

UCLA Luskin School *of* Public Affairs

Luskin Center for Innovation

California State Legislative Briefing: Plug-in Electric Vehicles

19 March 2014

Union of Concerned Scientists Legislative Briefing on
Electric Vehicles in California
Sacramento, CA

Brett Williams, MPhil (cantab), PhD

EV & Alt. Fuel Program Director, Luskin Center for Innovation
Assistant Adjunct Professor, Public Policy
University of California, Los Angeles

innovation.luskin.ucla.edu/ev

Outline

- Plug-in electric vehicles (PEVs):
 - What exists is possible: Current PEVs
 - “Managing EV Expectations”: Market status
 - Impact: Electric miles
- Charging infrastructure
- Electricity as a fuel

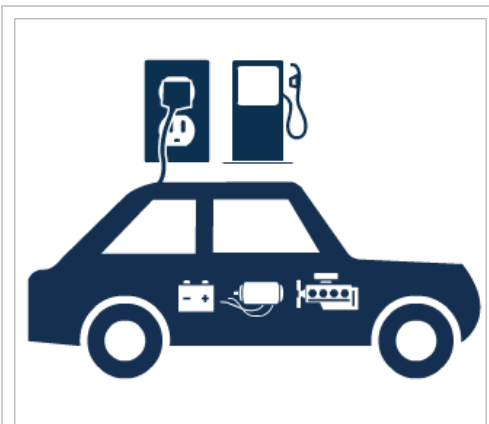
UCLA Luskin Center Activities Overview

- **PEV market dynamics**
 - Market blog
 - New-car-buyer survey
 - ZEV Sales Factors
 - Rebate design alternatives
- **Regional PEV readiness planning**
 - Won state best-practices, American Planning Association award
- **Charging-station analysis**
 - Workplace & Multi-unit-dwelling station financial viability and fueling costs
 - Utilization
 - Station siting
- **Emerging opportunities:** Mobile Electricity & Battery secondary use and V2G
- **Transportation Electrification Curriculum Roadmap**

“Electric Vehicles”

- **Plug-in EVs (PEVs)** —i.e., electric-fuel vehicles—comprise *both* **plug-in-hybrid EVs** and **all-battery EVs**
- Many common components under the hood, but different products for the consumer with distinct policy implications...

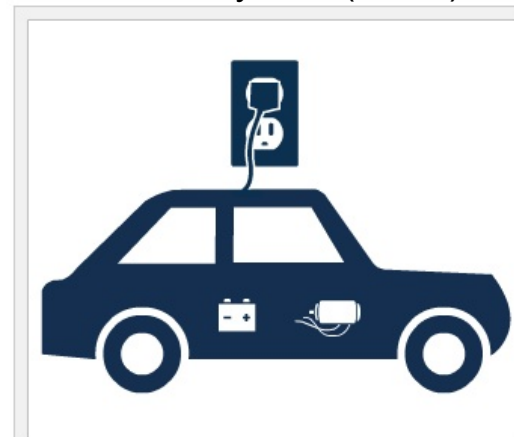
Plug-in-hybrid EVs (PHEVs)



Plug It in or Fill It Up

Plug-in hybrid electric vehicles have an internal combustion engine and electric motor. These vehicles are powered by an alternative fuel or a conventional fuel, such as gasoline, and a battery, which you can plug in to charge.

All-battery EVs (BEVs)








No More Gasoline

All-electric vehicles are plugged in to charge the battery, which stores the electricity that powers the electric motor.

<http://www.afdc.energy.gov/vehicles/electric.html>






Plug-in-hybrid EVs (1 of 3, in order of release)

bdw@ucla.edu	Vehicle	MSRP	Fuel economy* (gas–electric)	Range* (electric, total)
	GM Chevy Volt	\$34,185	37–98 mpg _e	38 e-mi 380 mi total
	Toyota Prius Plug-in	\$29,990	50–95 mpg _e	11 e-mi 540 mi total
	Ford C-Max Energi	\$32,950	43–100 mpg _e	21 e-mi 620 mi total
	Honda Accord Plug-in	\$39,780	46–115 mpg _e	13 e-mi 570 mi total
	Ford Fusion Energi	\$34,700	43–100 mpg _e	21 e-mi 620 mi total

*EPA rating






(photos and MSRPs from OEM websites 2/14)

Plug-in-hybrid EVs (2 of 3, in order of release)






bdw@ucla.edu	Vehicle	MSRP	Fuel economy (gas–electric)	Range (electric, total)
	Porsche Panamera S E-Hybrid	\$99,000	~30–72 mpg _e	20 e-mi (NEDC) >220 mi total
	GM Cadillac ELR	\$75,000	33–82 mpg _e *	37 e-mi* 340 total*
	Hyundai Sonata Plug-in Hybrid	TBD in 2014		
	Mitsubishi Outlander P-HEV	TBD in 2014		
	Mercedes S 500 Plug-in Hybrid	TBD in 2014		

*EPA rating

Plug-in-hybrid EVs (3 of 3, in order of release)

bdw@ucla.edu	Vehicle	MSRP	Fuel economy (gas–electric)	Range (electric, total)
	Volvo V60 PHEV	TBD in 2014		
	VW Golf twinDRIVE	TBD in 2014		
	Audi A4 e-quattro	TBD in 2014		
	Audi A3 e-tron	TBD in 2014		
	BMW i8	TBD in 2015		






All-battery EVs (1 of 3, in order of release)

bdw@ucla.edu	Vehicle	MSRP	Fuel economy* (gas–electric)	Range* (electric, total)
	Nissan LEAF	\$28,800	116 mpg _e	75 e-mi
	smart electric	\$25,000	107 mpg _e	68 e-mi
	Mitsubishi i	\$29,125	112 mpg _e	62 e-mi
	Ford Focus Electric	\$35,170	105 mpg _e	76 e-mi
	Tesla Model S	\$71,070	95 mpg _e	208 e-mi

*EPA rating

(photos and MSRPs from OEM websites 2/14)






All-battery EVs (2 of 3, in order of release)

