NextSTEPS (Sustainable Transportation Energy Pathways)

Infrastructure for Alternative Fuels: Policy Lessons

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UCDAVIS

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Lessons on Infrastructure Development for Alternative Fuels and Vehicles

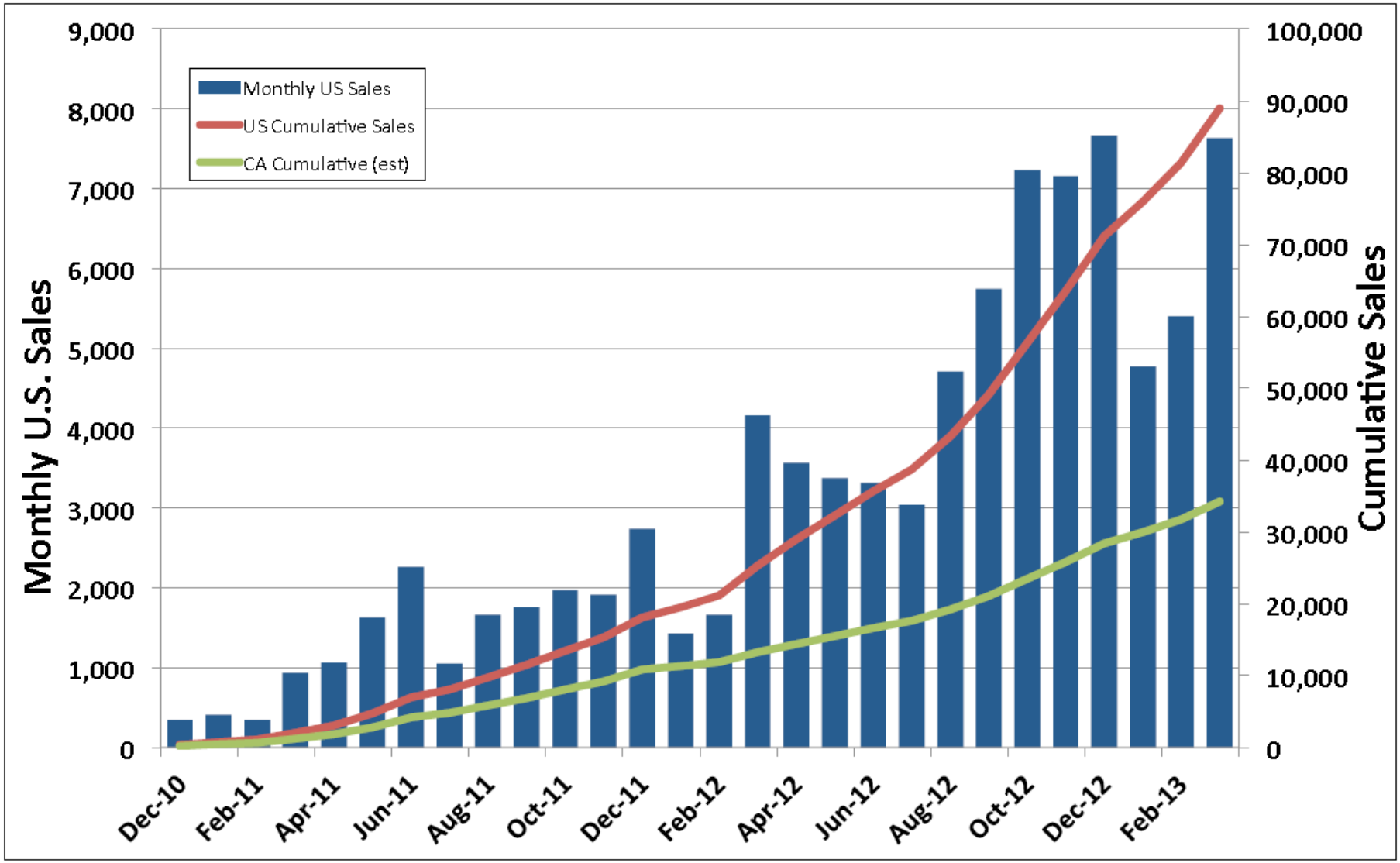
Pathways

- Electricity: California Case on EVs – Strongest progress to date on ZEV mandate
- Hydrogen: H2USA announced by USDOE **(new public private partnership to develop H2 infra.)**
- Biofuels: E 85 Case - uneven progress
- Natural Gas: Oklahoma succeeding with new model

