



Plug-in Vehicles & Workplace Charging

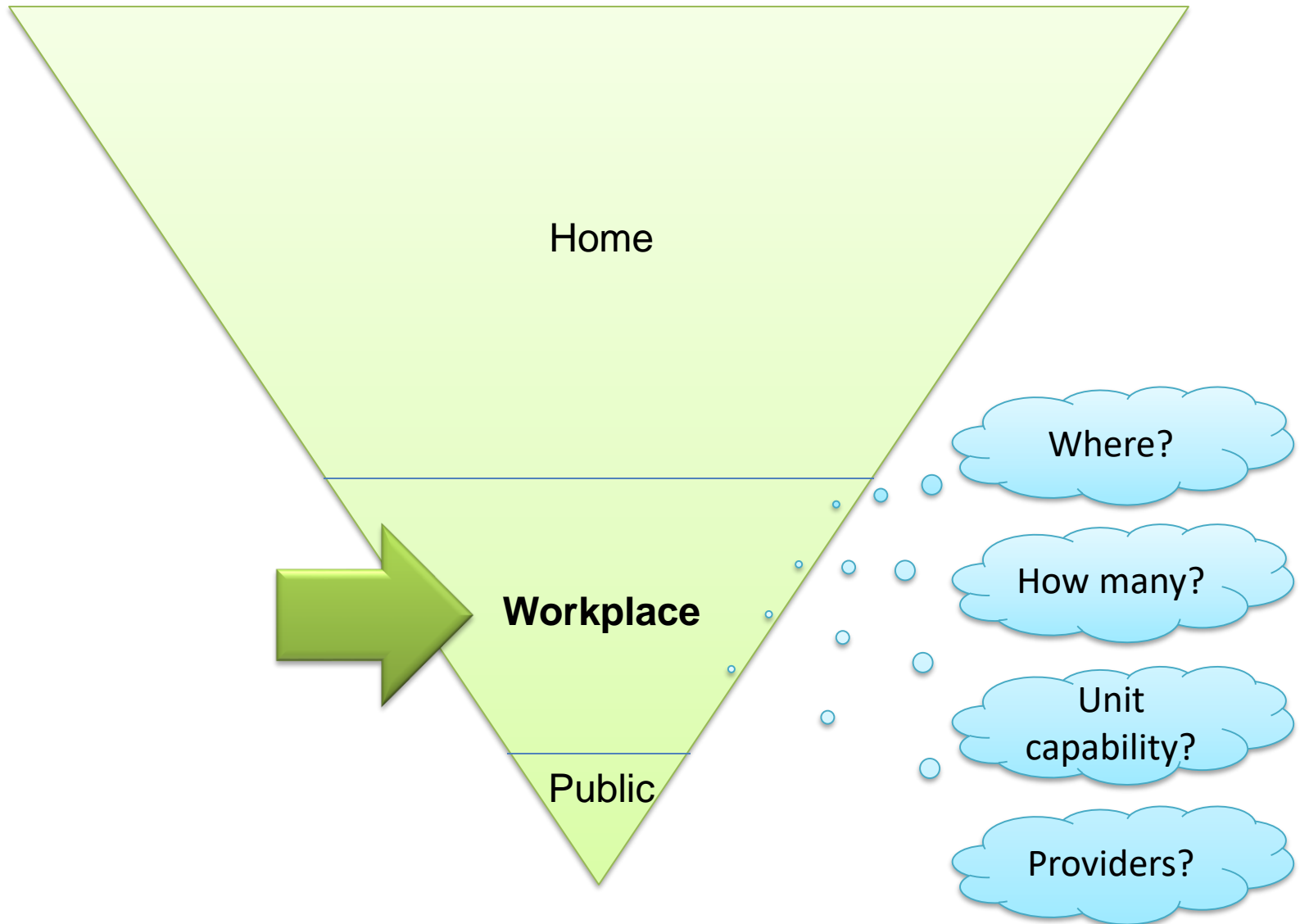
Important considerations for
employers and property owners

SDG&E Clean Transportation
Electric Transportation & Infrastructure

SDG&E Energy Innovation Center
[DATE TIME]

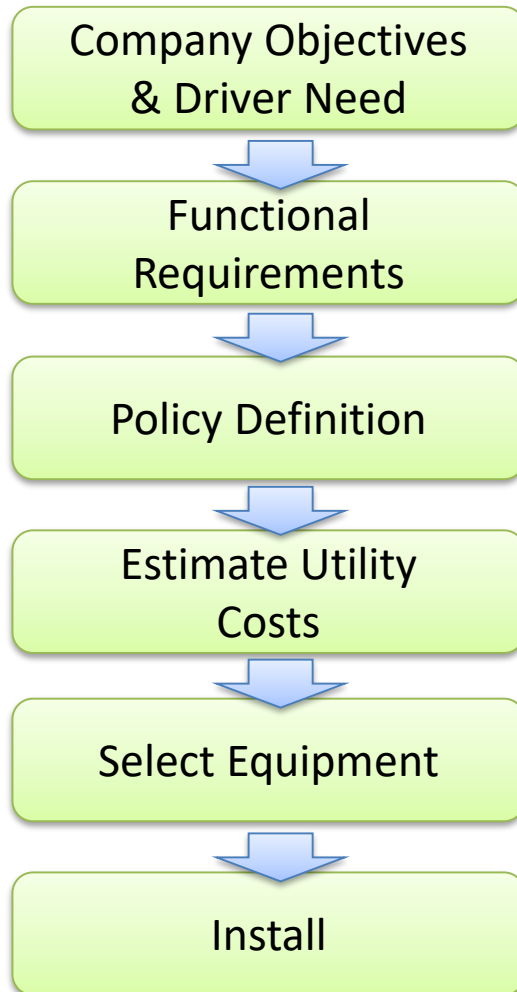


PEV Charging



Workplace charging considerations...

Getting set up...



Operations...