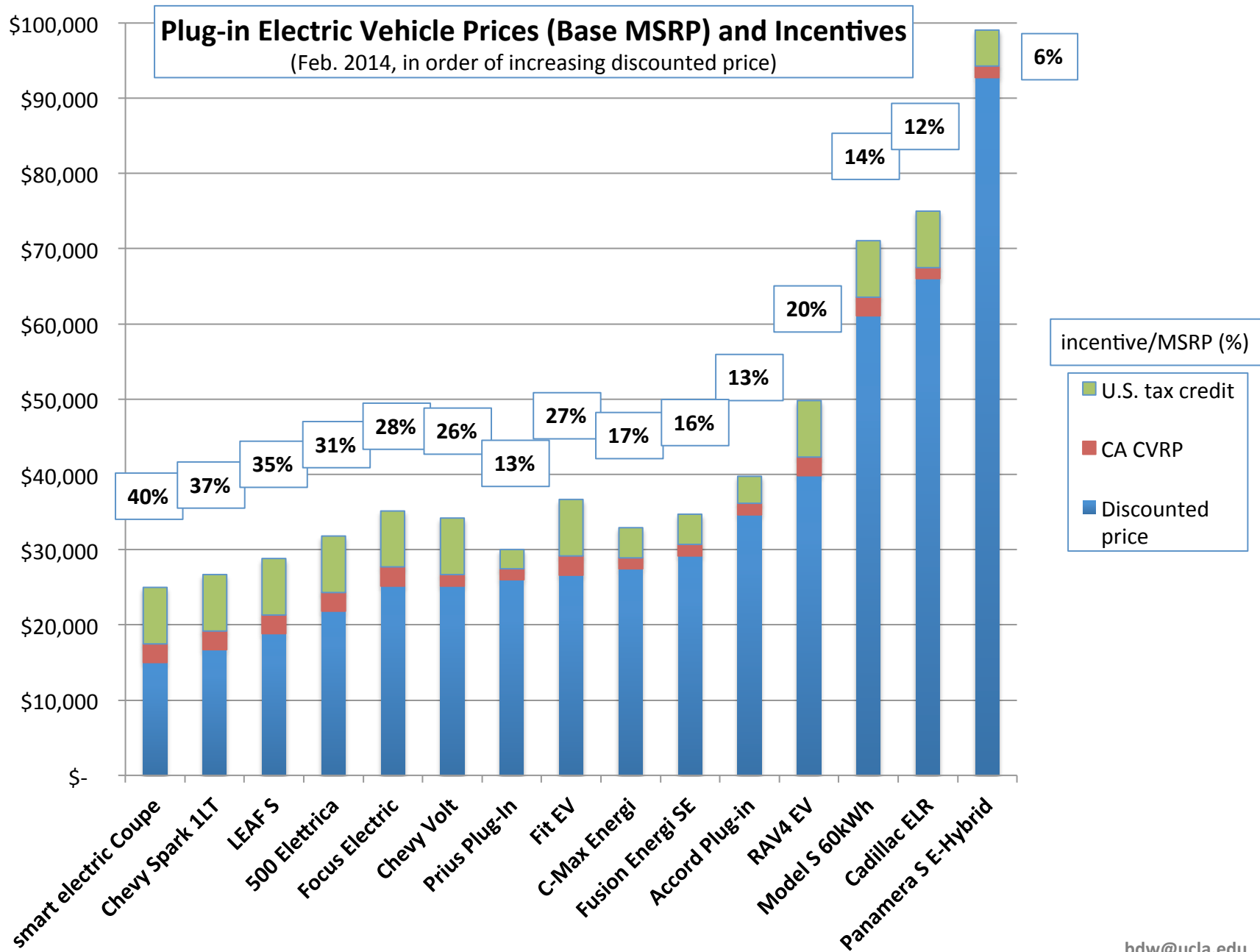
bdw@ucla.edu	Vehicle	MSRP	Fuel economy* (gas–electric)	Range* (electric, total)
	Honda Fit EV	\$36,625	118 mpg _e	82 e-mi
	Toyota RAV4EV (Tesla inside)	\$49,800	78 mpg _e	103 e-mi
	Chevy Spark EV	\$26,685	118 mpg _e	82 e-mi
	Fiat 500e	\$31,800	116 mpg _e	87 e-mi
	BMW i3	TBD in 2014		

*EPA rating

(photos and MSRPs from OEM websites 2/14)

All-battery EVs (3 of 3, in order of release)

bdw@ucla.edu	Vehicle	MSRP	Fuel economy (gas–electric)	Range (electric, total)
	Mercedes B-Class Electric			TBD in 2014
	Tesla Model X			TBD in 2014
	VW e-Golf			TBD in 2014
	Kia Soul EV			TBD in 2014
	Infinity LE			TBD in 2014



Managing EV Expectations

How are PEVs doing?

U.S. Plug-in Electric Vehicle Sales Trends & Analysis
Dec 2010 — Feb 2014

Brett Williams, MPhil (cantab), PhD
EV & Alt. Fuel Program Director / Asst. Adj. Professor
bdw@ucla.edu

18-Mar-14

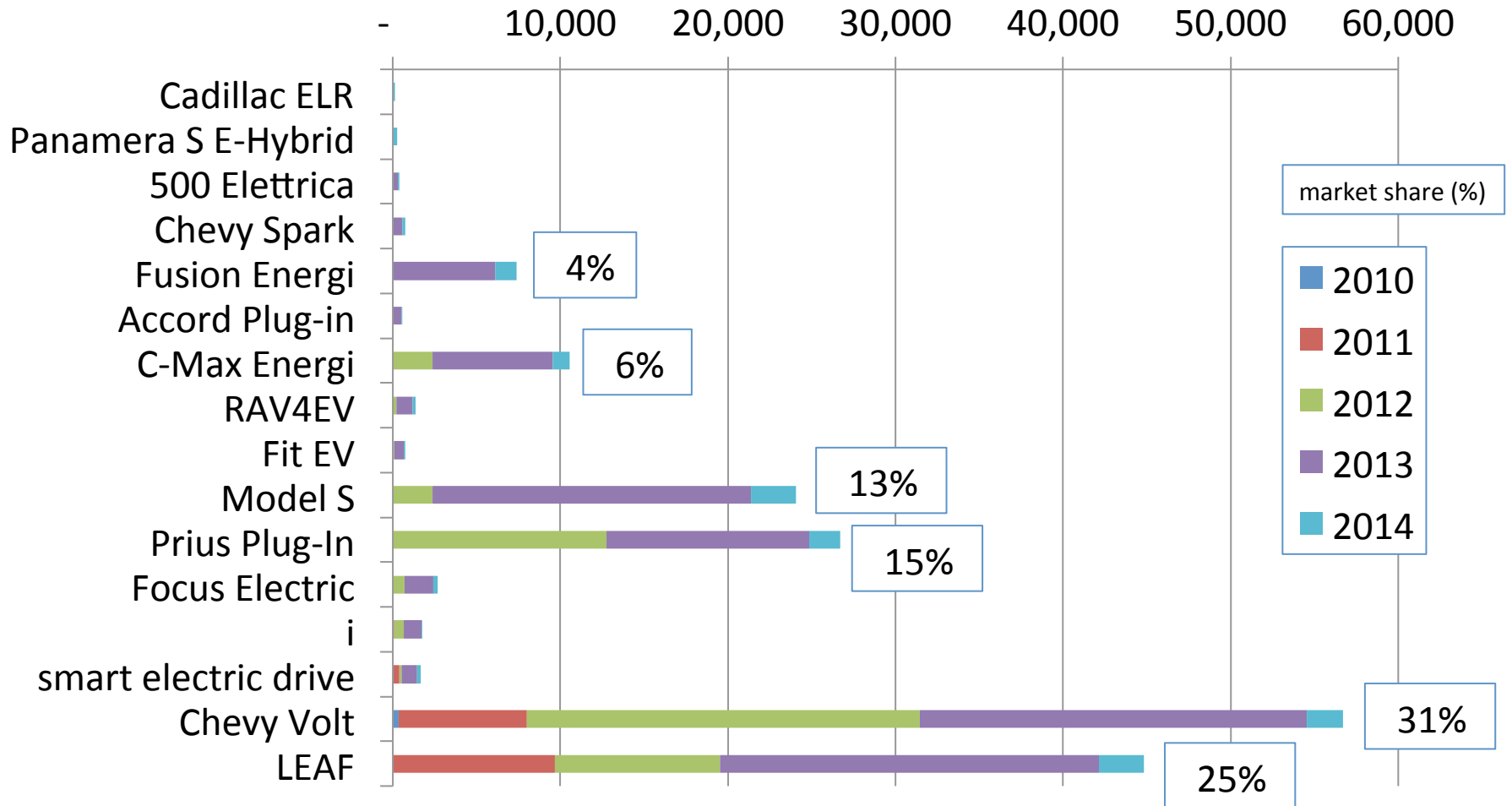
<http://luskin.ucla.edu/blogs/brettwilliams>

