Update on Status of ZEV Infrastructure

Diamond Bar, California

October 23, 2014

California Environmental Protection Agency

Air Resources Board

Today's Presentation

- ZEV Infrastructure Inventory
- Investments and commitments to ZEV Infrastructure
- Charging station types and usage
- Charging station business models

Making Progress Toward ZEV Targets

- Excellent progress on infrastructure
  - 50% increase in public EV charging stations since last year
  - Hydrogen fuel stations on schedule to meet fuel cell vehicle needs through 2017

- On track to meet the Governors Executive Order for 1.5 million ZEVs by 2025

Charging Station Types

	Power	Connector	Suitable for
Level 1	Household plug	SAE J1772	Home, workplace, public long-term, PHEVs
Level 2	Dryer outlet	SAE J1772	Home, workplace, public 2-4 hours
Fast Charger	High power DC	CHAdeMO SAE Combo Tesla	Public - retail, destinations, and highway corridors

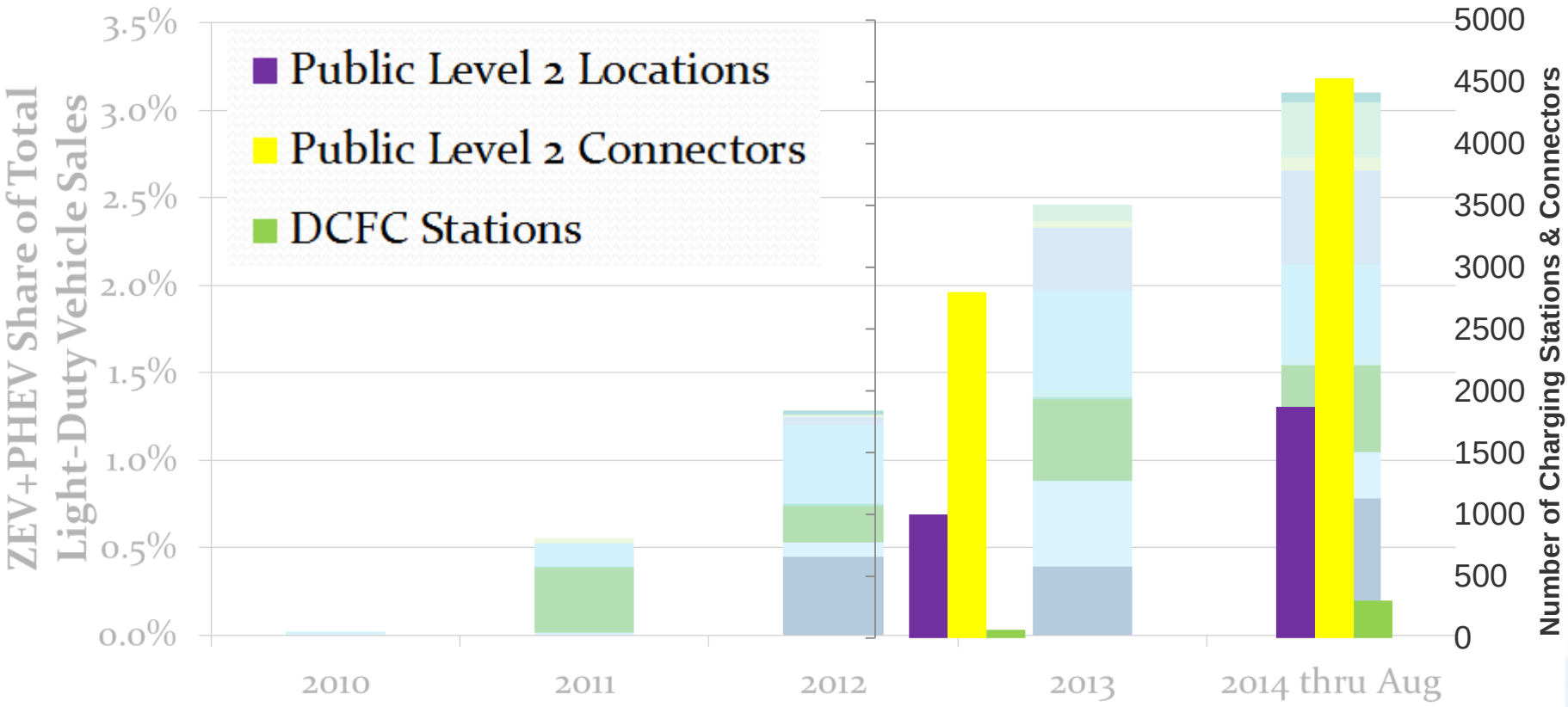
Level 1 convenience chord

DCFC Connectors

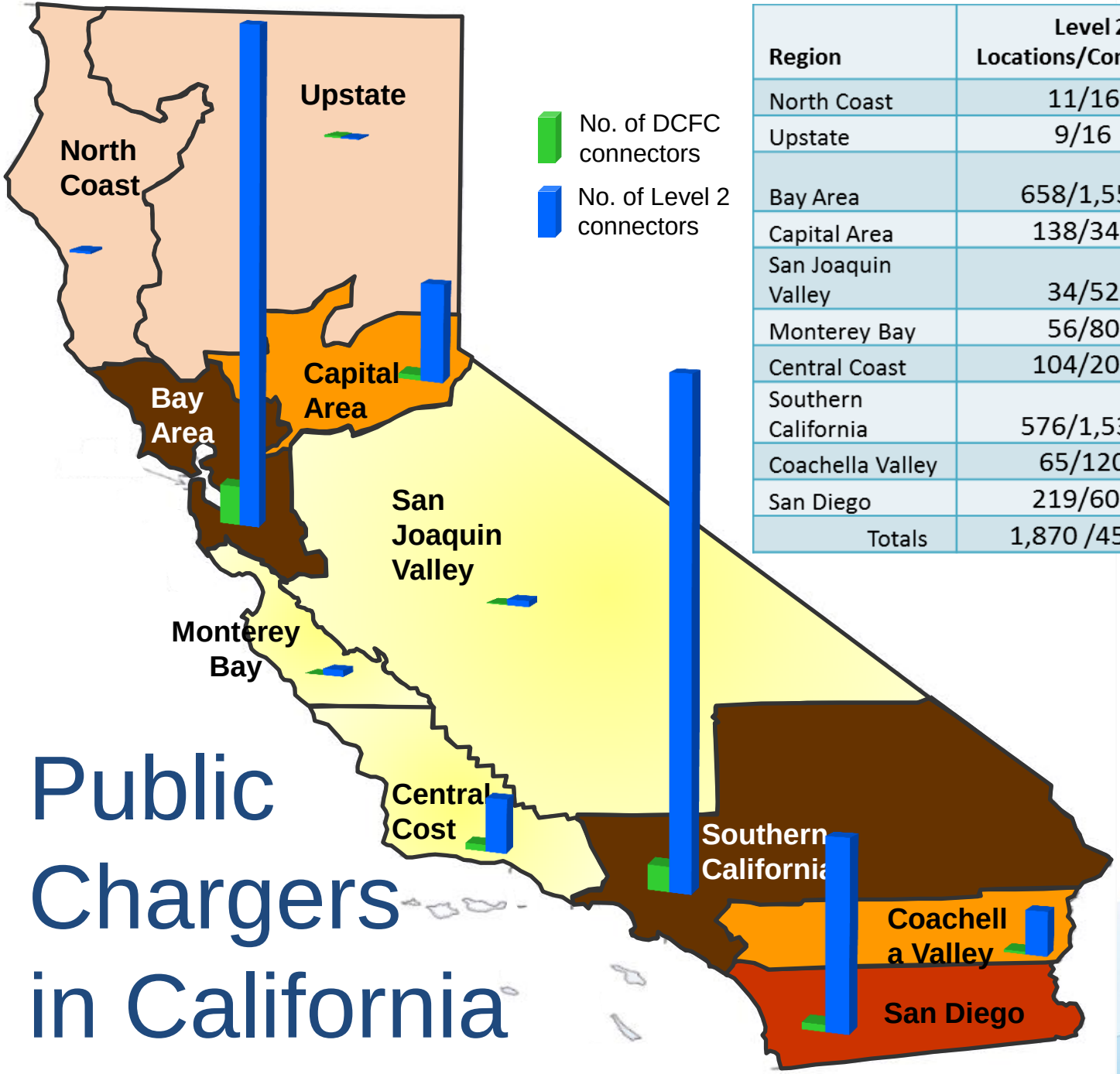
Tesla Supercharger