Vehicle types and terminology

Conventional



Hybrid



Plug-in Hybrid
PHEV



Battery Electric
BEV



PEV

More terminology

“EVSE” - Electric Vehicle
Supply Equipment



Utility “Demand Charges”
A significant part of
Commercial/Industrial rates

Energy (kWh) vs. Power (kW)



How much energy/fuel you use

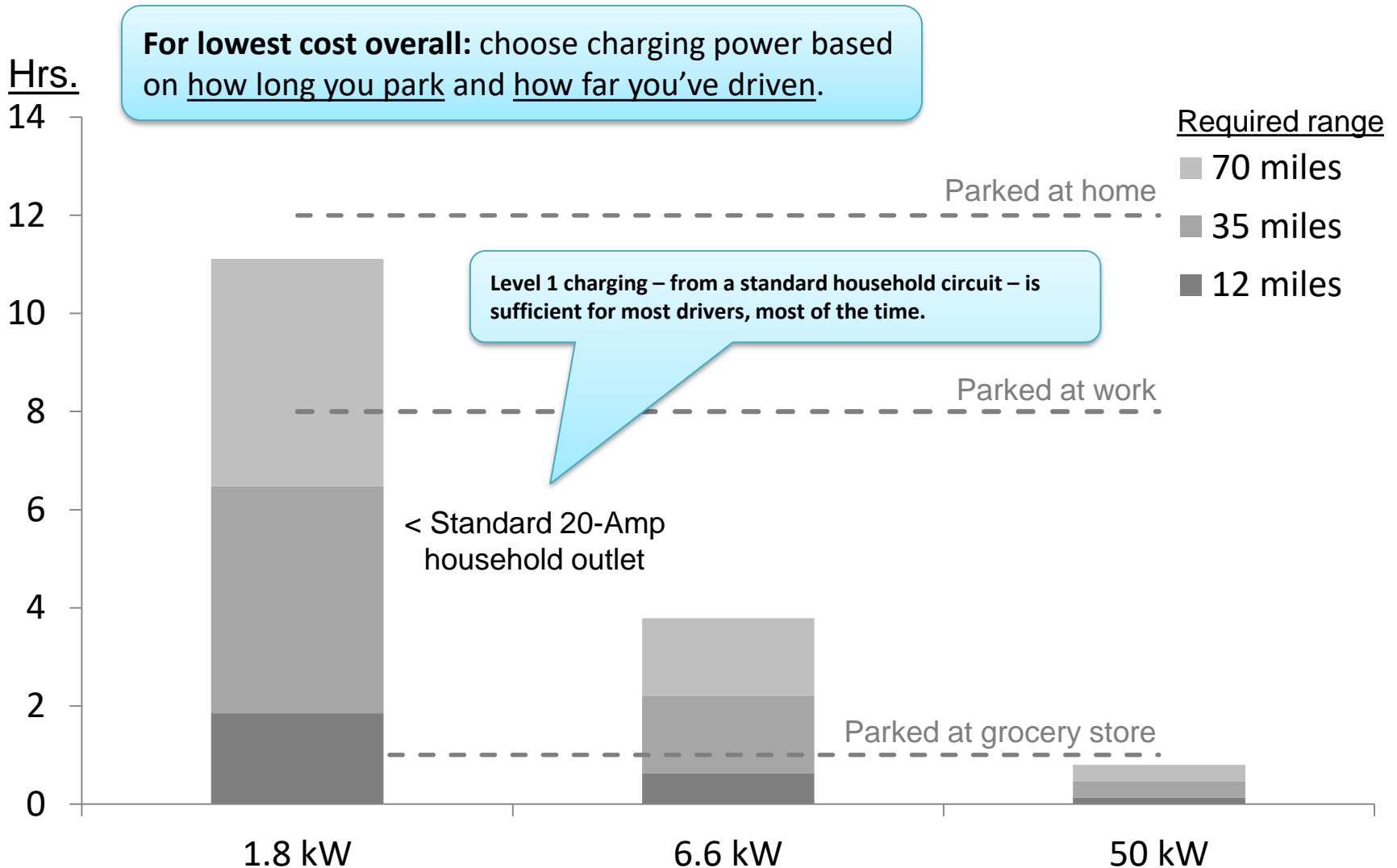
kW



How fast you charge

Matching charging equipment to charging time

Hours required to recharge, at various power levels



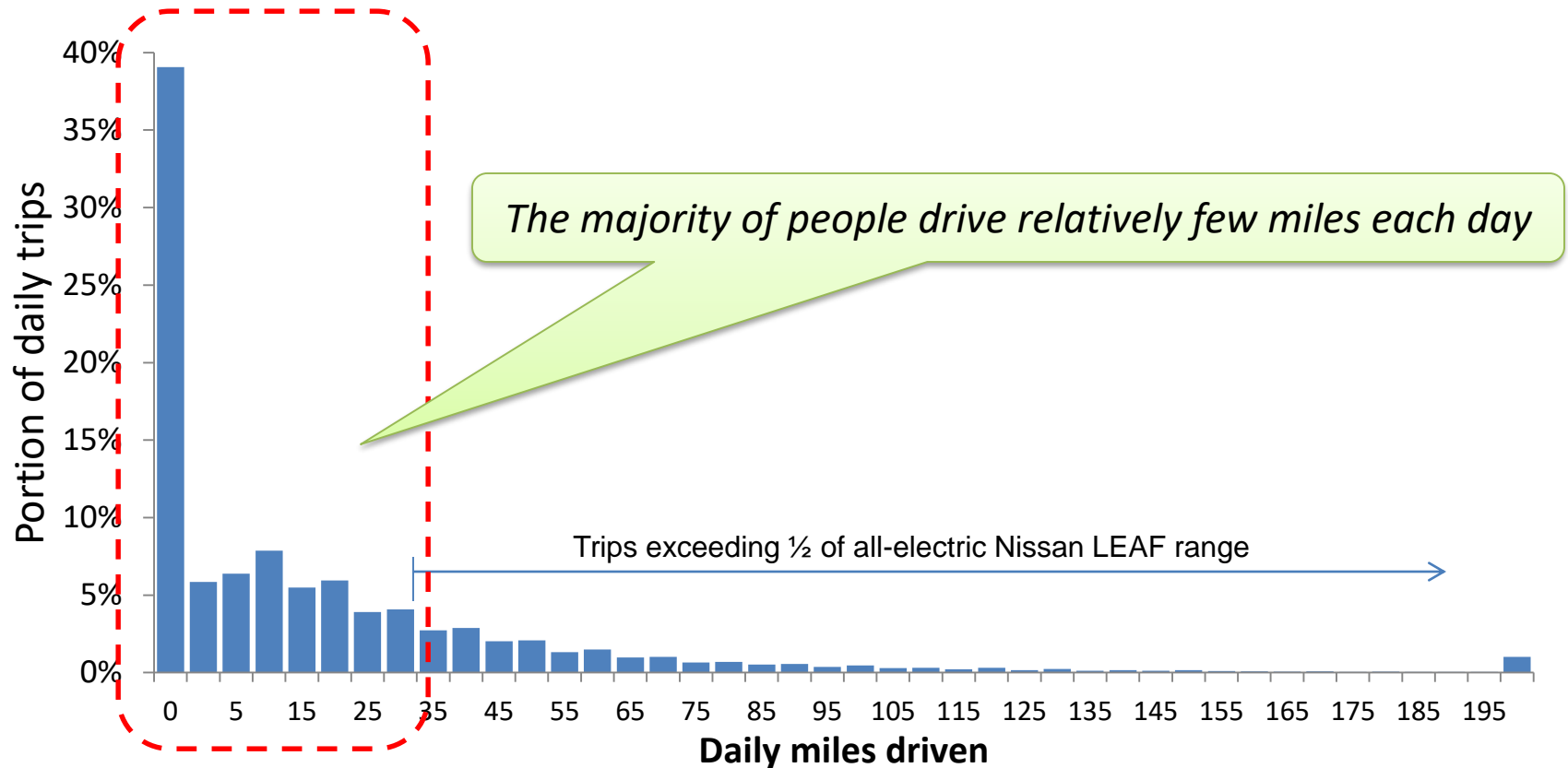
Assumptions: 3 miles of range per kWh, measure at utility meter; 6.6 kW charge time discounted by 20% and 50 kW discounted by 50% due to non-linear charging of batteries

Note: San Diego "...average regional commute...23.7 daily miles per person..." <http://www.movesandiego.org/reports.html>

Determine need – how far do employees drive?

Daily miles driven

2009 National Household Travel Survey



Source: U.S. DOT, Federal Highway Administration 2009 National Household Travel Survey <http://nhts.ornl.gov/2009/pub/stt.pdf>

Your objectives define requirements...