Where are we with plug-in electric vehicles (PEVs)?

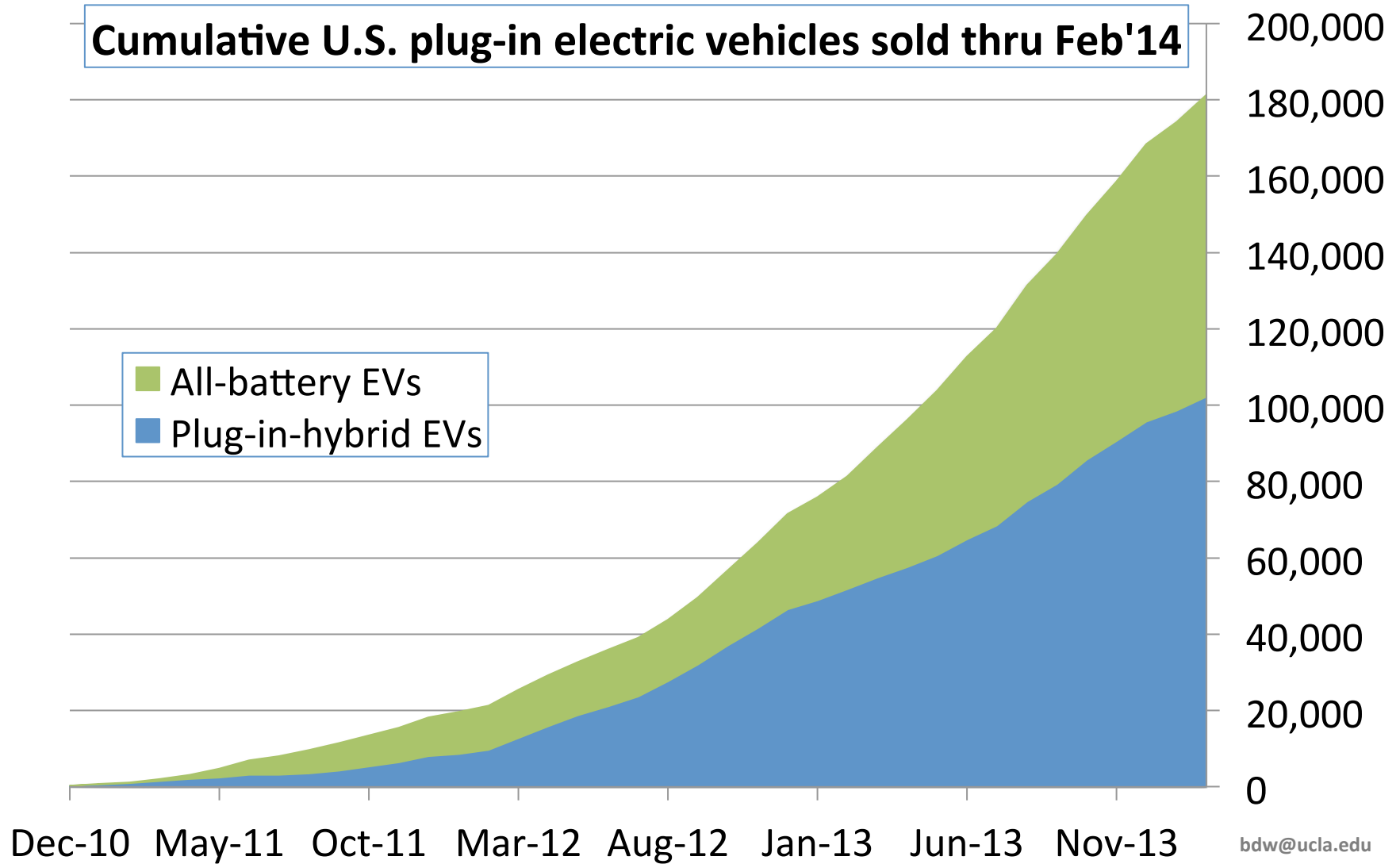
Cumulative U.S. sales

Light-duty U.S. PEVs sold and market share

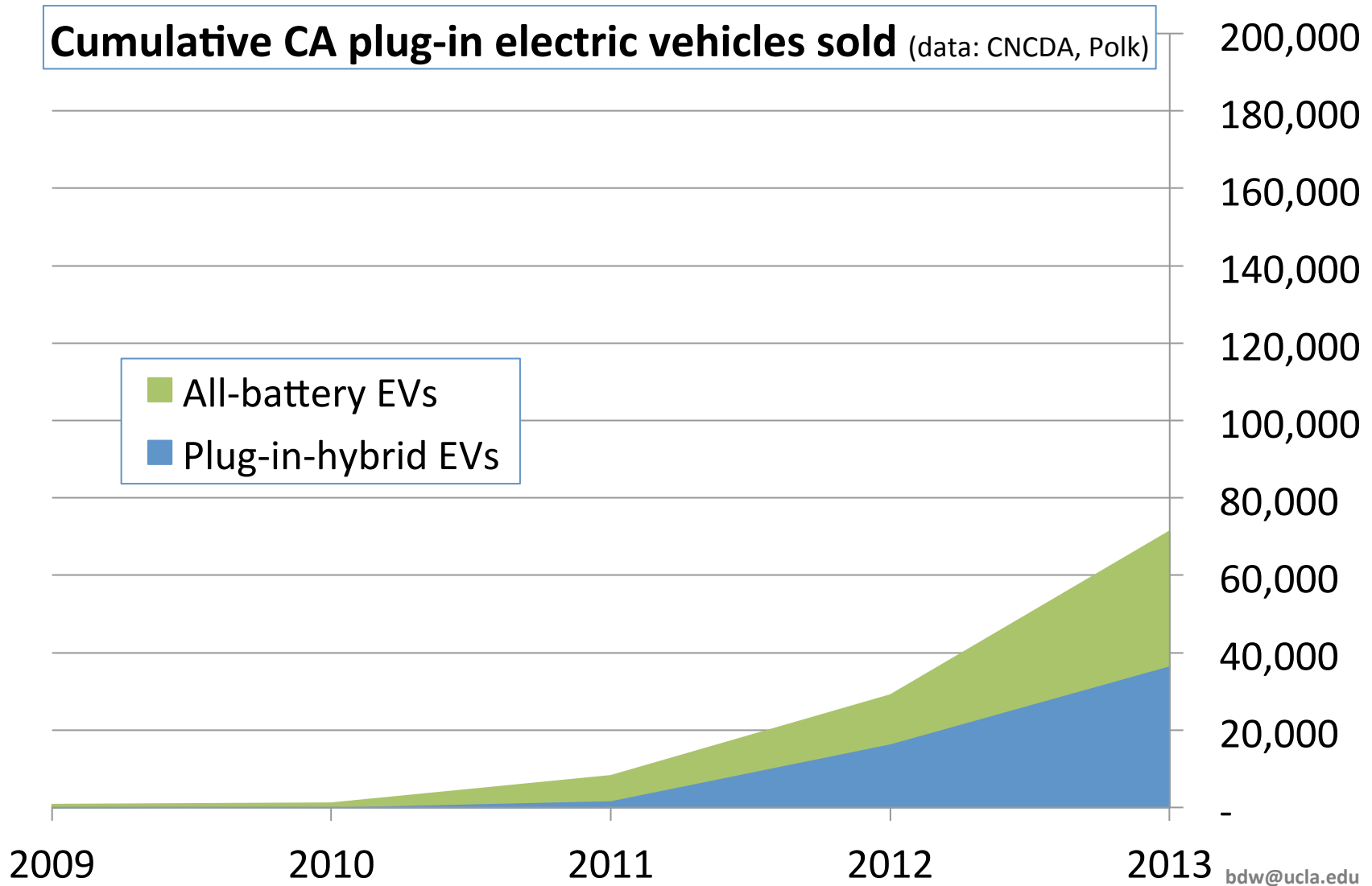
Cumulative plug-in-vehicle sales by calendar year thru Feb'14