PEVs are showing steady growth

Charging infrastructure is catching up



Public Chargers in California



Region	Level 2 Locations/Connectors	Fast Charge Locations/Connectors
North Coast	11/16	0/0
Upstate	9/16	4/17
Bay Area	658/1,557	72/124
Capital Area	138/346	9/19
San Joaquin Valley	34/52	2/8
Monterey Bay	56/80	1/1
Central Coast	104/201	10/25
Southern California	576/1,531	57/78
Coachella Valley	65/120	6/7
San Diego	219/607	16/23
Totals	1,870 /4526	177/302

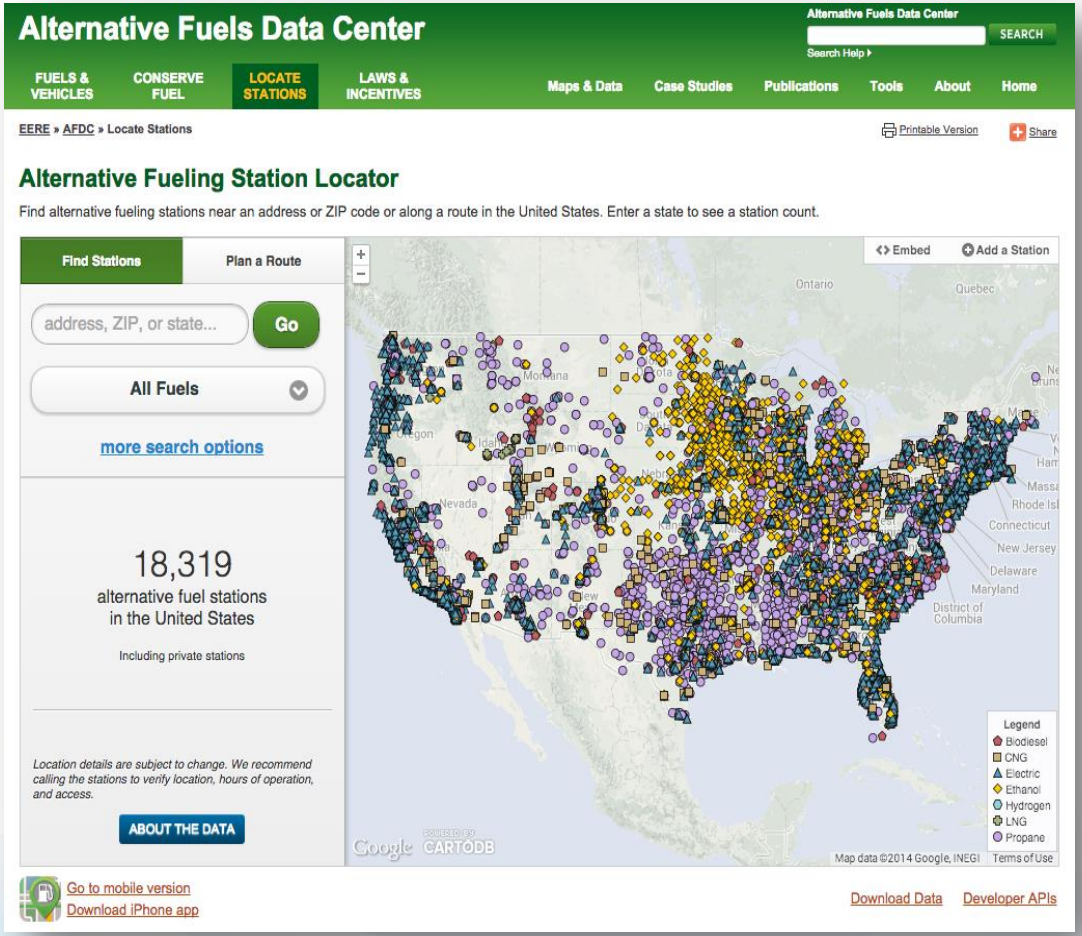
On-road PEVs (Spring 2014)