Context

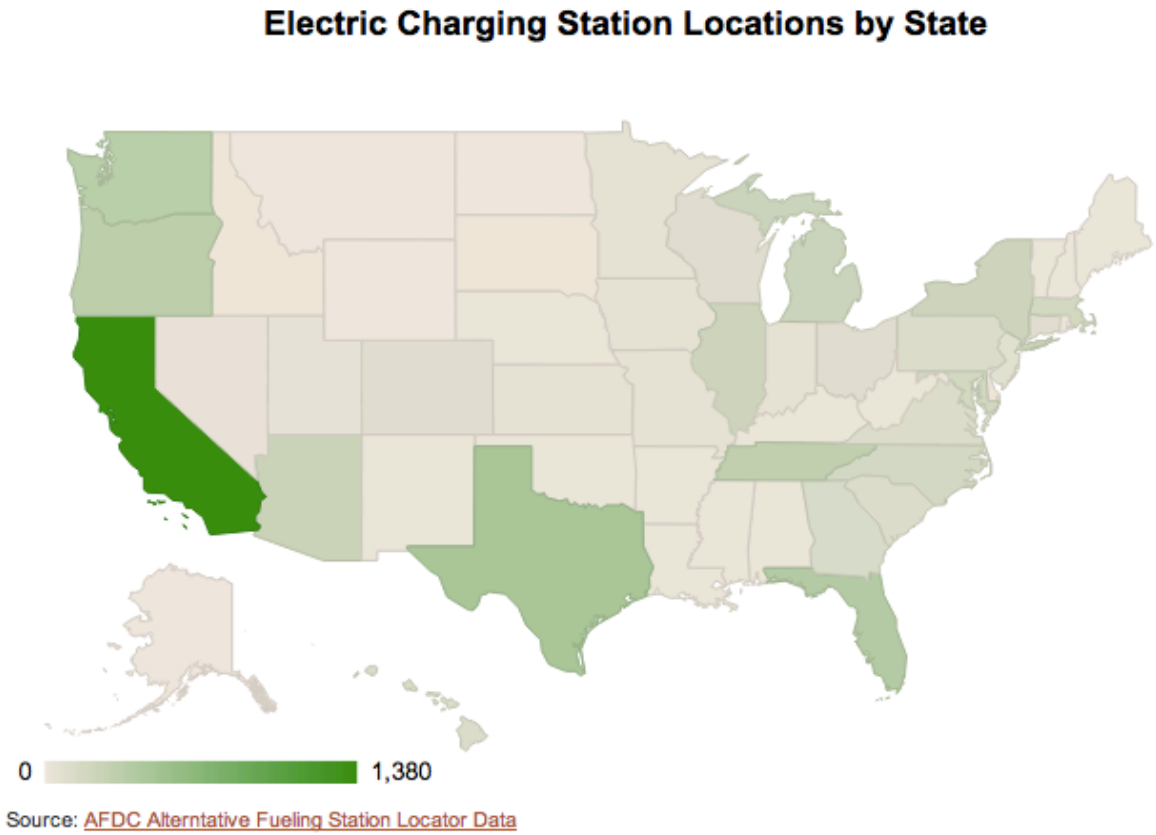
- Climate Change: 400 ppm CO2 concentration now reached
- Unrest in Middle East
- US Shale Revolution

Electricity: PEV Sales Set Rapid Pace (cumulative sales hit 100K!)