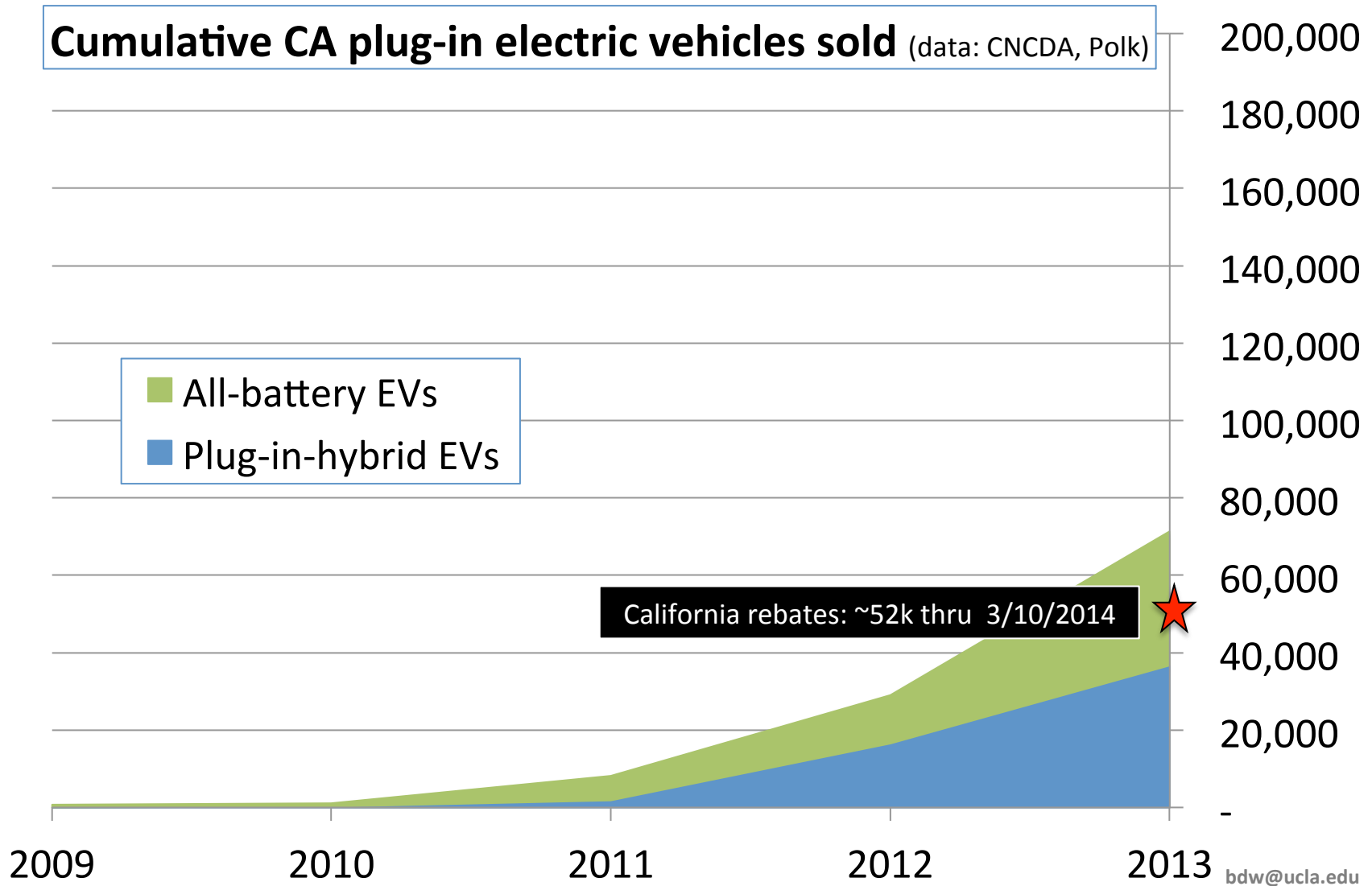
by PEV type



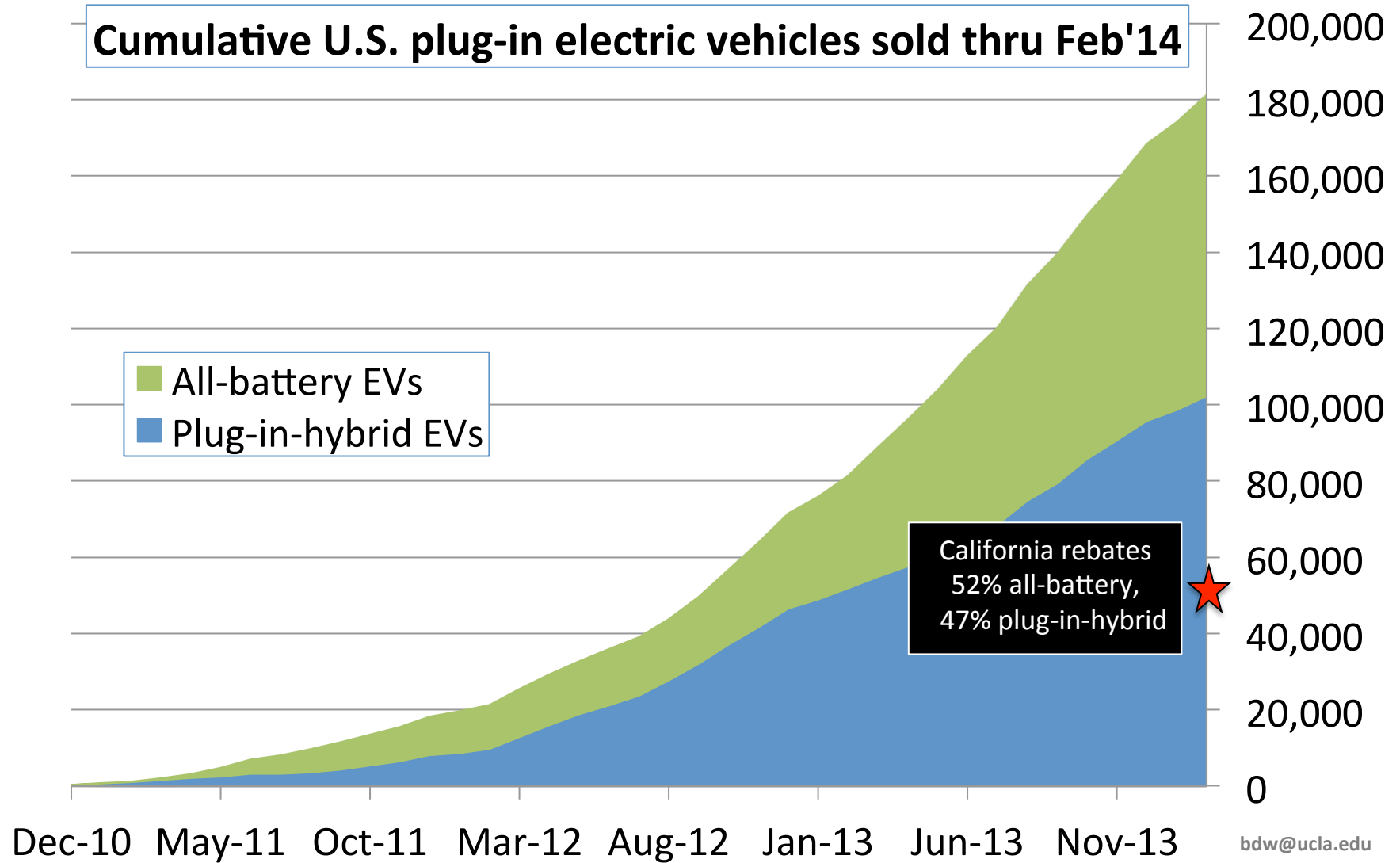
by PEV type, CA



by PEV type, CA

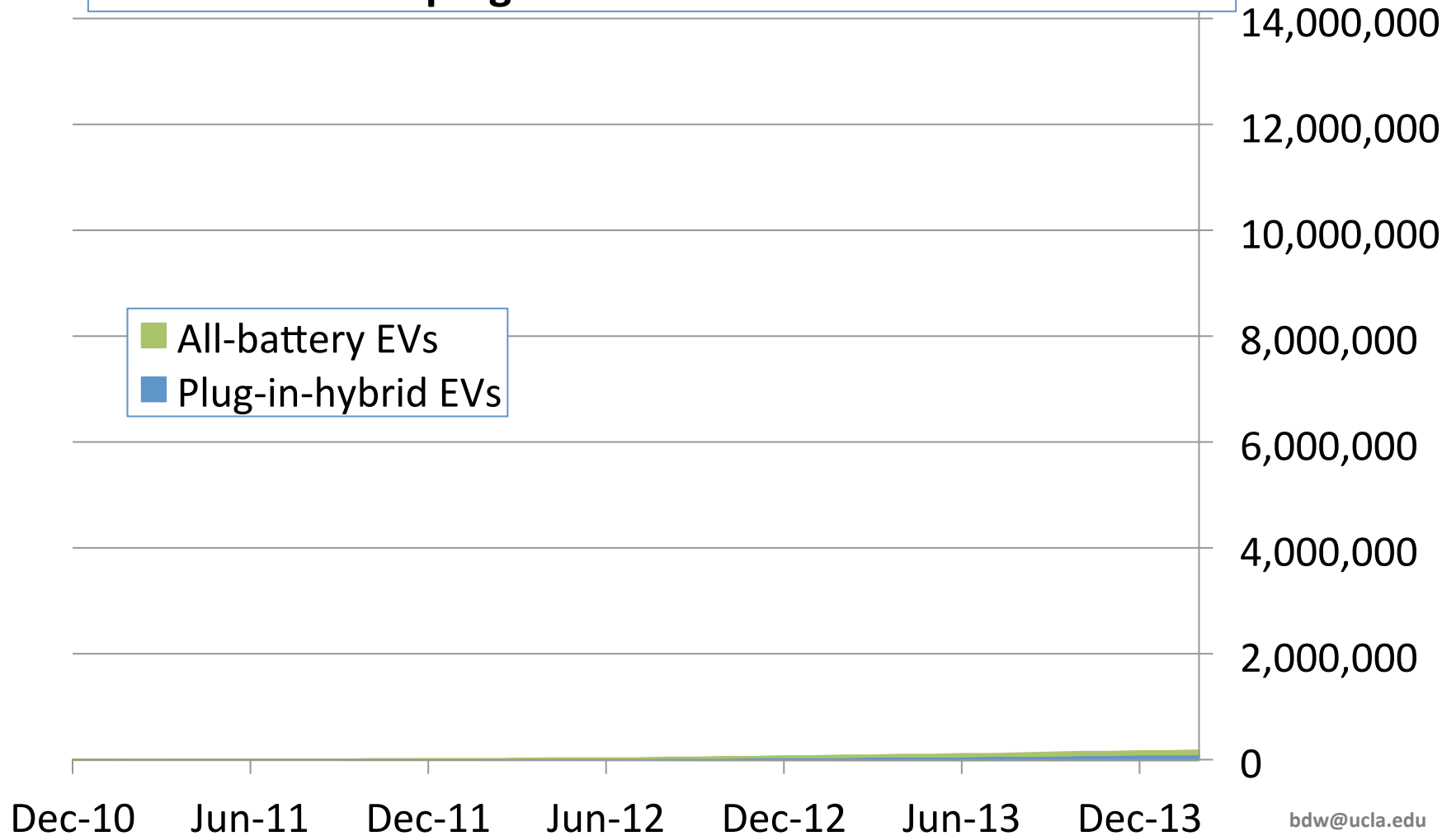


