

The Alternative Fuel Experience

Fitting the technology to the application

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About PG&E

Who we are

Gas & electric utility based in San Francisco

23,000 employees

Over 70,000 sq. mile service territory

16 million customers

Generation

More than 4,000 megawatts through hydroelectric, fossil & renewable generating facilities

Over 2,000 megawatts produced by Diablo Canyon Nuclear Power Plant

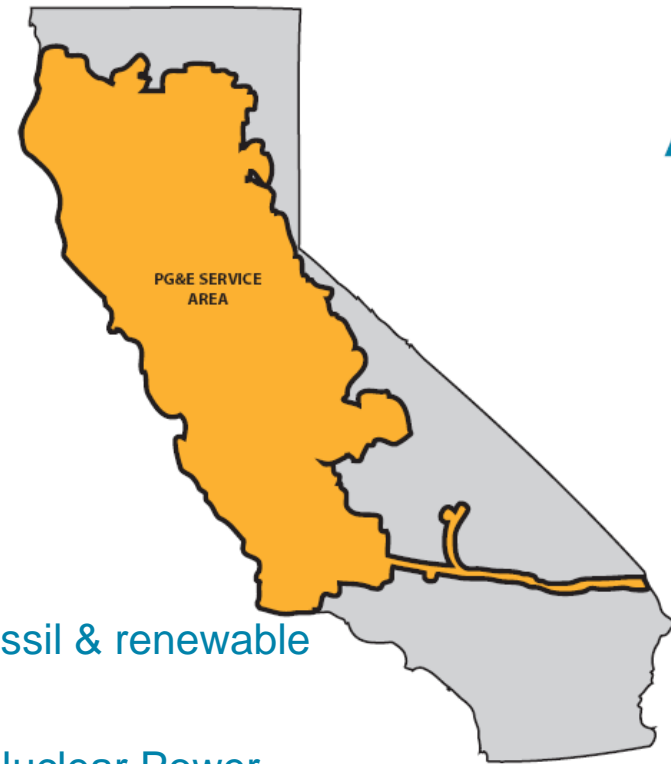
Transmission and distribution

More than 141,215 circuit miles of electric lines.

More than 42,141 miles of natural gas pipelines.

5.1 million electric customer accounts.

4.3 million gas customer accounts.



PG&E Fleet Current State

Almost 14,000 assets of which more than 10,000 are on-road/off-road vehicles of all classes. 33% are alternative fueled or high efficiency vehicles.

PG&E is ranked in the top quartile of green fleets nationwide.

Alt Fuel Vehicle Technology mix

ePTO	746
Electric (on- and off-road)	117
Hybrid (HEV and PHEV)	702
Natural Gas	384
Biodiesel	1,200

Approximately 1 million gallons of B20 biodiesel consumed per year.

CNG Customer = 2.9 M Therms

CNG PG& Fleet = 350K Therms



The Potential of Alternative Fuels

Opportunity	Petroleum	Natural Gas	Hybrid	PHEV	Electric
Fuel Savings	Red	Yellow	Yellow	Green	Green
No Range Limitations	Green	Yellow	Green	Green	Red
No Fueling Infrastructure Issues	Green	Red	Green	Green	Red
Nox Reduction	Red	Yellow	Yellow	Green	Green
Particulate Matter Reduction	Red	Yellow	Yellow	Green	Green
Extended Work Days	Red	Red	Red	Green	Green
Fuel CAGR Price Protection	Red	Yellow	Yellow	Green	Green
Idle Reduction	Red	Red	Yellow	Green	Green
Extended Useful Lives	Red	Yellow	Red	Green	Green
Job Site Power Supply	Red	Red	Red	Green	Yellow
Exportable Power	Red	Red	Red	Green	Red
EPA Act	Red	Green	Red	Yellow	Green
ZEV	Red	Red	Red	Yellow	Green
Acquisition Cost	Green	Yellow	Yellow	Red	Red