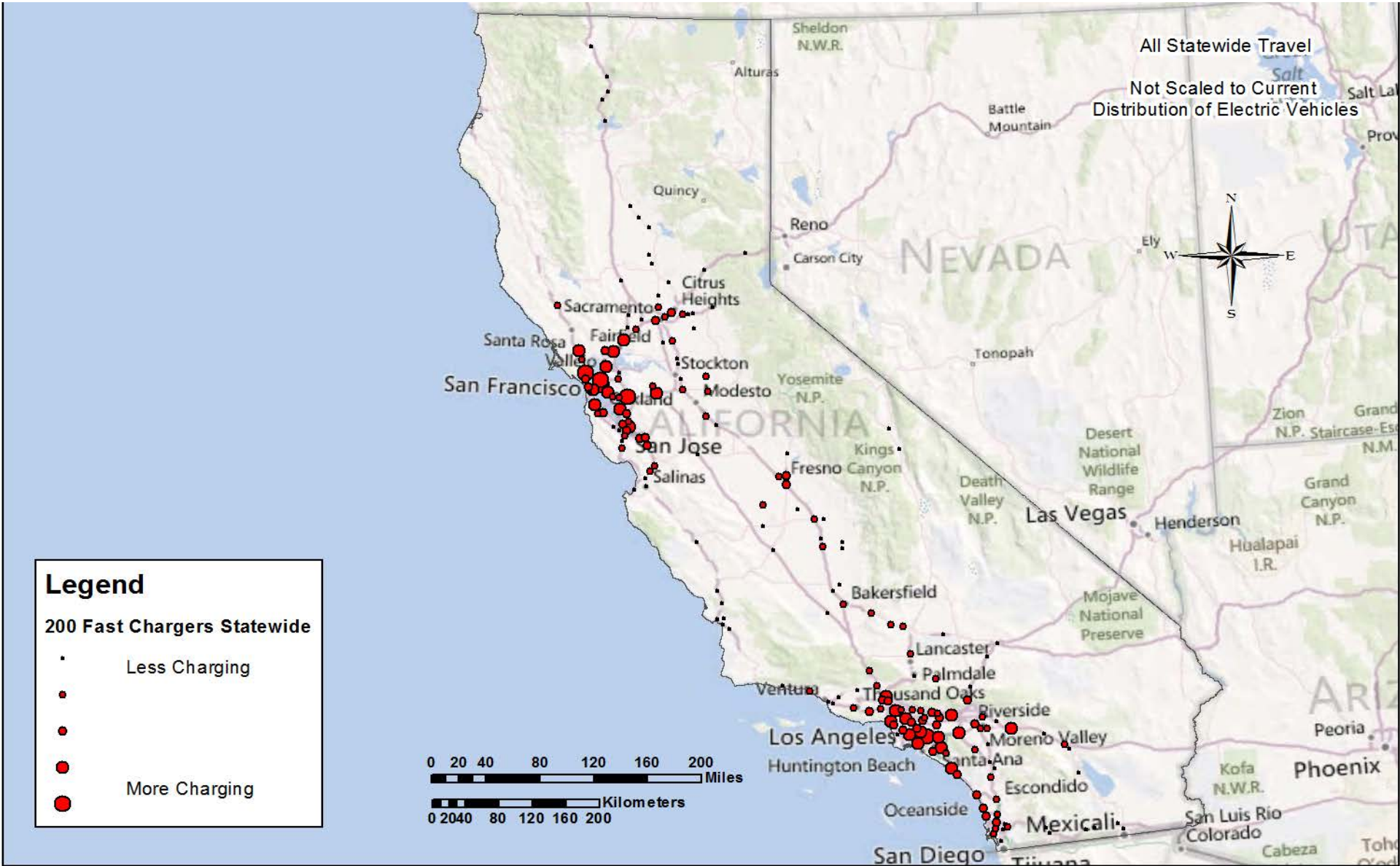


Note: Approximation assumes CA sales were 60% of U.S. sales in 2011 and 33% in 2012 and 2013.
Reference: www.hybridcars.com