by PEV type

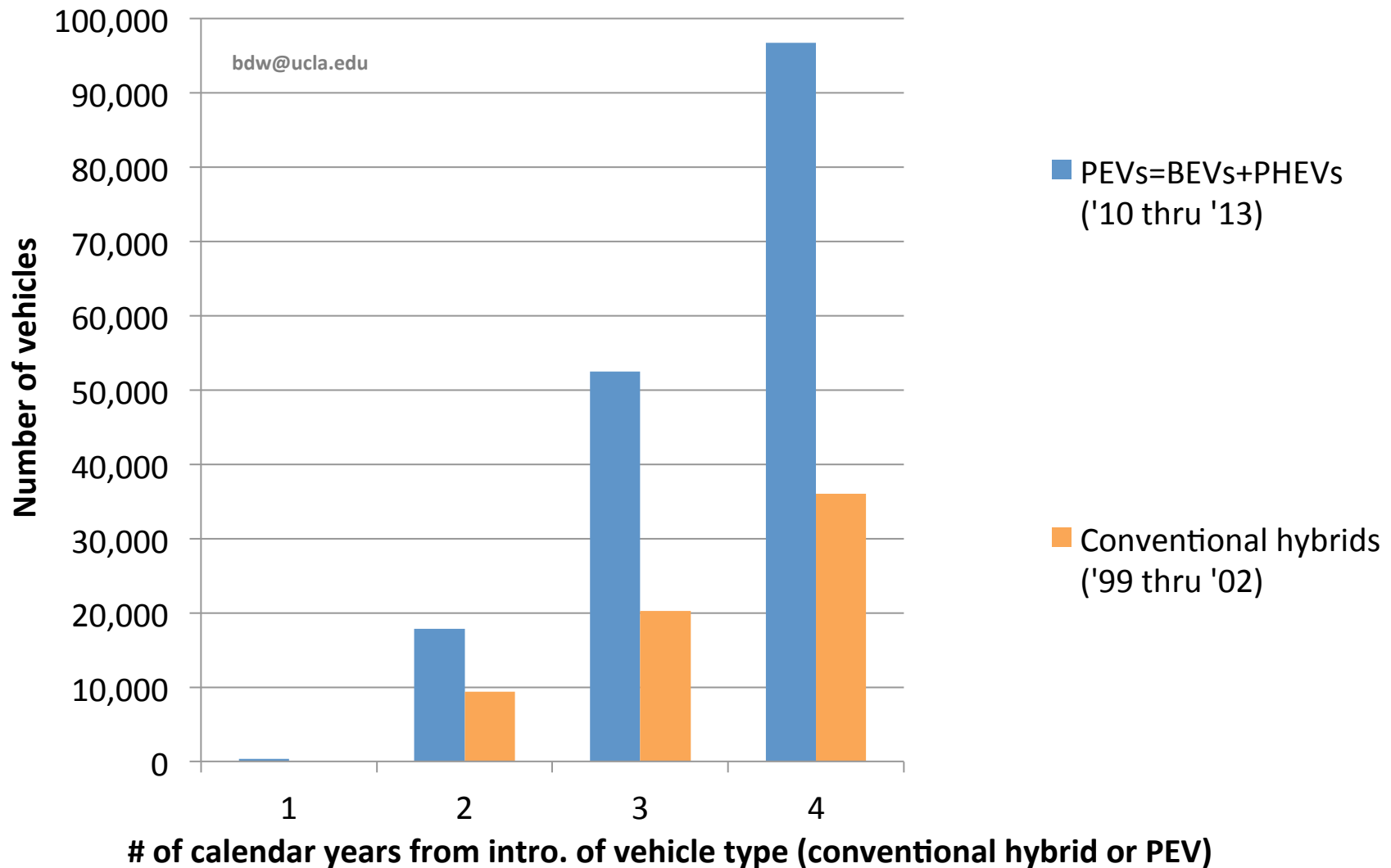


by PEV type

Cumulative U.S. plug-in electric vehicles sold thru Feb'14



U.S. sales by calendar