- >30k or more
- >10k-30k
- >6k-10k
- >3k-6k
- >1k-3k
- 1k or less

Charger data from AFDC Database, September 1, 2014

advanced clean cars

Improved National Database on Alternative Fuel Stations



Accessing station data:

1. Web-based locator
2. iPhone App
3. Data download
4. Web services/API
5. Widgets and website embedding

California's Growing Hydrogen Network

Current

- 10 stations mostly in greater Los Angeles and Orange County

Planned by 2015

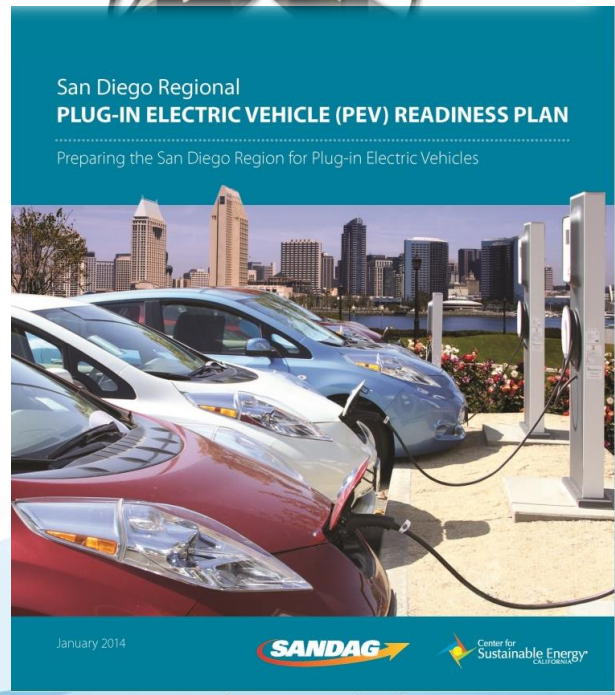
- 51 retail-like stations to cover near-term vehicle demand
- Drive from northern to southern California

California's Strong Support to Build the ZEV infrastructure

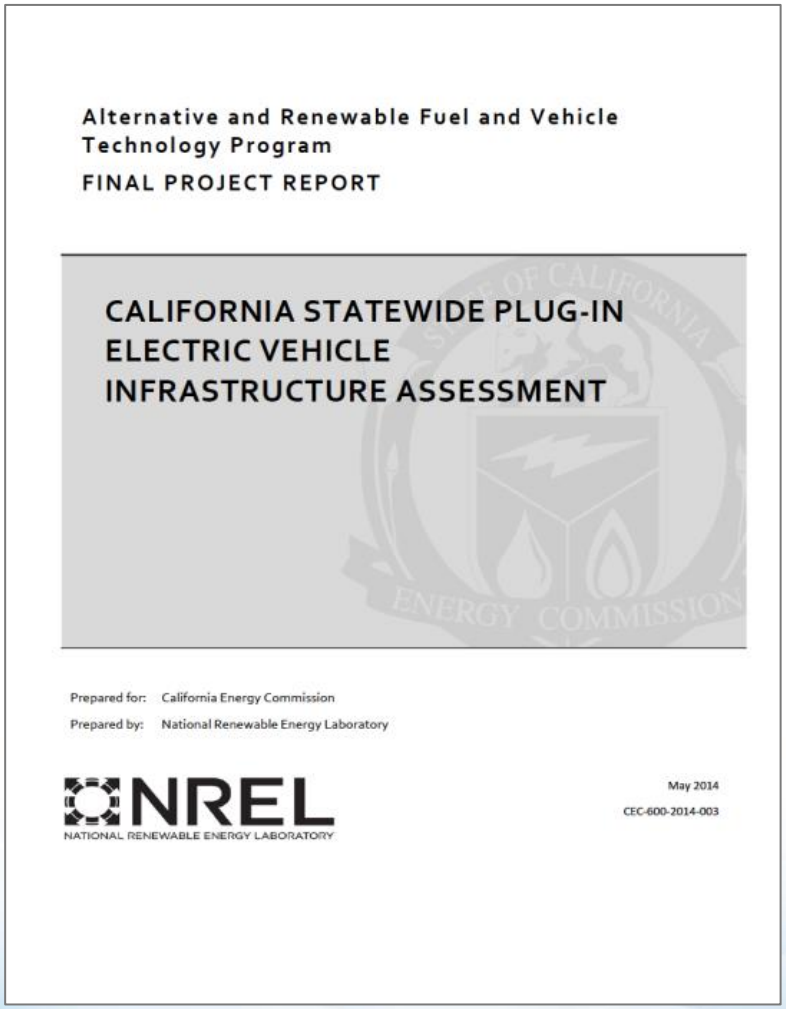
- The State is:
  - Showing its commitment by investing in charging and fueling infrastructure for ZEVs
  - Making significant progress with help of partnerships with the CaFCP, PEVC and automakers

