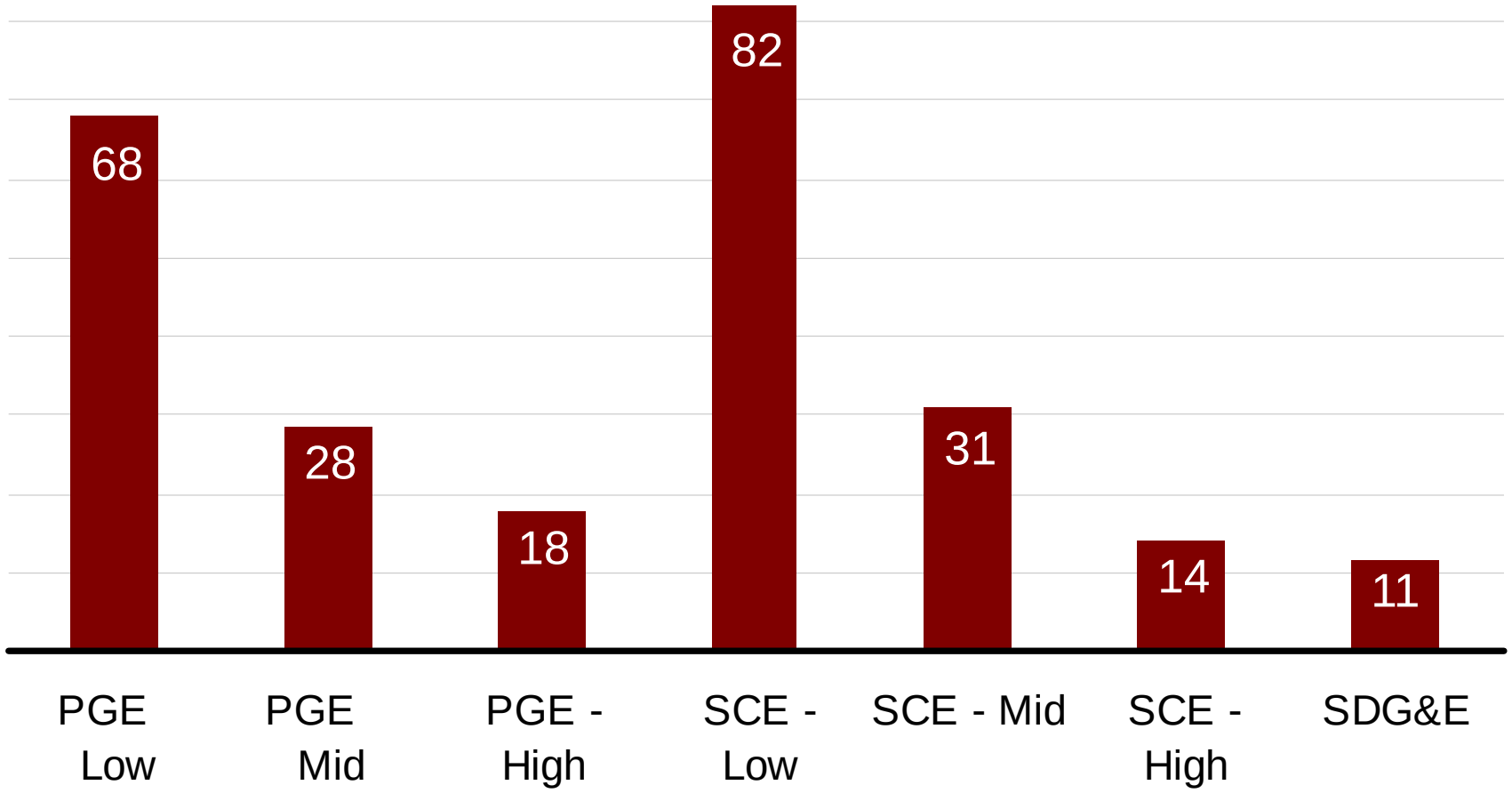
* Shifted 10 years forward

SDG&E Adoption Estimates



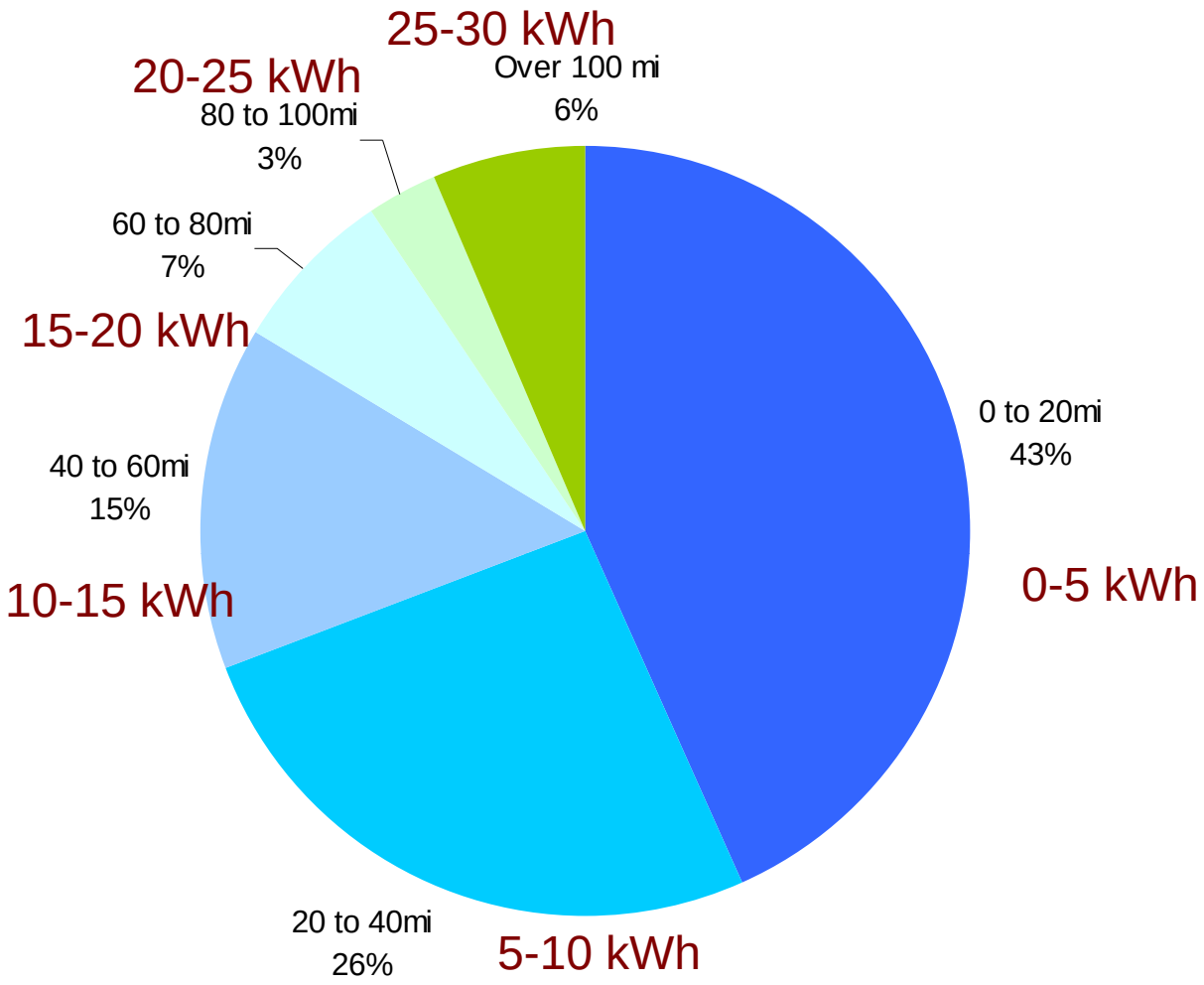
Adoption Density

Population (in 2010) per EV (in 2020)



PG&E pop.= ~15M SCE pop.= ~ 14M SDG&E pop.= ~ 3M

Daily Travel Distances (weighted %)