year from introduction of EV type



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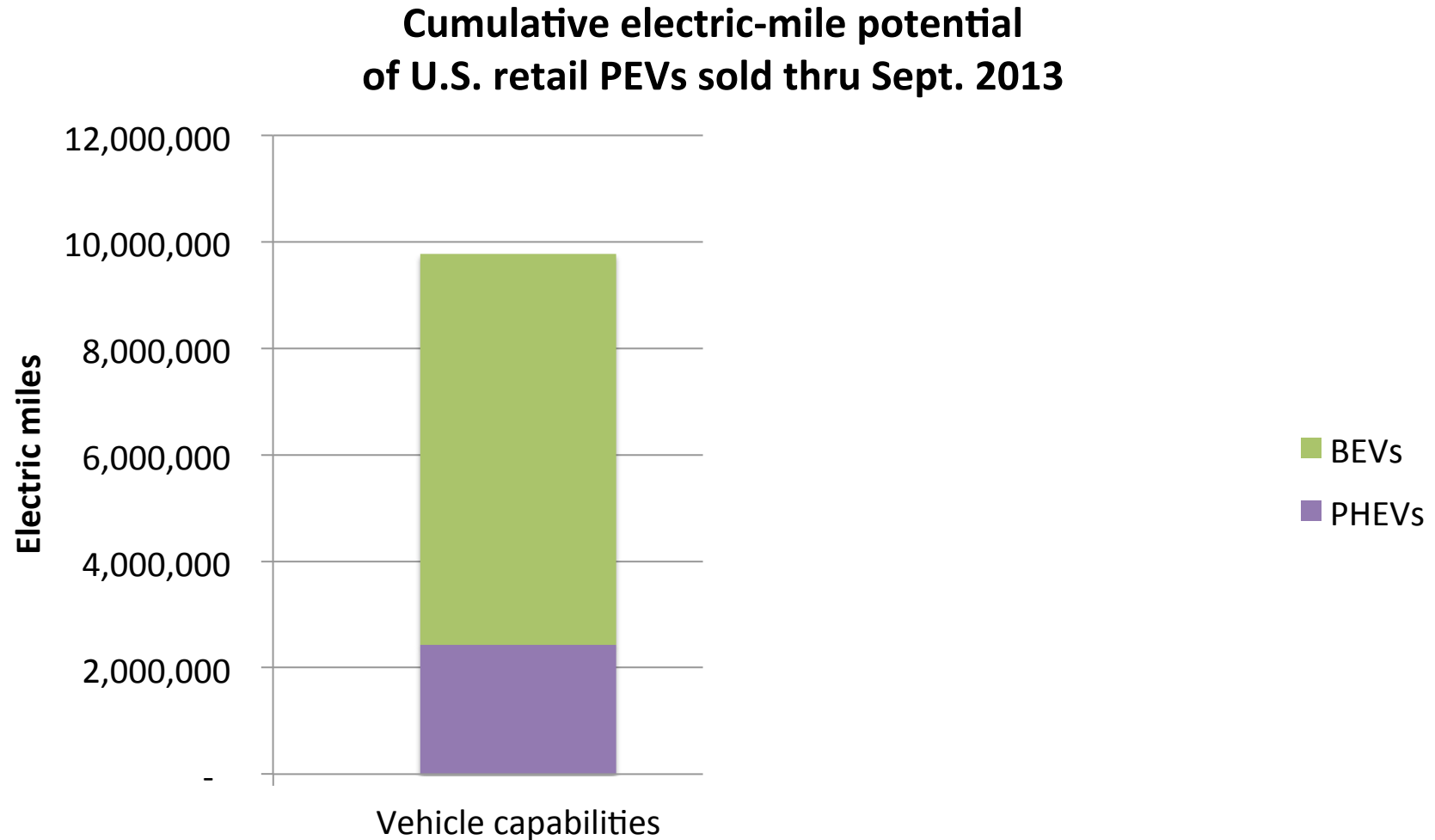
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PEV