PEV Related Investments and Support

- Significant investments:
  - Charging infrastructure - 9,400 stations to date
  - $15M allocated for charging in next investment plan
- Path moving forward
  - Coordination on PEV planning
  - Research on:
    - Battery second use and recycling
    - Vehicle-to-grid
  - DC fast Charger Analysis



CEC's Quantitative Assessment


Alternative and Renewable Fuel and Vehicle Technology Program

FINAL PROJECT REPORT

CALIFORNIA STATEWIDE PLUG-IN ELECTRIC VEHICLE INFRASTRUCTURE ASSESSMENT

Prepared for: California Energy Commission

Prepared by: National Renewable Energy Laboratory

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

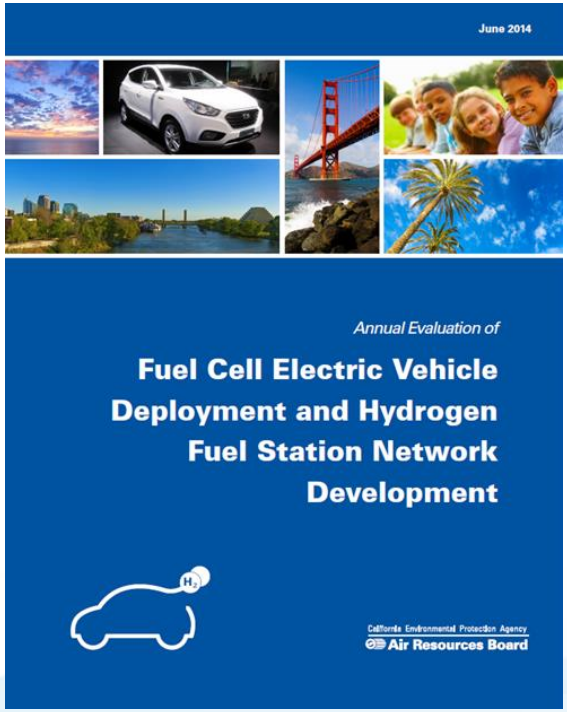
May 2014

CEC-600-2014-003

Establishes framework for achieving ZEV Action Plan Goal for charging infrastructure to support 1 million ZEVs by 2020

AB 8 Supports Continued Hydrogen Station Funding

- Broad-based coalition supported AB 8
- Up to $20 million per year for hydrogen stations (CEC-ARFVTP)
- Annual review of light-duty vehicle hydrogen supply and demand (ARB)
  - Assess station placement, fueling capacity, and fuel demand
  - Recommend number and locations of stations
  - Recommend technical requirements and operating standards for stations



More work needs to be done…

Our challenge is to find charging solutions and effective business models for:

- Multi-Unit Dwellings
- Workplaces
- Public settings
- Interregional connectors

ARB's Complementary Evaluation of PEV Infrastructure

Focus on three key objectives:
What type of away-from-home charging…

1. Supports PEV adoption
2. Increases zero emission miles traveled
3. Increases use of low/zero emission energy sources for transportation