...and drive costs

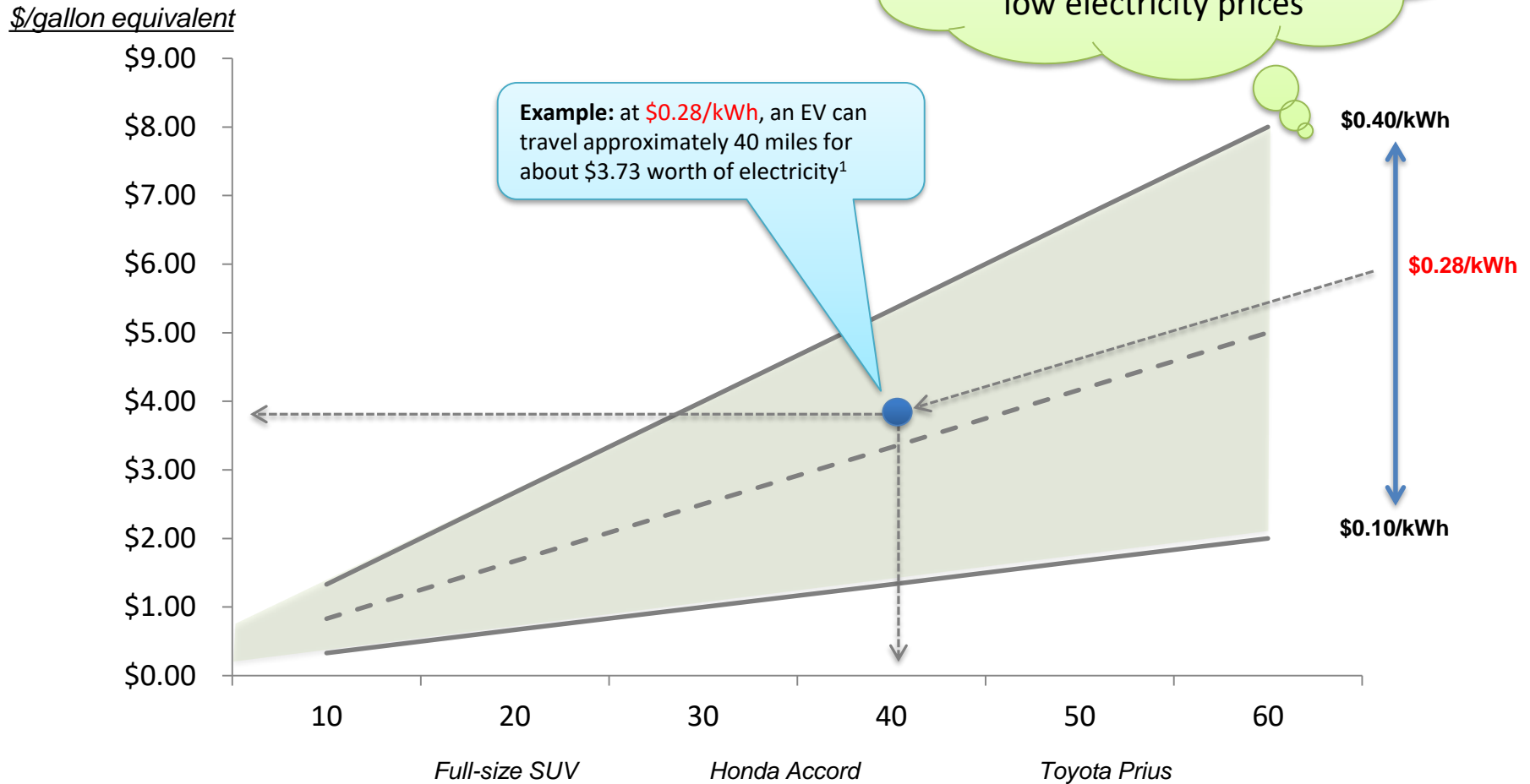
Define Objectives

Objective	Requirements/Implications
Employees..and Fleet?	Metering: groups vs. individuals; power level
How many sites & how many vehicles?	Number and type of equipment
Visual impact or min. parking impact?	Number of parking spaces
Benefit for all PEVs, or service for BEVs?	Parking enforcement
Free or subsidized?	Cost inversely related to expected use
Self manage or full-service provider?	Overhead cost and reliability
Load control?	Existing control system integration



It's also important to consider how price will likely affect usage

Why it's important to keep charging costs low...



77% of drivers cite fuel-cost savings as the #1 benefit to owning a plug-in vehicle²

1.) Assumes 3 miles/kWh; example $(40/3) \times \$0.28 = \3.73

2.) J.D. Power, 2012 utility customer satisfaction survey

Requirements define needed functions

Determine Functional Requirements

Functional Requirement	Consideration
Access control	If “behind the fence”, not needed...