Impact

Does size matter?

(Williams 2013)

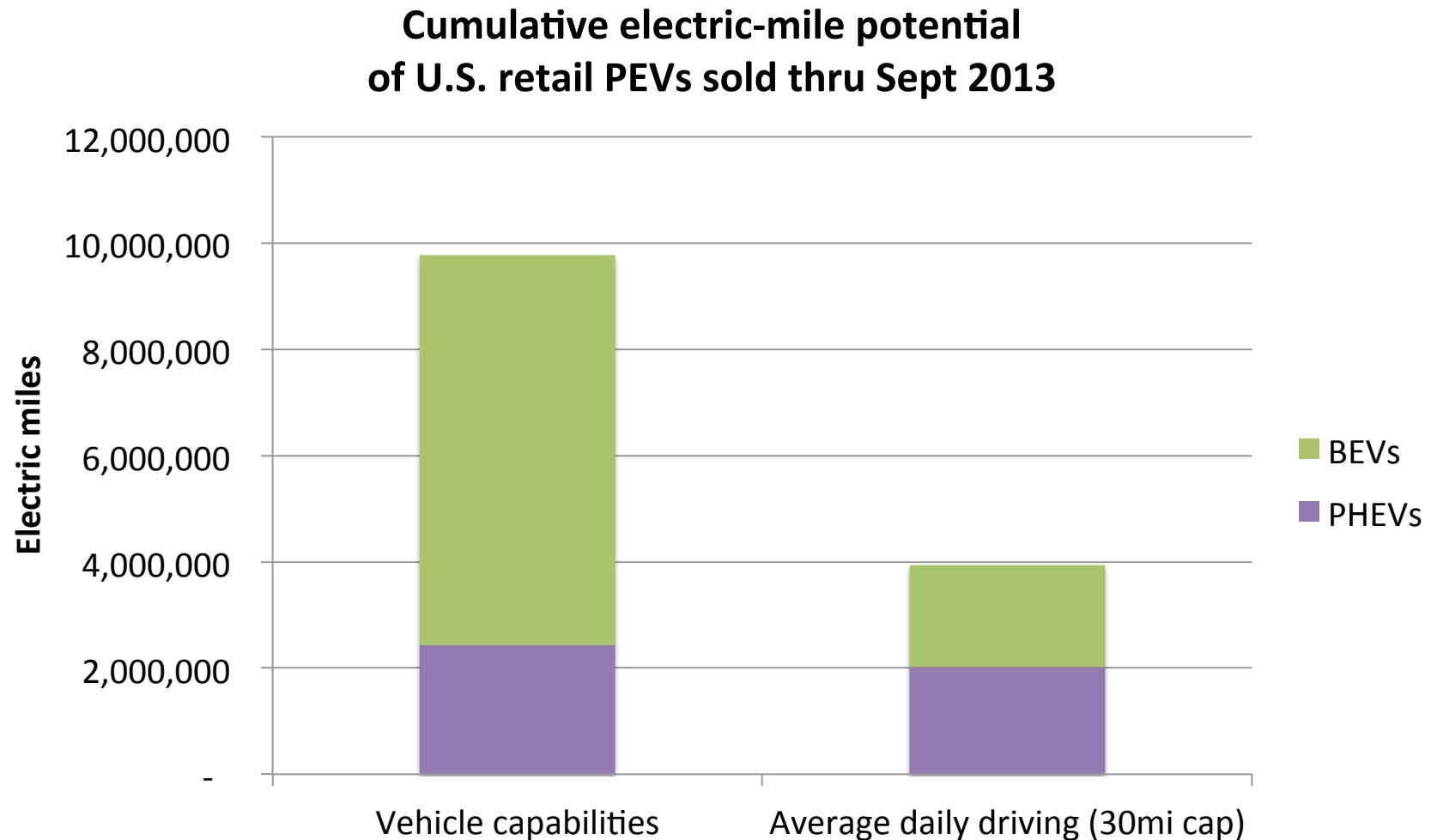
Per-charge and per-day e-mile potential



Does size matter?