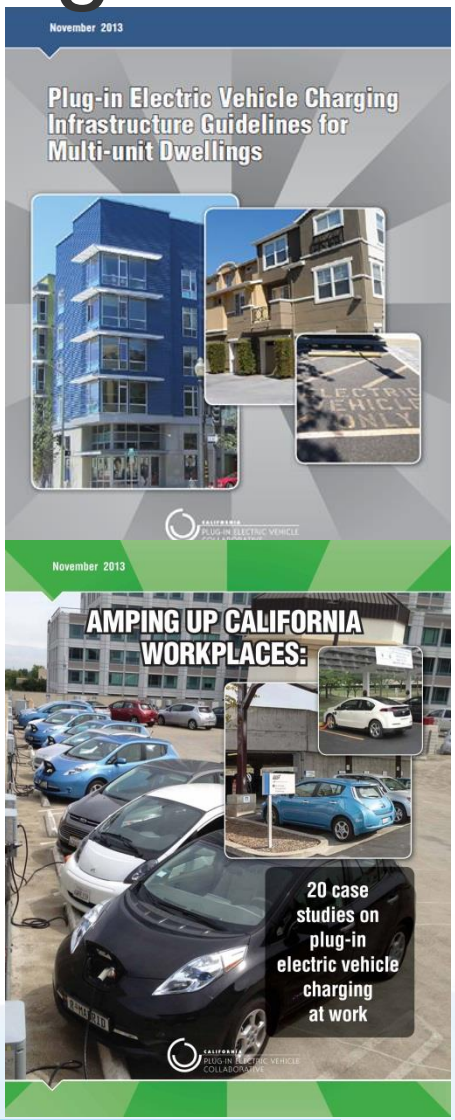
Home and workplace charging continue to dominate…

At home: ~80%

- Those who have it enjoy…
  - Ease of use, low off-peak rates, charger rebates
- *Focus needed on multi-unit dwellings*

Workplace - +15%

- Accelerates PEV adoption and allows for longer commutes
- *Focus needed on underserved areas*



"*Workplace charging is arguably the most important infrastructure strategy to accelerate adoption of PEVs*." GM, May 2014.

Workplace Charging

- Increases electric miles when:
  - Used to extend electric range
  - Used by people who do not have other charging options
- But charger congestion can have a reverse effect
  - Charging for charging ensures chargers are available to those who need it