Usage reporting (individual vs. group)	Third party or self billed (nascent services)
Remote/auto turn-on/off	Requires WiFi, wired, cell or other...
Time-variant pricing	An emerging feature

And like most products,
features add cost



Policy checklist

Policy Definition

Policy item	Consideration
Convenience or urgent need only?	Most San Diegans drive ~12 to work...
Free or pay-for-use?	Price affects use (\$0.14-0.31/kWh at home) ¹
Duration based or fixed fee?	Time-based encourages vehicles to move
HR & tax implications	“De minimis”? (taxable benefit?)*
Dedicated parking (BEV or PEV)?	First come, first serve; remote or premium
Your existing outdoor outlets	Enforcement...

*“de minimis” is used to describe a benefit that is too insignificant to be subject to taxation.

How much of a benefit?

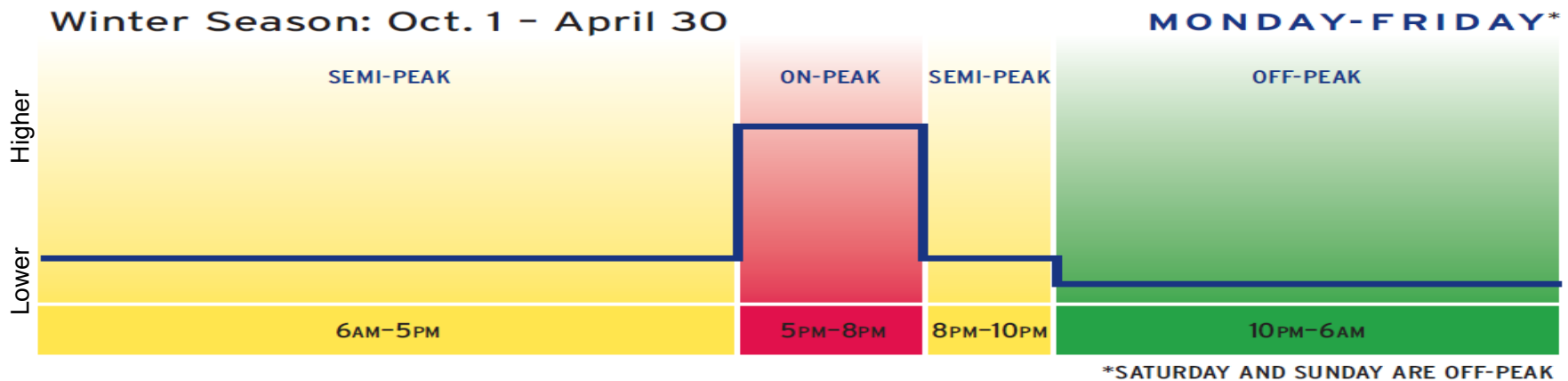
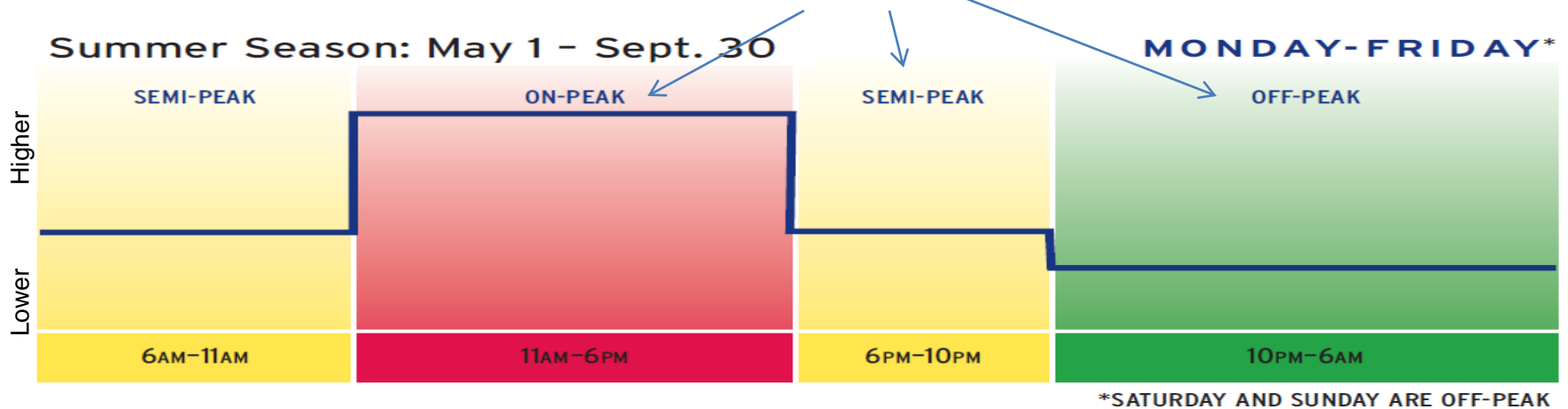
12 miles / 3.5 miles/kWh = 3.4 kWh / day x 250 days = **850 kWh / year**

Understand how utility rates work...