Alternative Fuels – Why the Time is Now

The obvious reasons

- National security
- Transfer of wealth
- Domestic fuel production
- Reduced dependence on foreign oil

- Fuel price volatility
 - 15 year is 7.5%
 - 4 year is 12%

- Emissions reduction targets
 - CARB Compliance
 - EPA Act Compliance
 - ZEV Mandates

The not so obvious reasons

- Economic development and job creation

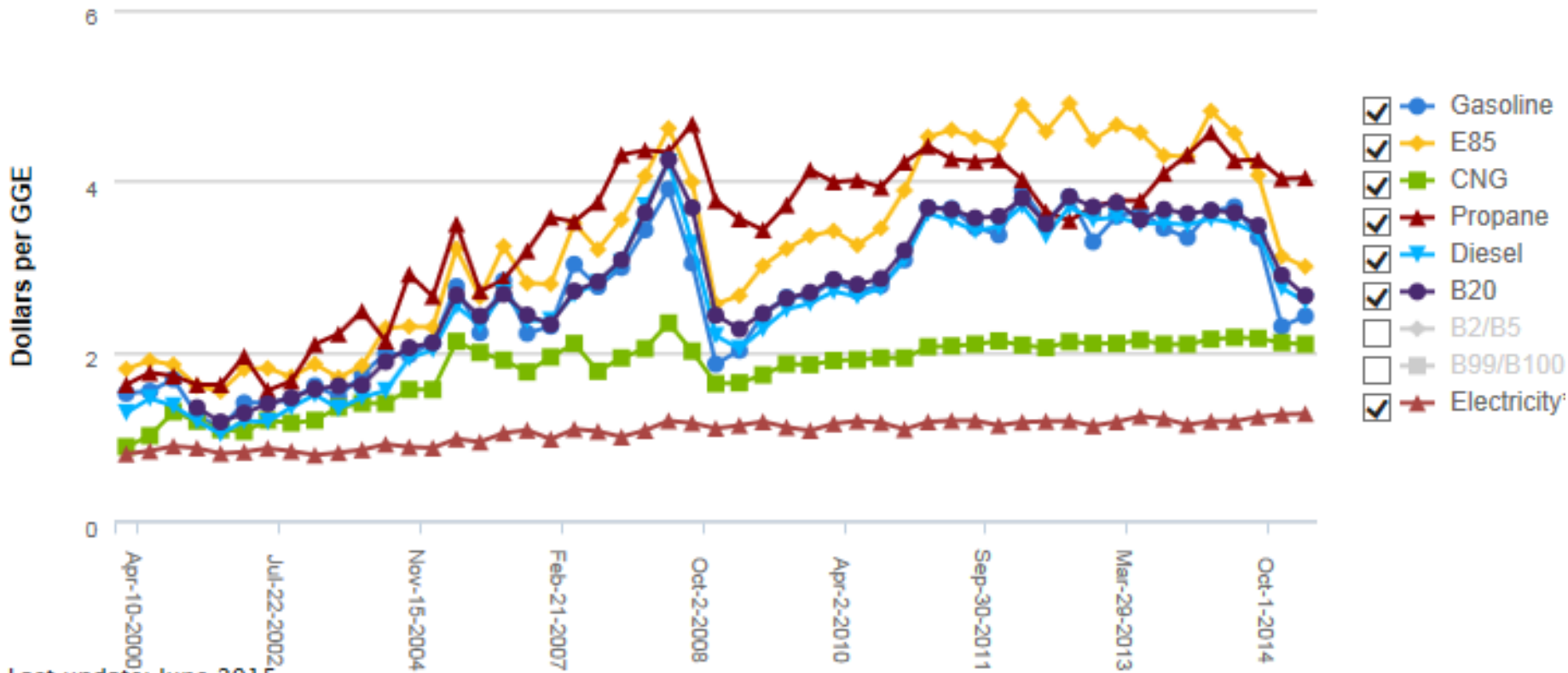
- Potential to extend vehicle useful life (some fuels)

- Improved operating costs (some fuels)
 - Lower fuel consumption
 - Lower maintenance costs

If it's about the money...