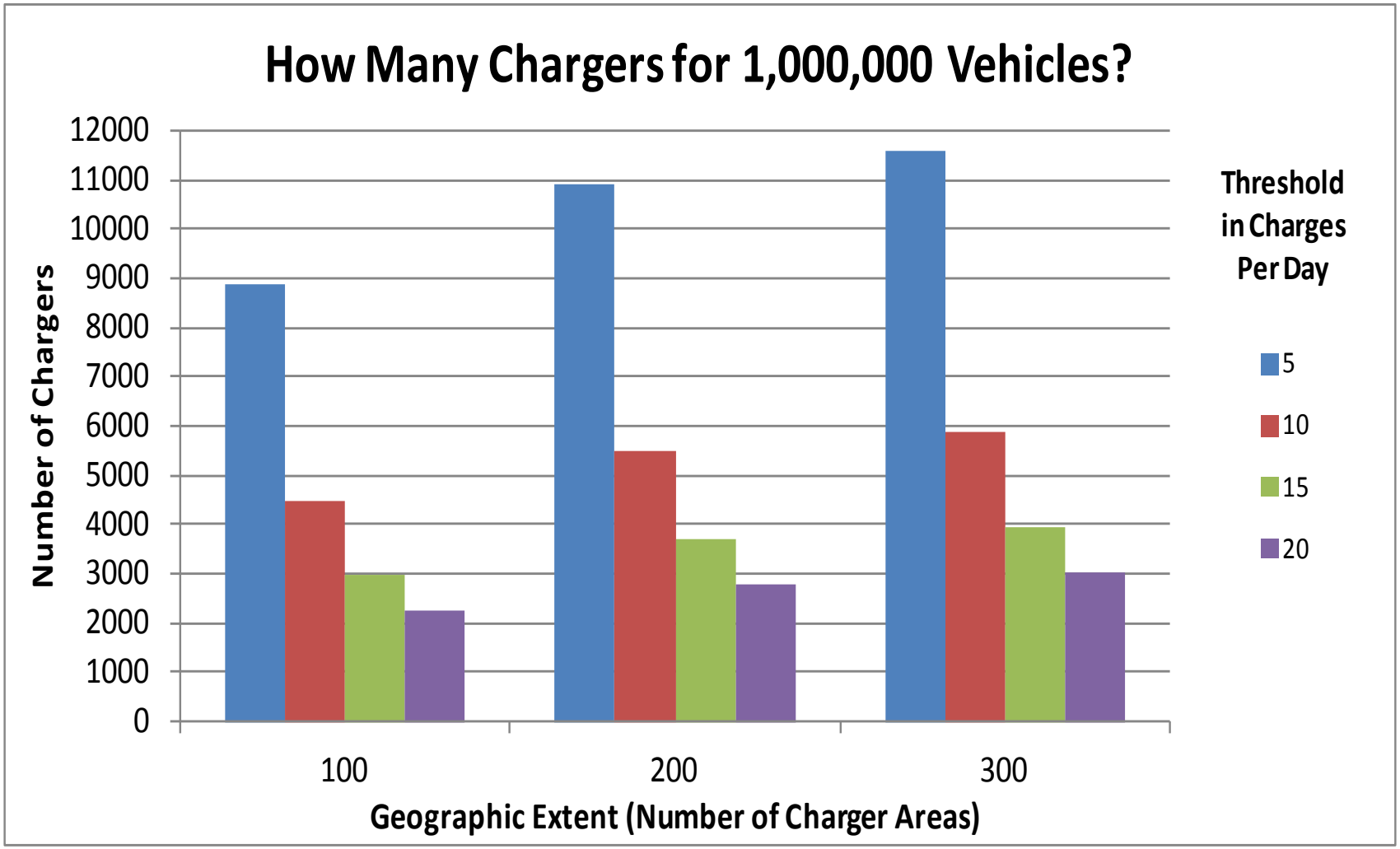
5,894 EV public charging stations in the US
1,322 EV public charging stations in California



Statewide Demand Distribution:
200 Initial Locations (246 Chargers @30,000 BEV)