Effect of price on charger use

Price dominates charging decisions

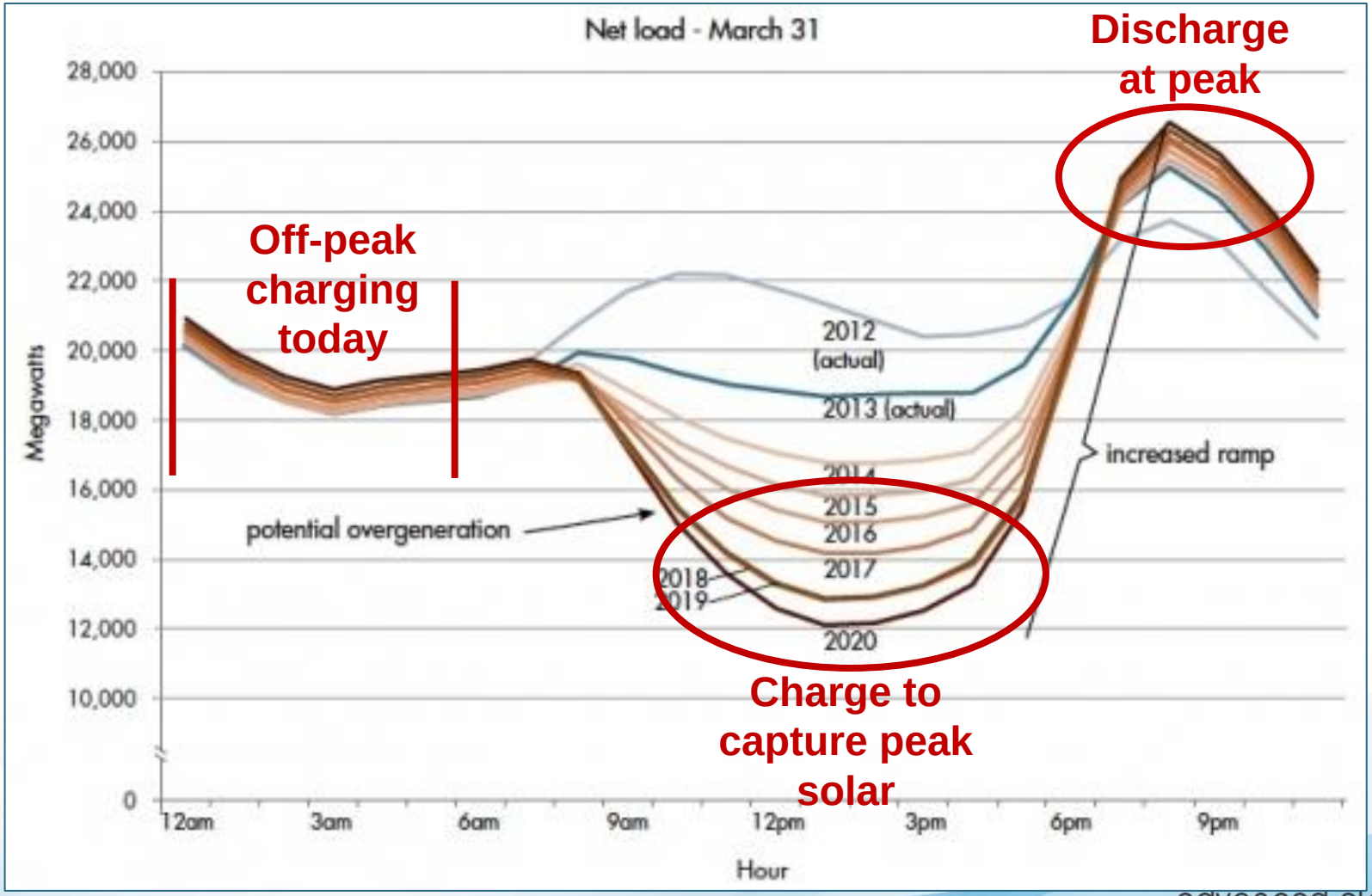
- Consumers like
  - Residential off-peak rates
  - $1.00/hour Level 2 work or public
- Most will unplug during
  - On-peak rates

Beyond price, convenience is key

- People will pay more for DCFC when necessary

Using price is an effective way to influence when people charge their cars.

PEVs can increase use of renewable energy



Sustainable Public Charger Business Model

- The solutions are not simply more State investment.
- Until we identify self-sustaining business models, ongoing support for charging infrastructure is necessary.