Average Retail Fuel Prices in the U.S.

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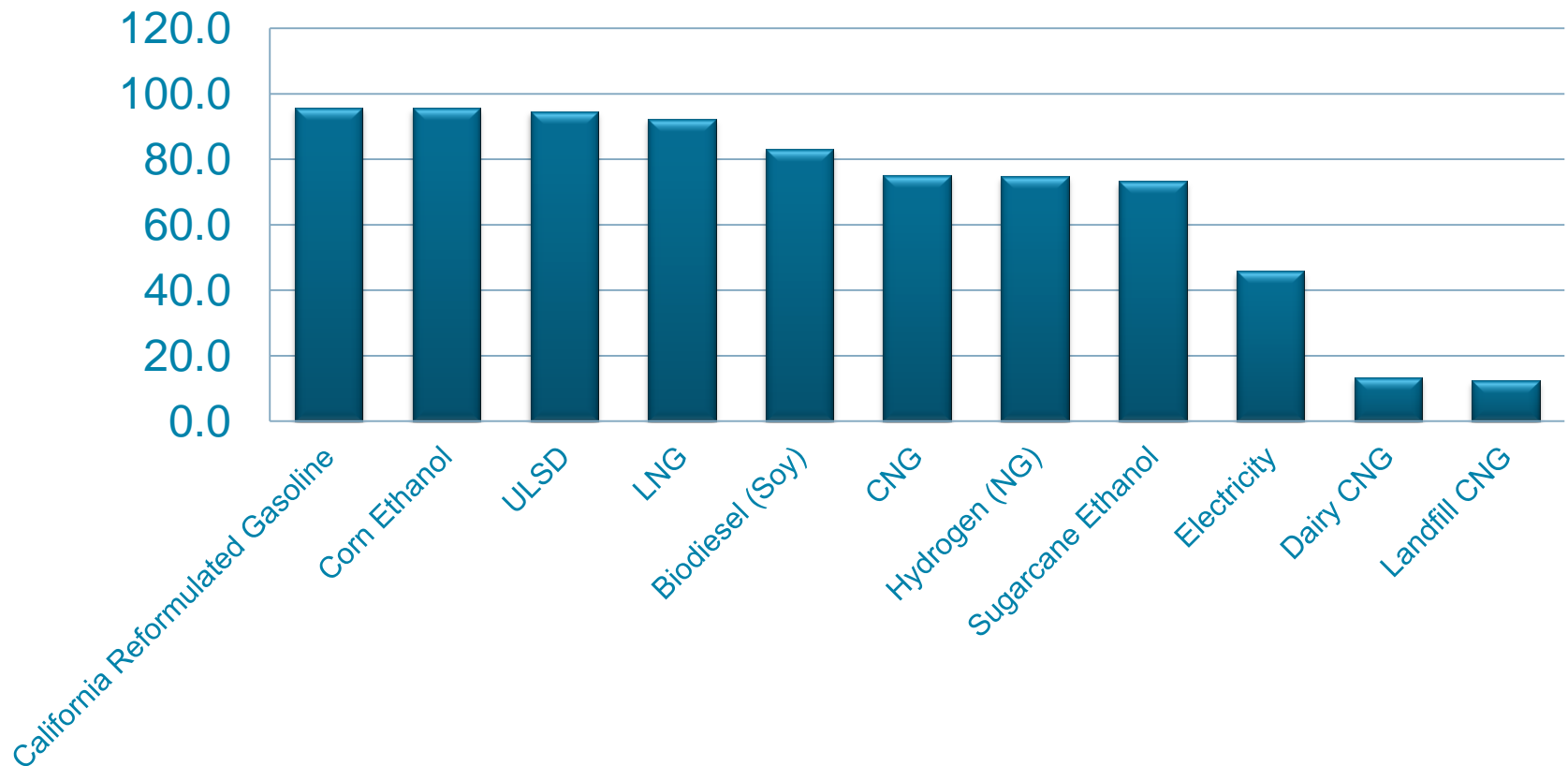
Source: Clean Cities Alternative Fuel Price Reports