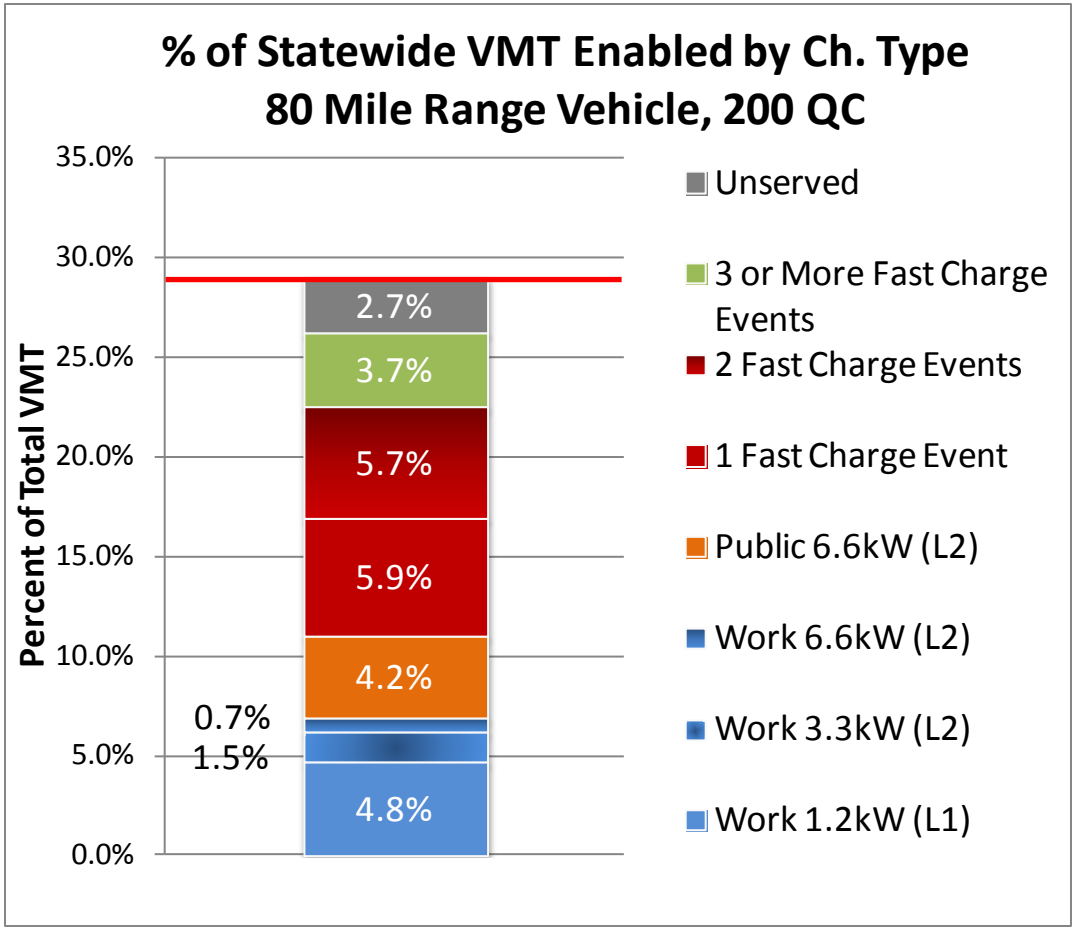


Scaling Locations to Number of Chargers in California. For an 80 Mile BEV, Approx. 1 Fast Charger/500 vehicles.



What Return Do We Get for Infrastructure Investment? (VMT/GHG)

- Home Charging VMT
  - 60 Mile Veh. = 59%
  - 80 Mile Veh. = 71%
  - 100 Mile Veh. = 79%
- L1 Work Charging is sufficient for ~5%
- L2 Work Charging is needed for ~2%
- QC accommodates up to an additional 10% EV miles