Commodity charges

Utility costs

*Commodity price
varies by time period*



Note: Time-Of-Use periods can vary – check sdge.com for up-to-date TOU periods applicable to particular rates.

Utility billing cost

Demand charges (on the AL-TOU rate)

kW

~~kWh~~

Demand charges are collected to offset infrastructure costs associated with delivering energy faster i.e., at higher power levels

Utility terminology	Your highest 15-min. demand moment ¹	Summer \$/kW	Winter \$/kW
“Non-Coincident Demand”	Highest kW, <u>no matter when</u>	\$13.57	\$13.57
“On-Peak Demand” ²	Highest kW <u>during peak</u>	\$7.65	\$4.75
“Generation Demand” ³	Highest kW <u>during peak</u>	<u>\$5.21</u>	<u>\$0.17</u>
Total:		\$26.43/kW	\$18.49/kW

As of 9 May 2012

Source: http://www.sdge.com/tm2/pdf/ELEC_ELEC-SCHEDS_AL-TOU.pdf and http://www.sdge.com/tm2/pdf/ELEC_ELEC-SCHEDS_EECC.pdf

1.) Demand is measured in 15-minute periods; at the Secondary

2.) A measure of demand on available transmission & distribution system capacity

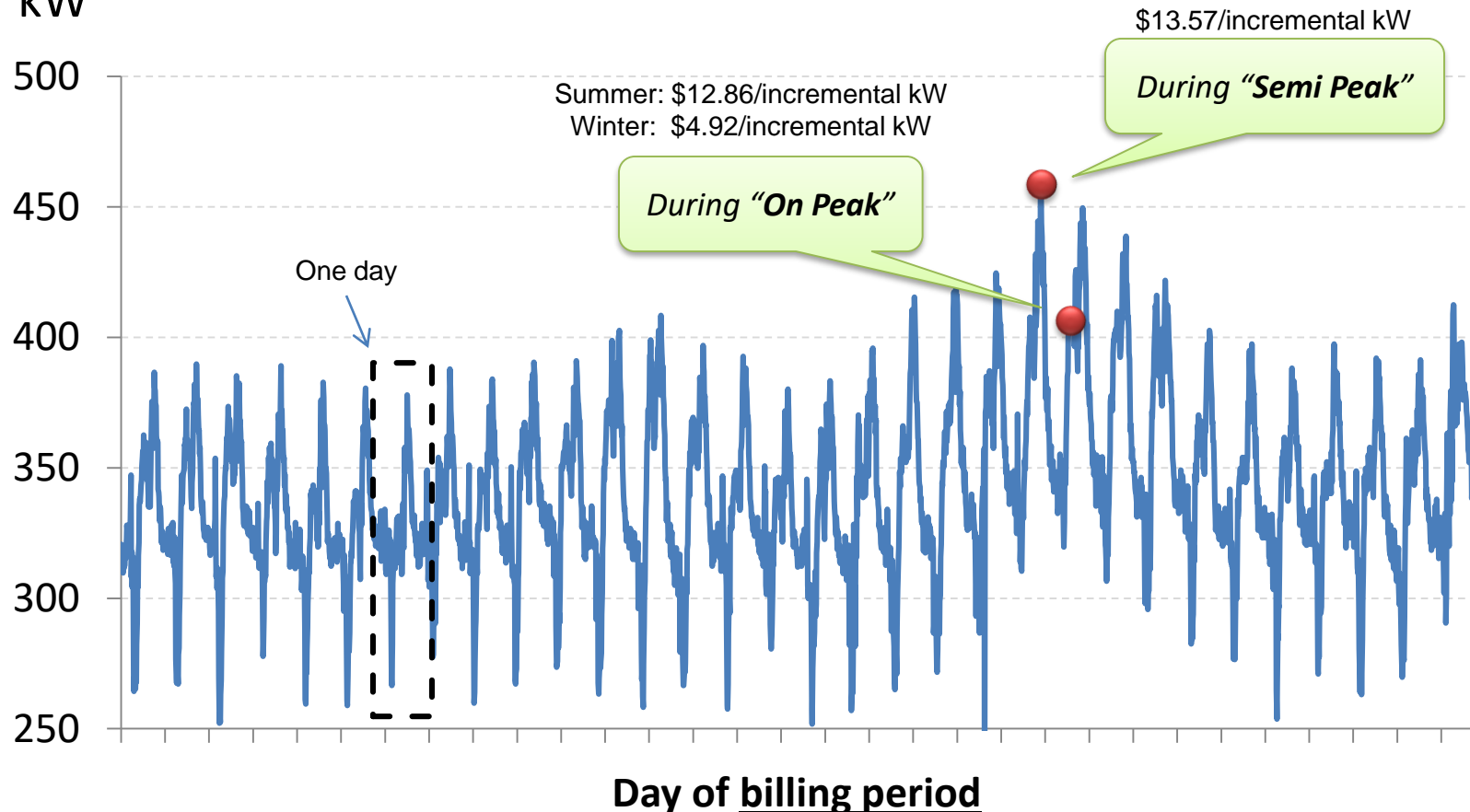
3.) EECC - a measure of demand on available power plant generating capacity (not applicable to Direct Access customers; does not reflect higher costs during CPP events)

Limiting your maximum demand...