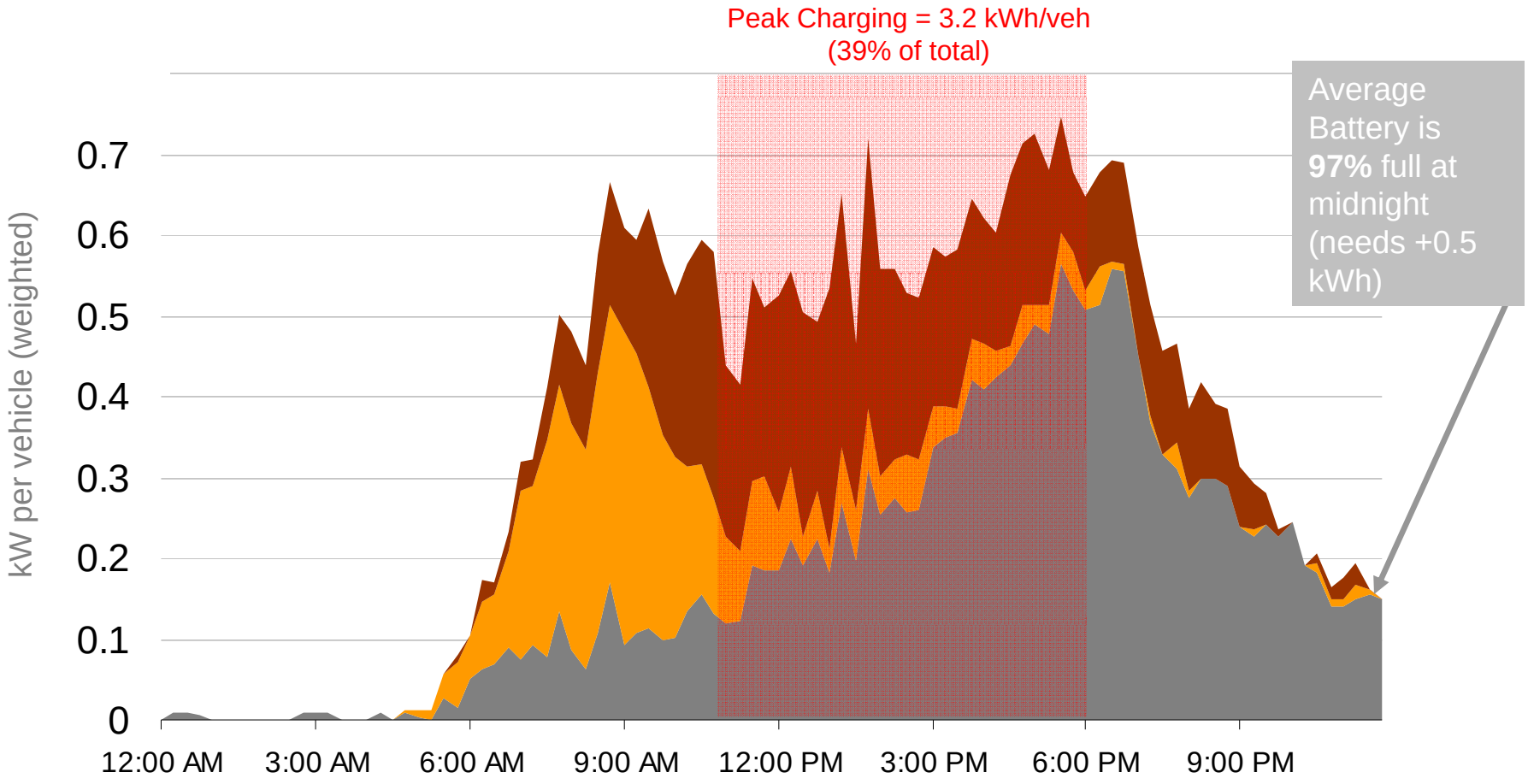


	Unweighted Mean	Weighted Mean	Weighted Plus Mean	Commuters	Weekend	Weekday
Average Daily Driving Distance (miles)	32.3	39.3	36.3	37.8	40.7	38.3

Figure 10: 100% L2 Chargers at All Locations

Battery: 75 mi. range, home chargers: 100% @ L2, work chargers: 100% @ L2, public chargers: 100% @ L2

97.9% Complete daily travel needs



Per Vehicle Totals:

@Home = 4.1 kWh (50%)