Notes: Fuel volumes are measured in gasoline-gallon equivalents (GGEs), representing a quantity of fuel with the same amount of energy contained in a gallon of gasoline. *Electric prices are reduced by a factor of 3.4 because electric motors are 3.4 times more efficient than internal combustion engines.

This chart shows average monthly retail fuel prices in the United States from 2000 to 2014. The price of petroleum fuels (gasoline and diesel fuel) is the primary driver of overall fuel prices. For as petroleum prices rise, so does demand for alternative fuels, thereby pushing their prices upward as well. However, natural gas and electricity prices have been buffered from this driver because transportation only constitutes a tiny portion of their markets. These two fuels are tied to each other, though, because over a quarter of all electricity is produced from natural gas.

If it's about the environment...

Total Carbon Intensity



Data source: California's Low Carbon Fuel Standard Final Regulation Order, April 15, 2010

PG&E's Technology Strategy

- Any technology must meet the operating needs of the business
- For every technology we develop a business model that includes potential operating savings or safety impacts and potential cost impacts
- Because no fuel or technology can provide a single solution to our fuel dependency, emissions, and operational needs, we use a blended technology portfolio approach. Each technology is matched with the appropriate application.
- We remain actively involved in the development, demonstration and application of alternative fuel and idle reduction technologies

Alt Fuel Implementation

Development of a comprehensive rollout plan is critical to the success of your alternative fuel vehicle implementation

- Technology identification
- Matching technology to current business needs
- “Engineering” vehicles
- Identifying potential placement locations
- Constructing “flexible, expandable” infrastructure
- Provide a systematic rollout to clients and garages
- Provide over-all communications to all stakeholders on project
- Continue to seek outside funding for vehicles and infrastructure

History Of NGVs At PG&E

1970s – Early conversions

1980s – NGV program growth

1990s – Full NGV program

- Early focus on conversions
- OEM light duty products later

2000s – Expansion into MD/HD vehicles

- At our peak we had over 1,000 NG vehicles

2010s – Moving away from LD and dedicated.

- Interested in a bi-fuel underbody tank pickup.



The pros and cons of **NATURAL GAS**





The Good News about NG

- In recent years, 80% to 90% of the natural gas used in the United States was domestically produced.
- CNG and LNG are considered alternative fuels under the Energy Policy Act of 1992.
- CNG is trending around \$2.25 per GGE in our service territory.
- Compared with vehicles fueled by conventional diesel and gasoline, natural gas vehicles can produce lower levels of some emissions. And because NG fuel systems are completely sealed, NG vehicles produce no evaporative emissions.
- A wide variety of new, heavy-duty natural gas vehicles are available from U.S. original equipment manufacturers (OEMs). The number of light-duty natural gas vehicles from original equipment manufacturers are limited but growing.
- NG conversions are readily available.
- Current generation of equipment is much more reliable than first generation.



NG Barriers

- Fueling infrastructure is the largest limitation. Stations are expensive to install and maintain.
- Range limitation due to storage and density.
- Still significant premium on capital vehicle purchase.
- Higher maintenance costs due to durability and parts availability.
- Lack of qualified technicians and service centers.
- CNG may require you to specify a larger truck (for fuel storage) than you would specify for diesel.
- NG is currently equivalent to clean diesel technology in terms of emissions.
- Political climate in some states. CNG doesn't meet the definition of ZEV in the 10 state MOU: California, Connecticut, Maryland, Maine, Massachusetts, New Jersey, New York, Oregon, Rhode Island and Vermont + Washington D.C

NG vs. Electricity

NG

- \$2.25/gal for PG&E NG
- Speed of fill varies from 3 min to 8 hrs.
- Fast fill NG stations can serve many vehicles, but costs can vary dramatically (up to \$6M) depending on the location and infrastructure needs.