Like **any new load**, adding to your existing maximum demand moments will increase demand charges

One month of demand (large retailer)

kW

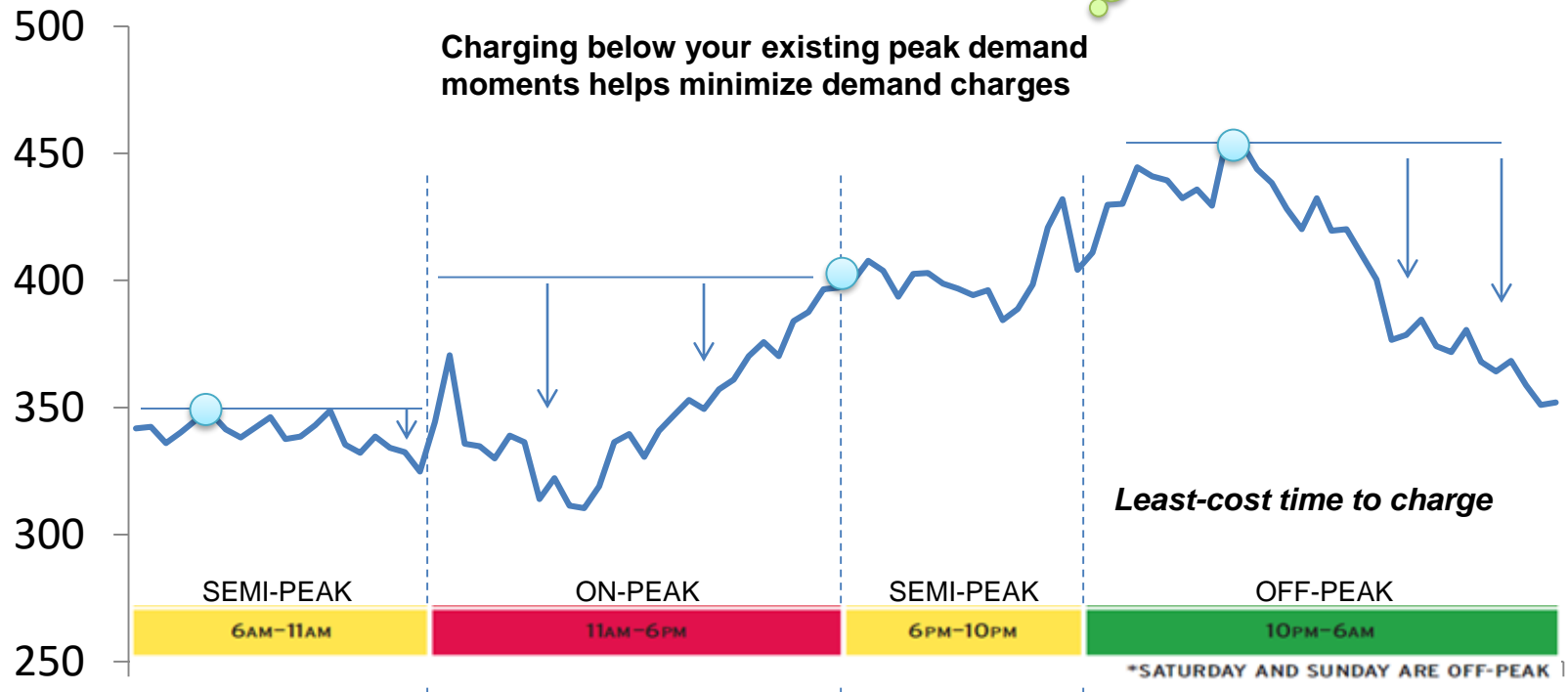


Limiting your maximum demand...

The best time to charge

Peak demand during one day's energy use

kW



Achieved by network services,
building management system
integration or simple timers

Charging below your existing peak demand
moments helps minimize demand charges

Least-cost time to charge

SEMI-PEAK
6AM-11AM

ON-PEAK
11AM-6PM

SEMI-PEAK
6PM-10PM

OFF-PEAK
10PM-6AM

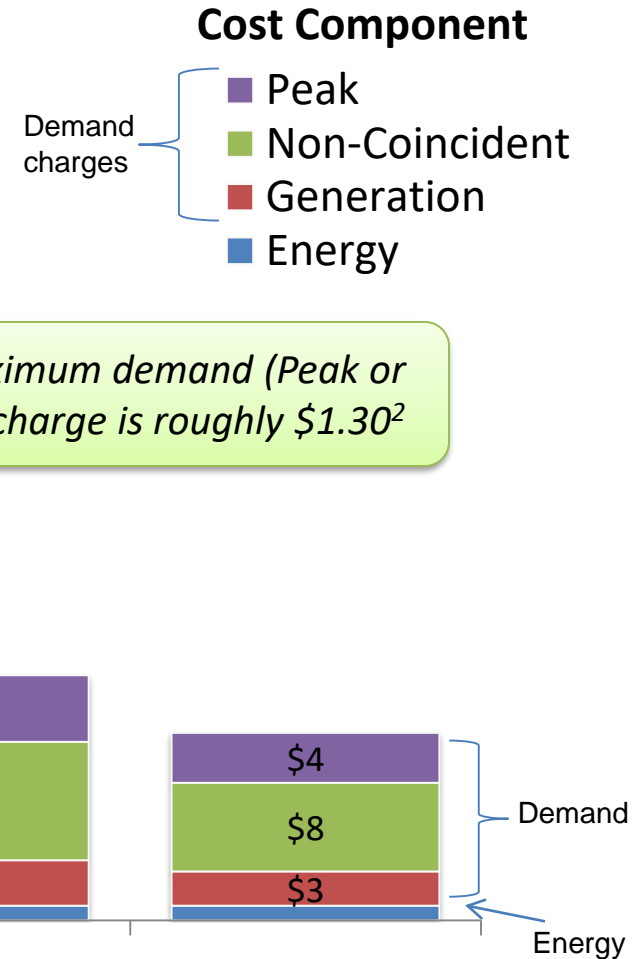
*SATURDAY AND SUNDAY ARE OFF-PEAK

Utility billing cost components

Cost per 50-mile charge (Summer)