(Williams 2013)

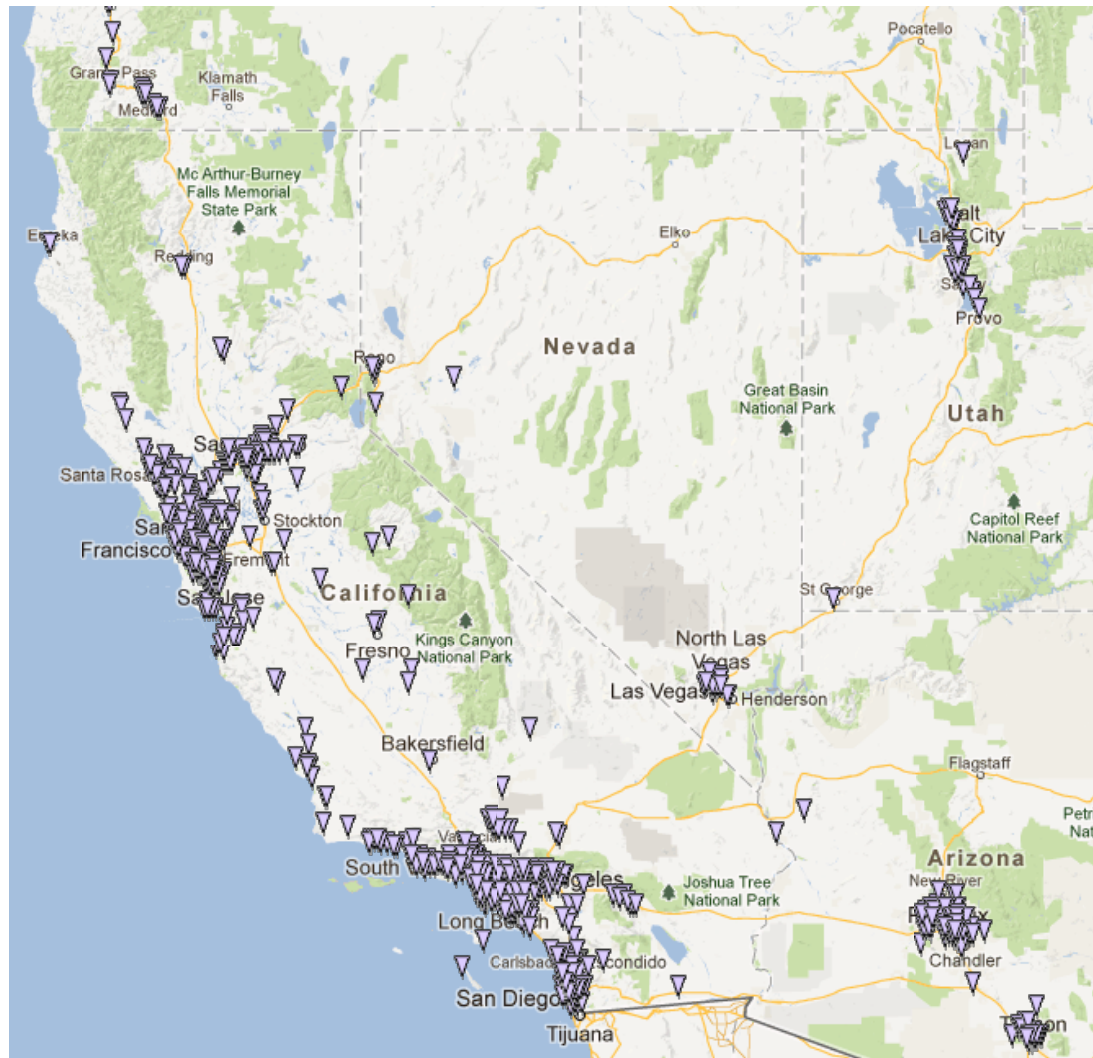
Per-charge and per-day e-mile potential



Recharging Infrastructure

Charging Stations

California charge stations (~1,626 as of Feb'14)



Alternative Fuel Stations - Electric

- Existing Electric Stations
- Planned Electric Stations

(produced Mar. 2013 using
<http://maps.nrel.gov/transatlus>)

Electricity production: Diverse, increasingly clean portfolio

- Diverse production portfolio
- Different solutions for different locations
- Existing CA grid mix positions plug-in vehicles for “80 in ‘50” emissions-reduction goal
- As approach 33% renewables, plug-in cars get cleaner as they age



Moss Landing, CA (wikimedia)



San Geronio Pass, Riverside County, CA (wikimedia)



Twentynine Palms, CA (wikimedia)

Thank you for your attention!

Additional slides, references available...

Notes about these slides

- EV = electric-drive vehicle = conventional hybrids + PEVs + FCEVs
 - HEVs = hybrid EVs (aka “hybrids”) = conventional (all-gasoline) hybrids + PHEVs
 - PEVs = plug-in electric vehicles (aka “plug-ins”) = BEVs + PHEVs
 - PHEVs = plug-in hybrid EVs (aka “plug-in hybrids”)
 - BEVs = all-battery EVs (aka “all-electric”)
 - FCEVs = fuel-cell EVs
- Figure legend order usually reflects sequence of vehicle introduction.
- No single source used contained a complete and/or accurate list of sales data, so multiple sources were compiled by the National Renewable Energy Laboratory (gasoline-only hybrid data), CNCDA (California yearly totals), and UCLA Luskin Center (PEV data, most of which were compiled from monthly reports at hybridcars.com).
- Data for the Tesla Roadster, Cooper MINI-E, Th!nk City, Azure Transit Connect Electric, Fisker Karma, and Coda Sedan are usually not included.
- Tesla Model S sales are estimates and increasingly overestimate U.S. sales as the vehicle is marketed globally. Further, for simplification, it is assumed that all 2012 sales are the 85kWh model and 2013 and subsequent sales are the 60kWh model.