Electricity

- \$1.00 /gal for the Volt at \$0.06/kWh
- Charge time from 20 minutes to 8 hours
- Charging points (EVSE) for an electric vehicle costs \$2-3k per unit, but running the cable to the chargers can be incredibly expensive.

Convenience vs. Coverage

- We have a coverage model of CNG fueling stations in the San Francisco Bay Area. PG&E owns 33 CNG fueling sites
- Stations are spaced along main thoroughfares so travelers can fuel at half way points on common trips
- When a station is down for maintenance (planned or unplanned) drivers must travel 20-30 miles out of the way just to get enough fuel to complete their trip
- Gas stations are placed on a convenience model. They have a 100-year head start on convenient locations and density of service.



Why alternate fuels can be a challenge for most light duty utility fleets

\$10,000 premium price for CNG pick-up

Average mpg standard gasoline: 17

Average mpg CNG: 19

Average miles per year in utility industry: 11,000

Gasoline to CNG Discount: \$1.50 (\$3.75 to \$2.25)

11,000 miles / 17 mpg = 647 gal. gasoline

647 x \$3.75 = \$2426

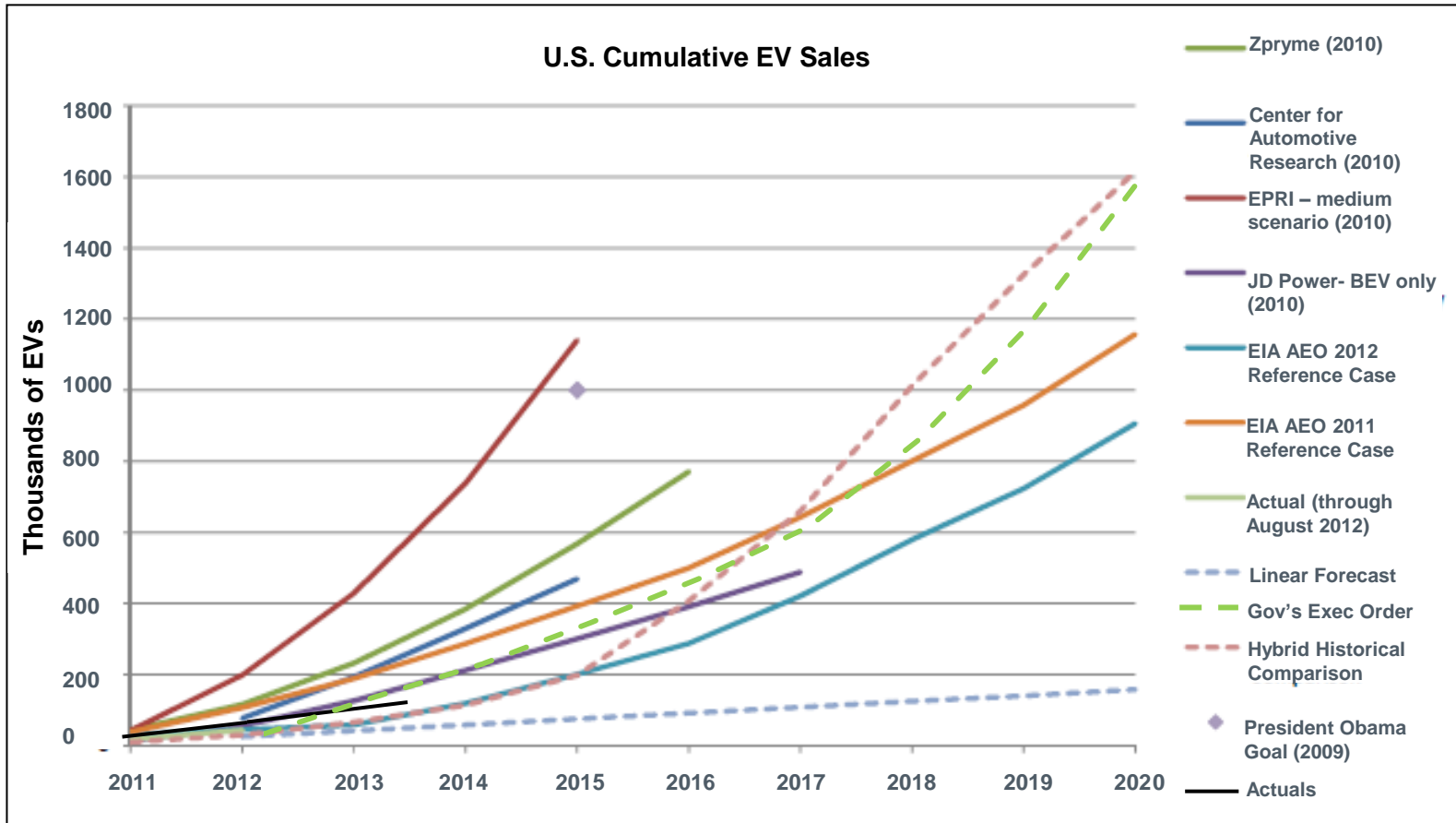
11,000 miles / 19 mpg = 579 gal. CNG

579 x \$2.25 = \$1303

\$2426 - \$1303 = \$1123 savings per year

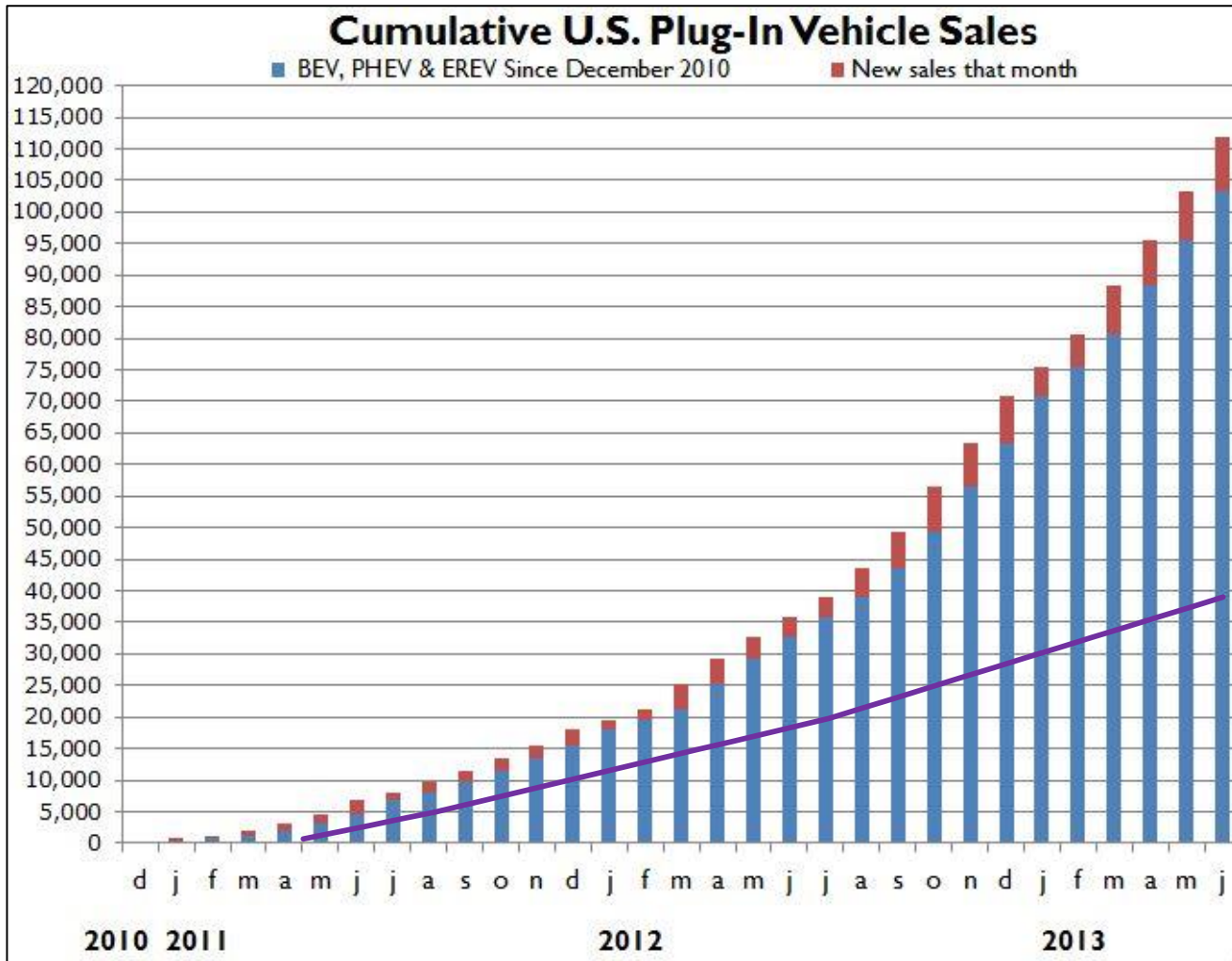
\$10,000 / \$1123 = 8.9 yr. payback

Future EV adoption is unknown, and predictions vary widely, but.....



Source: <http://www.mwcog.org/uploads/committee-documents/IV1cXI5c20121002092155.pdf>