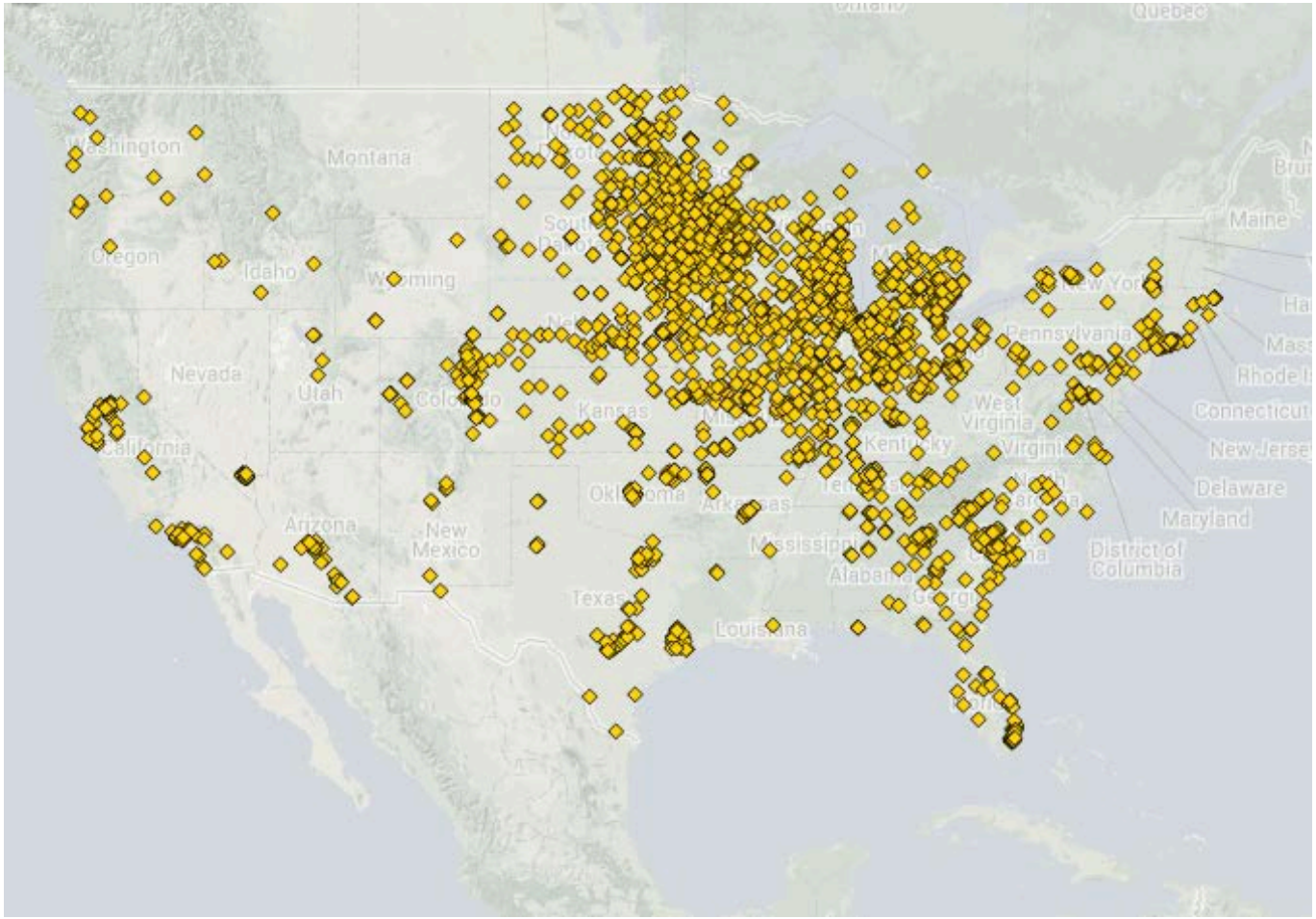
Nicholas, Michael, Gil Tal, and Justin Woodjack. 2013, January. California Statewide Charging Assessment Model for Plug-in Electric Vehciles: Learning from Statewide Travel SurveysDavis, CA: University of California, Davis. Institute of Transportation Studies, UCD-ITS-WP-13-01.