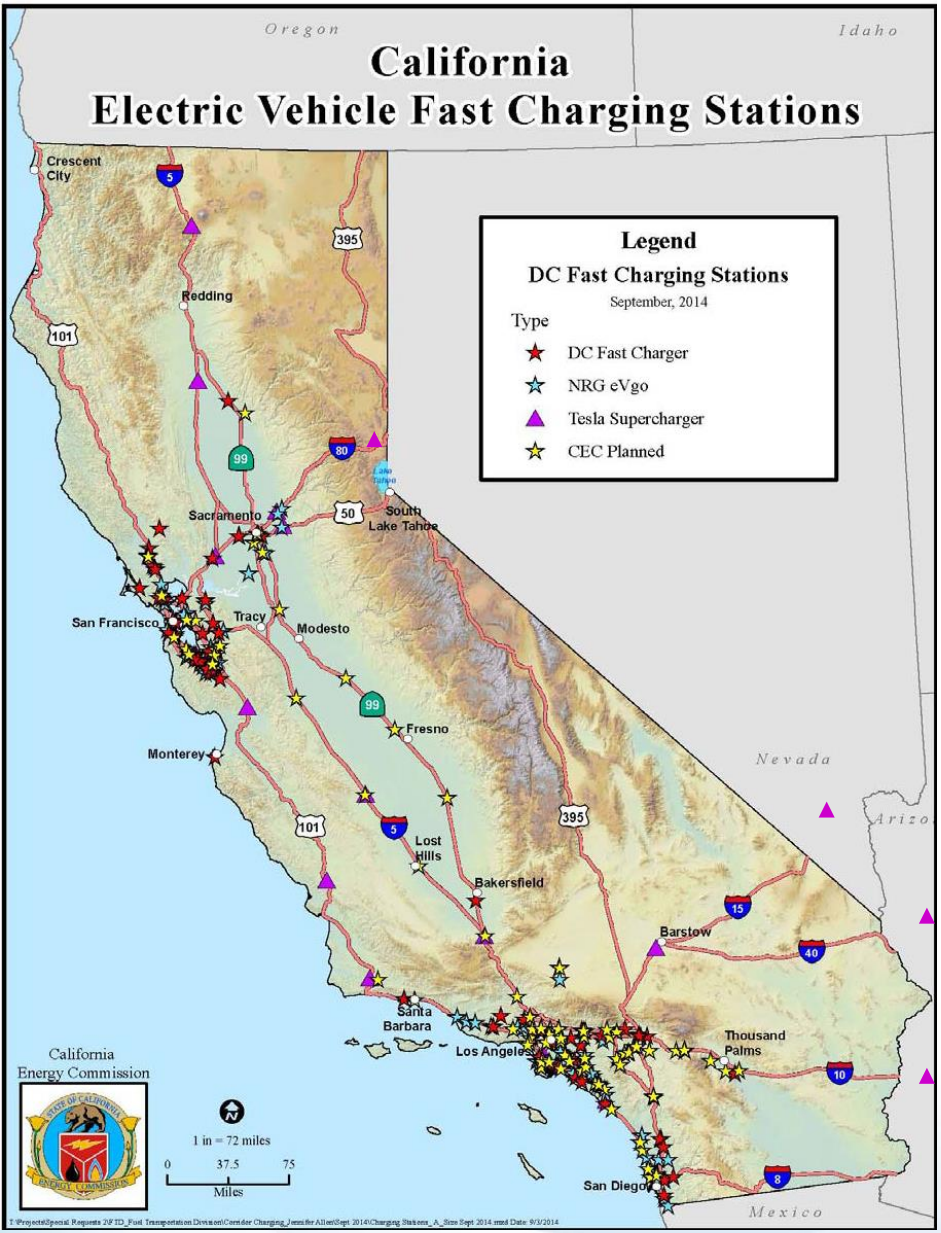
Lets look at:

  - Public parking structures
  - Corridor charging

Public Parking Structures

Site and design to maximize number of connected cars

- Locations serving
  - 3+ hour stays
  - More than one user group
- “Right” balance of level 1 and 2
- Include expansion in initial design
- Plan for grid integration capabilities



Corridor Charging

- Convenient & desired when placed with retail or dining
- Encourages longer distance BEV travel
- May encourage PEV adoption in underserved areas
- Important part of West Coast Electric Highway

Source: http://www.energy.ca.gov/renewables/tracking_progress/index.html

PEV infrastructure investments are important

- Business case is challenging in initial market areas
  - Cost recovery options alone are not enough
  - Shopping and dining revenue helps
- Other revenue sources are worth exploring

The business case is far more challenging in underserved areas.

Conclusions

- Public charging and hydrogen fueling infrastructure is on-track to meet 2025 goals.
- The state and its partners are making significant progress with investments in ZEV infrastructure.
- More work is needed to reach underserved communities and regions.
- Self-sustaining business models are most likely to occur in areas with high ZEV adoption rates; support is needed elsewhere.

Next Steps

- Complete report in early 2015
  - Expand on current work
  - Equipment and installation costs, and cost recovery opportunities
  - Parking structure design for vehicle-to-grid integration
  - Codes and Standards progress/challenges
  - Interoperability progress
  - Board update in Summer 2015
- Annual AB 8 Hydrogen Infrastructure Assessments each July

We'll continue to keep you posted…