EV adoption is growing, and is outpacing historical hybrid car adoption

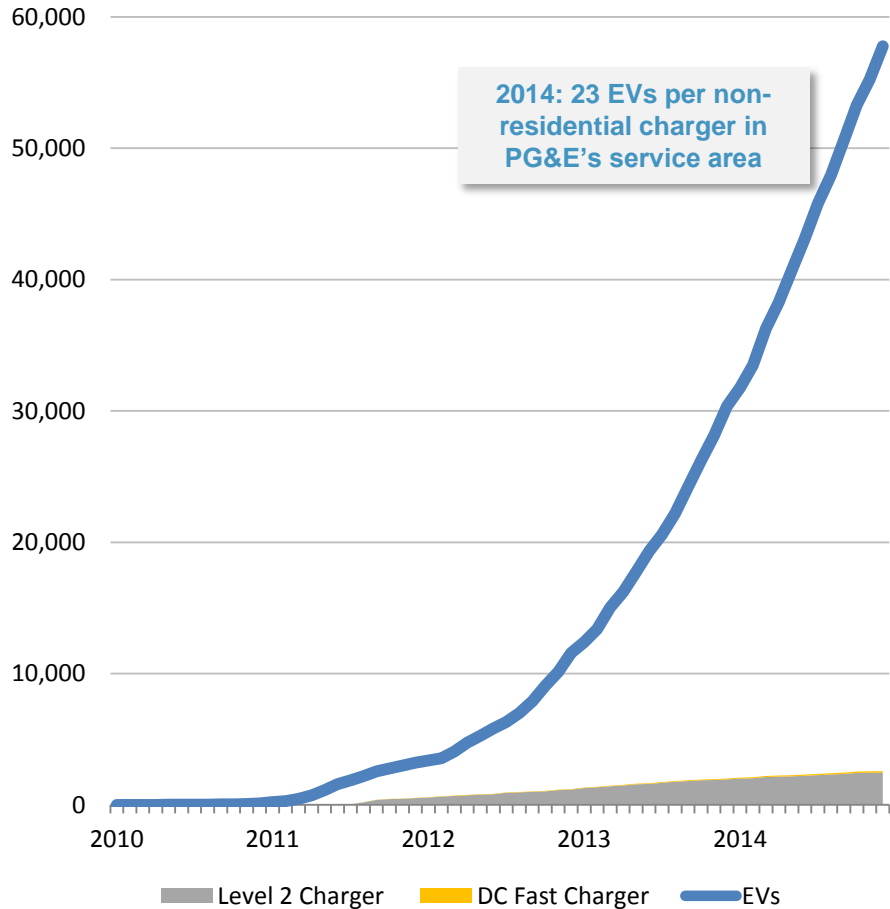


Hybrids

Source: Electric Drive Transportation Association

Public charging infrastructure is not keeping pace with EV adoption in California

Cumulative EV registrations¹ and charger deployments²
in PG&E service area



Key EV challenges today

- Higher upfront cost of EVs relative to conventional vehicle
- Range anxiety and lack of available charging infrastructure
- Charging availability for customers in multi-unit dwellings and workplaces
- Lack of easily-accessible customer information about EVs
- High infrastructure upgrade costs for commercial and fleet customers

Utility can play key role in addressing

1. EPRI, R.L. Polk Data, Dec. 2014

2. PlugShare © data, 2014

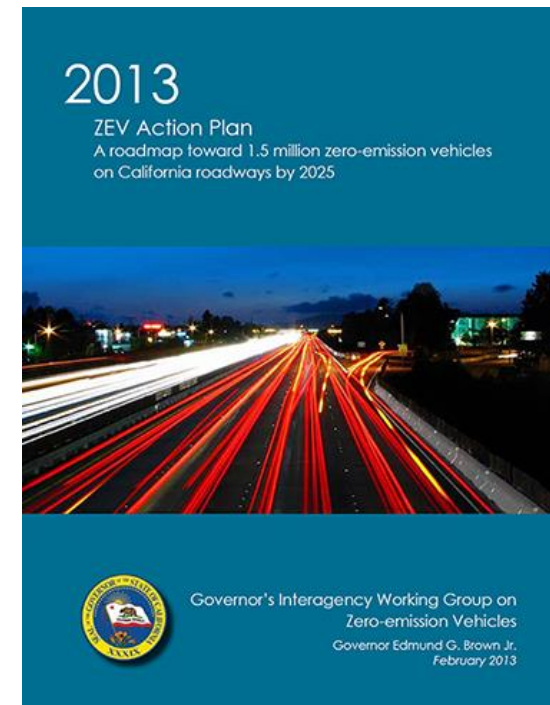
Electric vehicle market is gaining momentum, and California is focused on accelerating adoption

Electric Vehicle (EV) Market Conditions

- EV offerings are growing significantly each year (20+ models on the market today; 30+ planned for 2016)
- Sales growth limited by high vehicle cost and range anxiety
- EV adoption is outpacing infrastructure deployments

State Focus on EV Adoption

- January 2013: Governor Jerry Brown issued the Zero Emission Vehicle (ZEV) Action Plan calling for 1.5 million ZEVs in California by 2025, and the infrastructure to support 1 million EVs by 2020
- December 2014: California Public Utilities Commission (CPUC) repealed 2011 prohibition on investor-owned utility (IOU) involvement in EV infrastructure market
- January 2015: Governor Brown's inaugural address proposed to reduce petroleum use in cars and trucks by up to 50 percent by 2030



Future of CNG/LNG

Marketplace

- Class 8's over the road
- Marine
- Drayage
- Short duration non-attainment areas

PG&E

- Light Duty: more towards electric
- Heavy Duty – no clear NG benefits
- Tanks are a problem w/CNG – Vehicles are not bad but the tank... Have throw vehicle out

Thank you

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