15-minutes on 60 kW DC Fast Charger

Equivalent to 20 – 30 houses in the Summer



1 car per day

60
Cars charged each billing period

4 cars per day

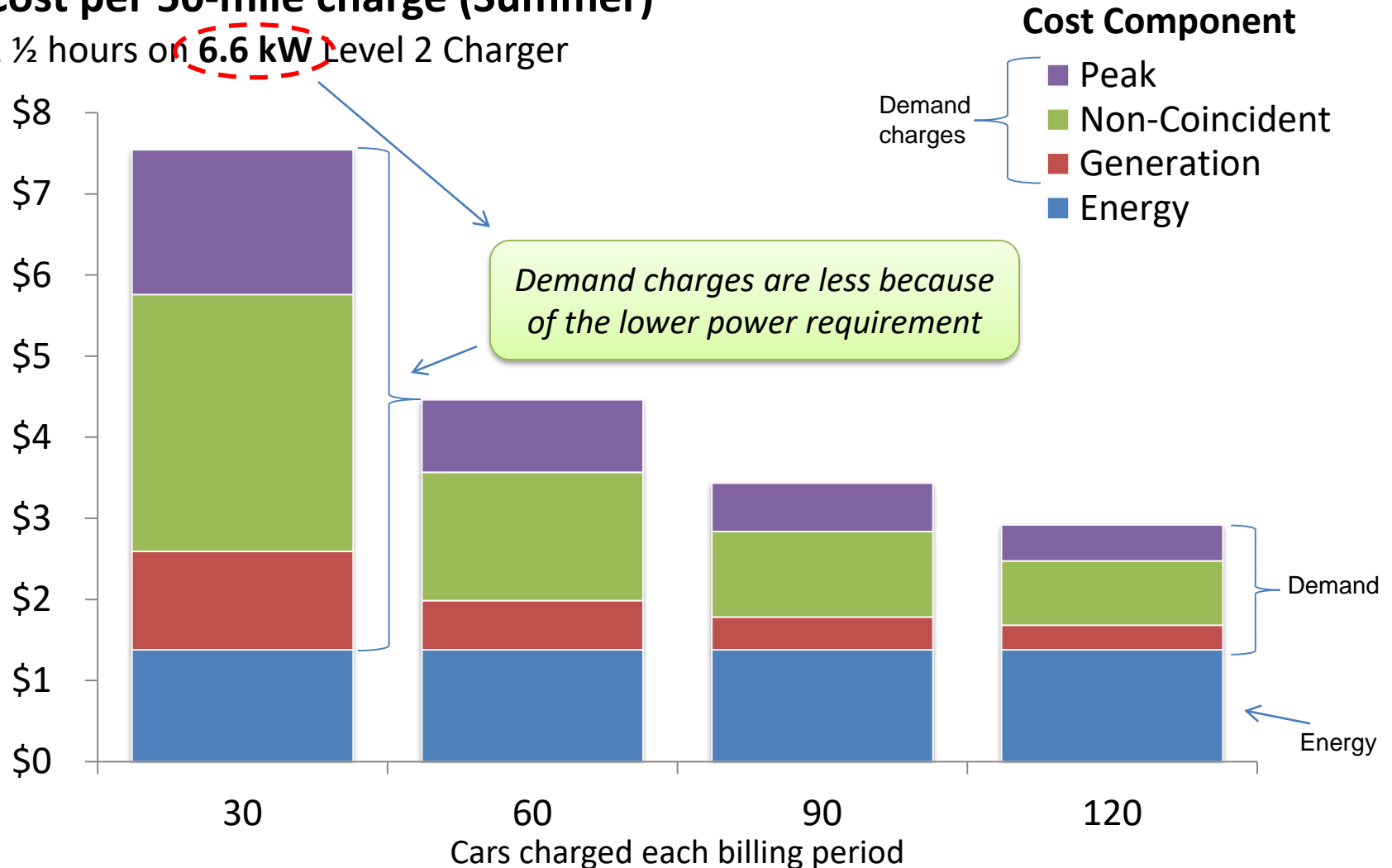
1.) Assumes 70 kW grid power requirement

2.) Energy cost is average of AL-TOU On, Semi and Off-Peak and includes UDC, Commodity, DWR Bond, Taxes (~\$0.10./kWh)

Utility billing cost components

Cost per 50-mile charge (Summer)

2 ½ hours on **6.6 kW** Level 2 Charger



1.) Assumes 7kW AC grid power requirement

2.) Energy cost is average of On, Semi and Off-Peak and includes UDC, Commodity, DWR Bond, Taxes

What you need to know to estimate utility cost...

- **You will need to estimate:**
 - How many chargers you will install and what type
 - Number of cars that will charge each month
 - Average duration of charge
 - What proportion of charging will occur each pricing period (On-Peak, Semi-Peak, Off-Peak)



Select Equipment

Install

Equipment costs and capabilities vary widely, and installation costs can be minimized by installing nearest to existing electric service.