Biofuels Face Blend Wall Problem, Slow Progress on Drop in Fuels

- Total E85 station in US= 2,342
- E85 stations in farm states (Iowa, Illinios, Nebraska, Minnesota, Indiana, Ohio, South Dakota, Wisconsin, Missouri, Kansas) = 1,389

- 59.3% of the US E85 fueling stations are in the Midwest
- US oil refiners generally speaking resisting regulations, R & D on drop in fuels making slower progress than expected
- RFS targets will not be met

Locations for E 85 Stations in the United States



Natural Gas for Transportation: Lessons from Oklahoma

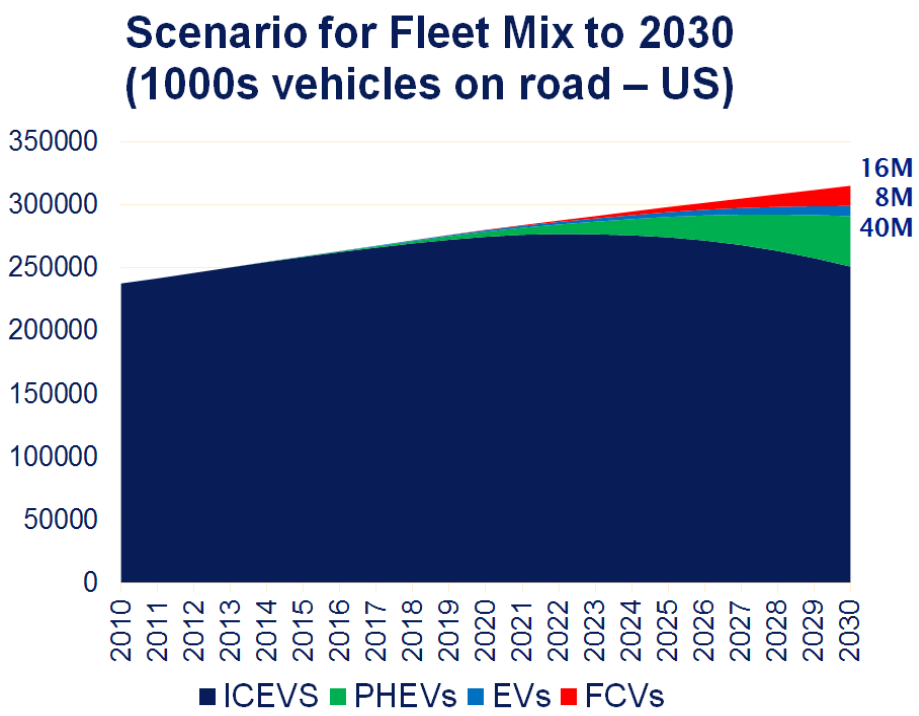
- State of Oklahoma initiative – multi-state RFP for the purchase of CNG vehicles resulted in major cost savings for direct purchases from OEMs, combined with simultaneous station provider commitments. Incentives 75% cost of filling stations, 50% home refueling costs, funded via 0.25 GGE surcharge
- Natural gas producers increasingly focused on creating new demand markets for natural gas including transportation
- Currently natural gas has a $1.00 to $1.50/gge cost advantage compared with diesel which for an LNG heavy duty vehicle that goes 90,000 miles a year means a payback of less than 3 years
- Transportation demand in US could top 1 Bcf/d to 3Bcf/d if oil-gas price ratio holds
- Oklahoma model an example for future initiatives in alternative fuels

Pricing Examples (Oklahoma)

Vehicle Awarded	Previous Contract Option & Post-RFP Option	Savings
Dodge Ram 2500, Crew Cab (b)	Before: **$36,302**	**$6,309**
	After: **$29,993**	
Honda Civic GX (d)	Before: **$27,095**	**$2,191**
	After: **$24,904**	
Ford Transit Connect (b)	Before: **$31,000**	**$1,261**
	After: **$29,739**	
Ford E-250 (b)	Before: **$33,678**	**$4,689**
	After: **$28,989**	
Ford E-350 (b)	Before: **$35,827**	**$5,459**
	After: **$30,368**	

Notes:
(b) bifuel
(d) dedicated

Investments to Support Alt. Fueled Vehicles to Breakeven Cost Competitiveness w/ ref. Gasoline Vehicle (Ogden/Fulton)