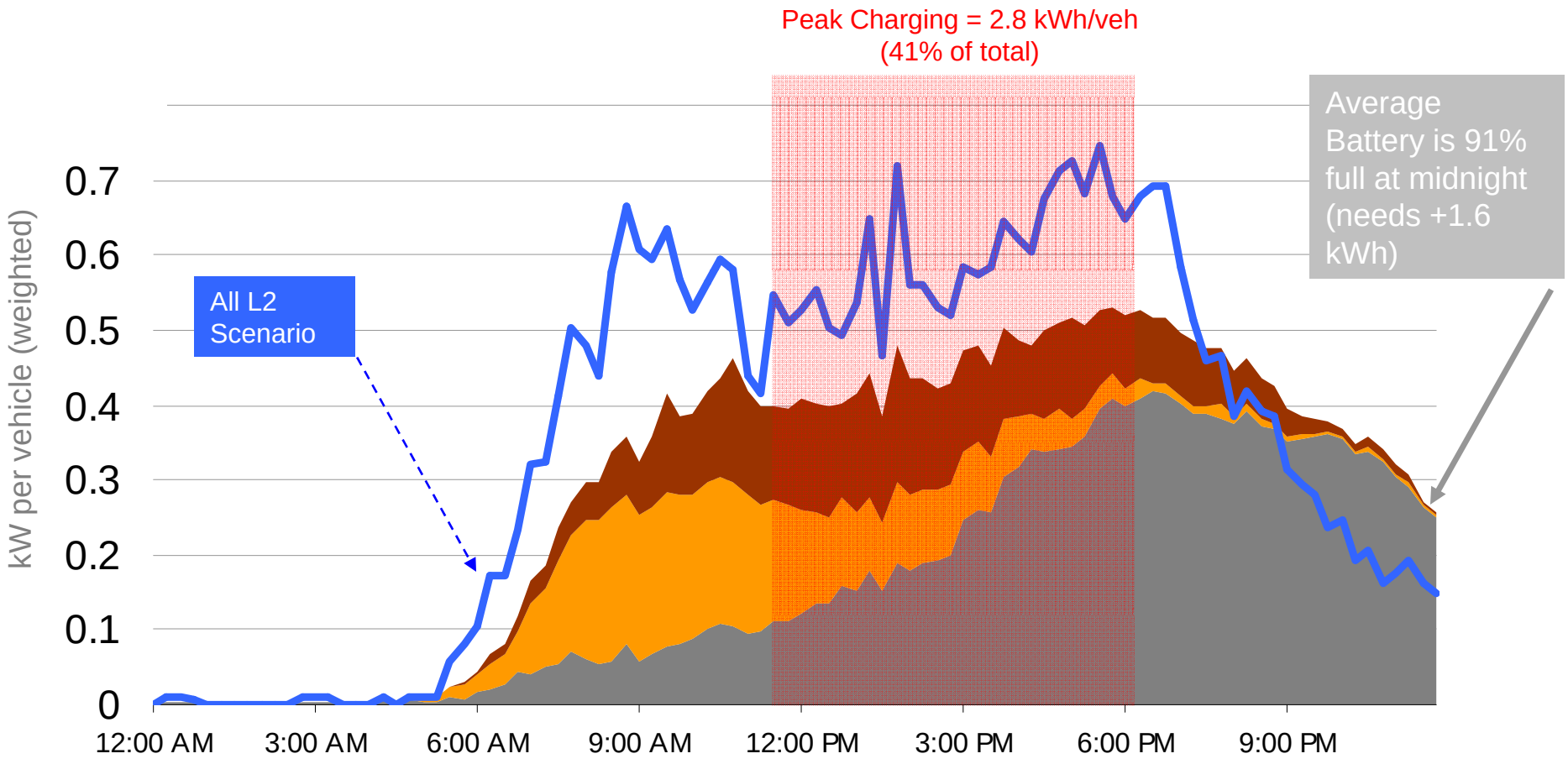
@Work = 2.4 kWh (29%)

@Public = 1.8 kWh (22%)

Figure 11: 100% L1 Chargers at All Locations

Battery: 75 mi. range, home chargers: 100% @ L1, work chargers: 100% @ L1, public chargers: 100% @ L1

95.3% Complete daily travel needs



Per Vehicle Totals:

@Home = 3.6 kWh (52%)

@Work = 2.2 kWh (32%)

@Public = 1.1 kWh (16%)

Contact Information

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Infrastructure Scenarios:

Impact on Daily Travel Completion Rates and Peak Demand

Charge Station Availability by Location Type			% Time Charge Station Present	Travel Completion %		Peak Time Charging per Vehicle (kWh)	
Home	Work	Public					
0%	0%	0%	0%	90.4%		N/A	
50%	0%	0%	29%	90.4%	90.4%	0.6	1.0
50%	50%	50%	42%	91.6%	96.3%	1.8	2.4
50%	100%	100%	54%	93.7%	97.4%	2.2	2.3
100%	0%	0%	69%	91.7%	92.1%	1.5	2.5
100%	50%	50%	81%	93.1%	97.6%	2.5	3.4
100%	100%	100%	94%	95.3%	97.9%	2.8	3.2

How are residential rates set to encourage off-peak charging?

Residential Rate Schedules

Utility	Tariff	TOU	Tiered	Meters	Meter Charge (mo./day)	Summer On-to-Off-Peak Ratio
PG&E	E-9 (A)[1]	Y	Y	1	$0.21881d	5.76
	E-9 (B)[1]	Y	Y	2	$0.21881d	5.01
SCE	TOU-EV-1[4]	Y	N	2	$0.00	2.24
	TOU-D-TEV[1,2]	Y	Y	1	$0.00	2.24
SDG&E	EV-TOU[2,3]	Y	N	2	$0.00	4.14
	EV-TOU-2[2,3]	Y	N	1	$0.00	4.14

1. Baseline (Tier 1)
2. Super-Off-Peak
3. Rates given reflect EECC. Retrieved from: http://www.sdge.com/tm2/pdf/ELEC_ELEC-SCHEDS_EECC.pdf
4. TOU-EV-1 does not have a meter charge, only a basic customer charge ($/meter/day)

Note: No demand charges exist in the residential context