\$100,000+

Cost \$500



1.4 kW¹
(5 mi/hour)



6.6 kW (23 mi/hour)



60 kW
(105 mi/30-min)



50 kW (85 mi/30-min)
Reduces demand charges

Tens of dollars/no service fees

Hundreds of dollars/service fees



NEMA standard
Lowest cost



Key-code access control
No communications needed



Credit card POS
Vending machine standard



RFID Card
With or w/o transaction service

Charging equipment incentives



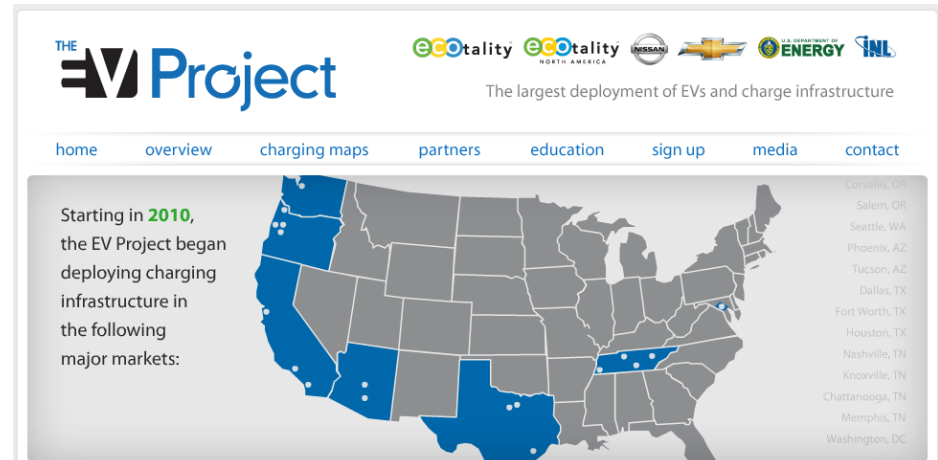
Check here for the latest incentives...

Federal & State incentives:
<http://www.afdc.energy.gov/afdc/laws/>

- “The EV Project” – free equipment and subsidized installation

A fleeting opportunity...

<http://www.theevproject.com/overview.php>



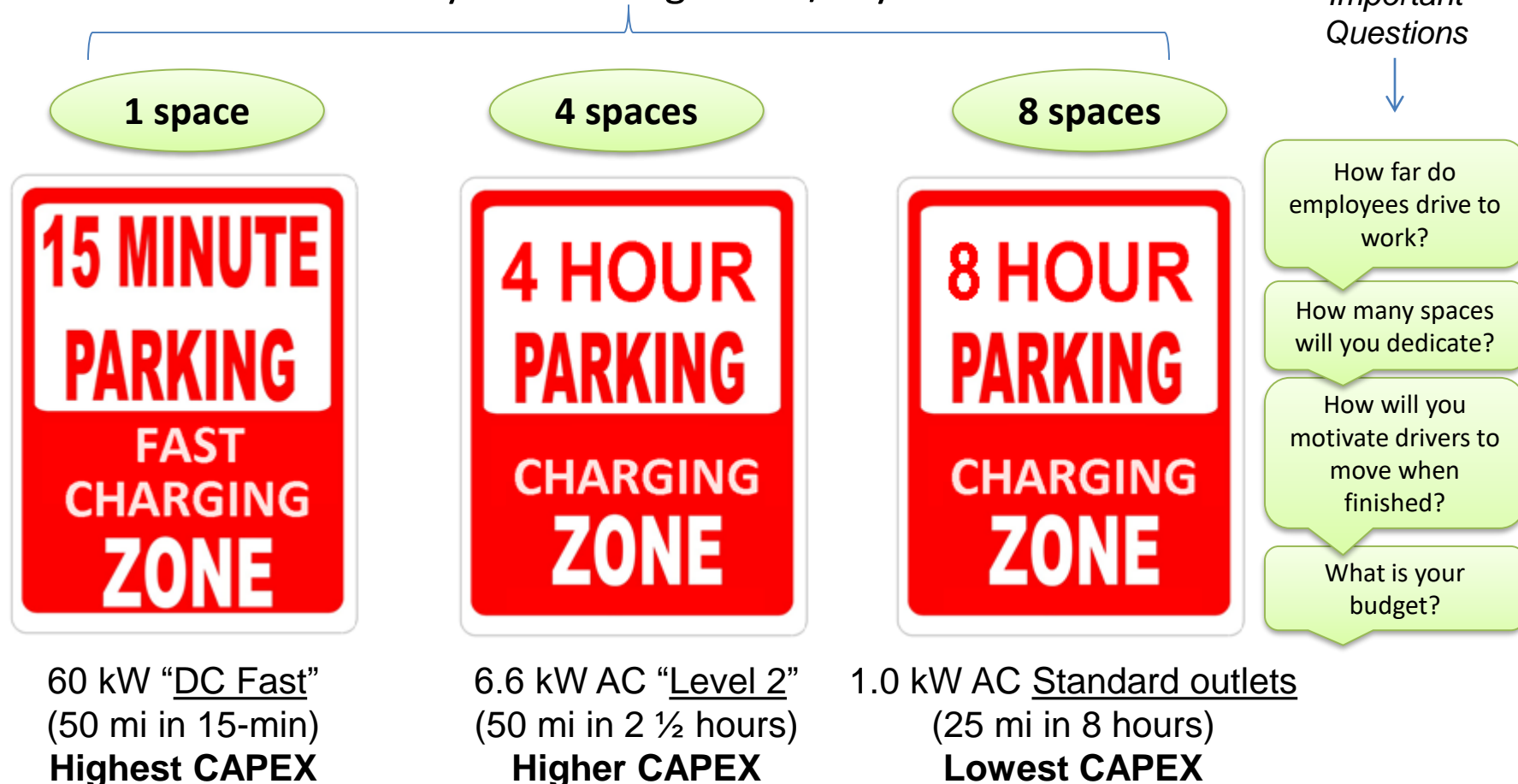
Since parking spaces aren't free...

Define Parking
Management Practices

...It's important to balance CAPEX with spaces required

Rule of thumb: The faster you charge, the more cars you can serve per charging unit/parking space

- **EXAMPLE:** How will you serve eight cars/day?



Training and O&M

Operations and
Maintenance

User and Operations
Training

Group	Description
Drivers	Equipment operation (authentication, confirmation charging is active, moving vehicle upon completion)
Accounting	Usage reporting (kWh, duration) Payment process
Facilities	Suppliers may be able to provide maintenance training Security & parking enforcement
O&M	Description
3 rd party	Few choices; ask your equipment vendor
Self-provided	Ask your vendor for training and documentation