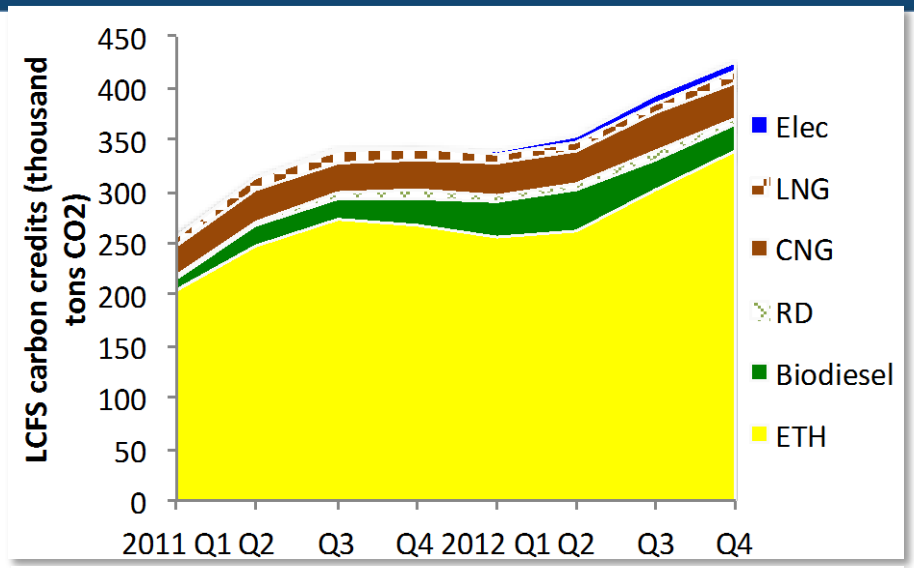
H2	PHEVs	Battery EVs
Breakeven in 2023	**Breakeven in 2026**	**Breakeven in 2020**
2 million FCVs	**20 million PHEVs**	**1 million BEVs**
~$4B for H2 supply	**~$20 B for chargers**	**~$1-2 B for chargers**
~$11 B to subsidize FCV price	**~$140 B** to subsidize vehicle price	**~$7B to subsidize vehicle price**

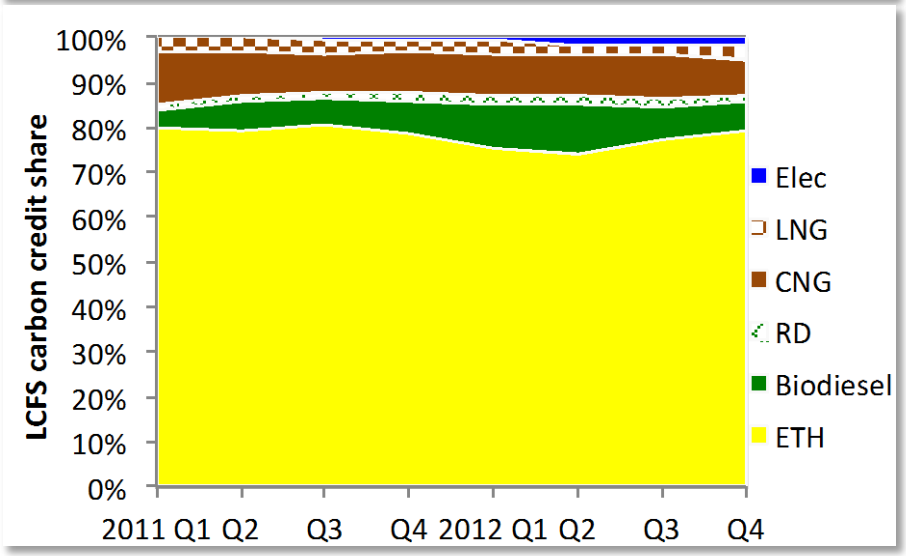
Ogden/Fulton – Transition Costs presentation, NextSTEPS Symposium, May 2013

California LCFS Carbon Credits Come from a Range of Sources

- The shares of credits for different fuel types have remained relatively constant.

- Ethanol: 78%
- Fossil/bio LNG/CNG:12%
- Bio-/renewable diesel: 9%
- Electricity: 1%





Yeh, Witcover, Kessler – LCFS and FRS Update, NextSTEPS Symposium, May 2013

Appendix

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