



# Now and Then

## Transitioning to Alt-Fueled Vehicles

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Research Manager, E SOURCE

# Now and Then

## West Coast AFV Trends

- Fueling Infrastructure
- Vehicle Adoption
- Utility Grid Impacts
- Rate Structures
- Business Models
- Summary

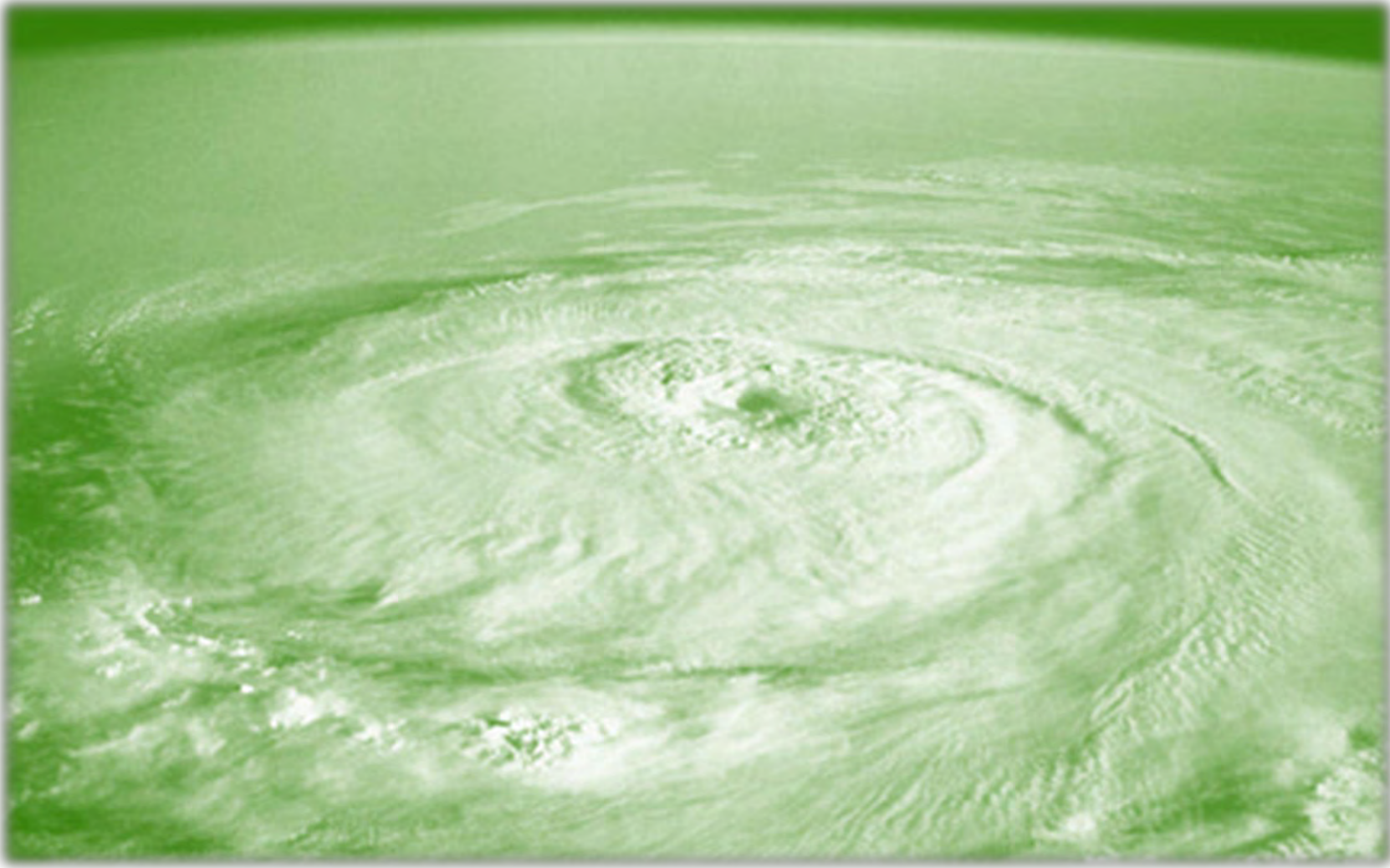


Courtesy: Tennen-Gas

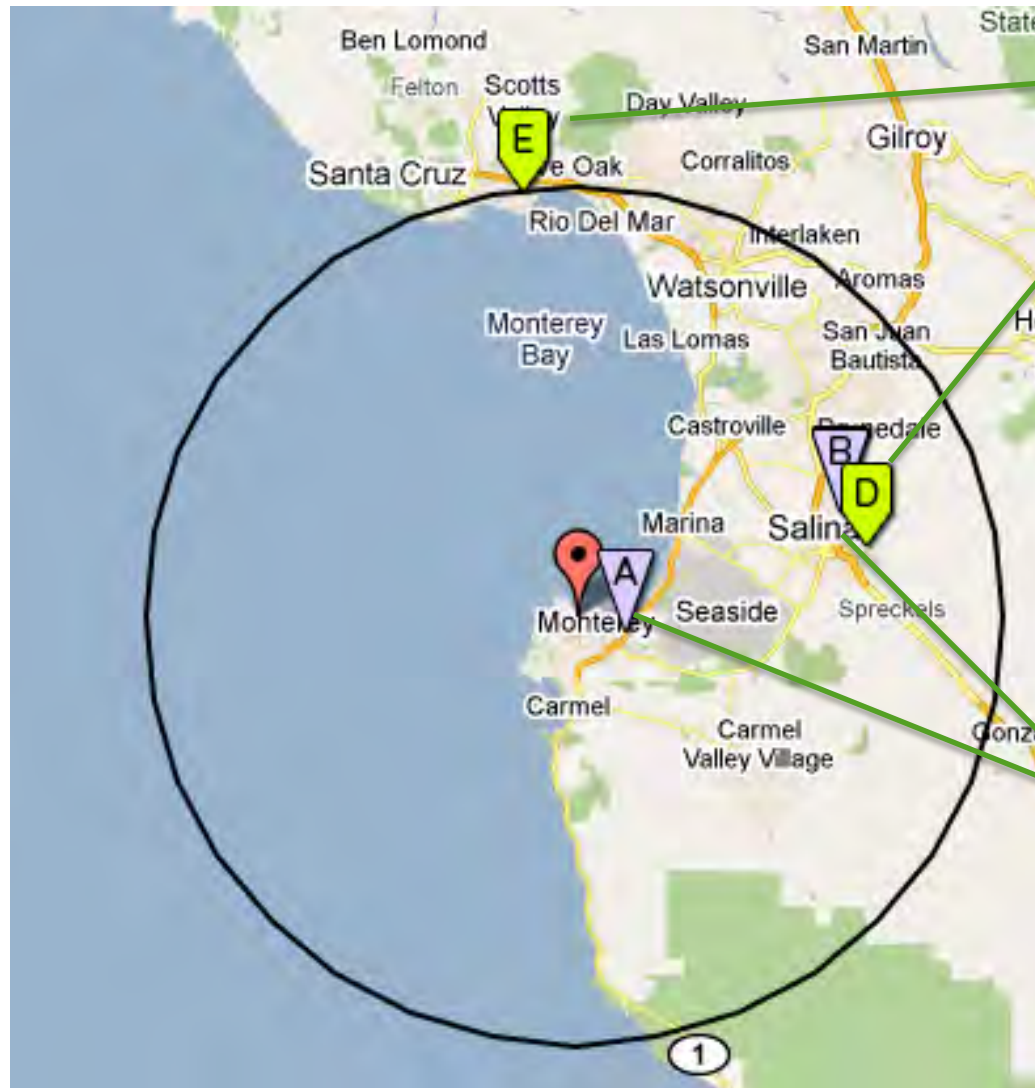
*Utilities have the opportunity to benefit from alternatively fueled vehicle adoption, proportional to planning & investment.*



# A Perfect Storm?



# A Courtesy Map: Fueling Near Asilomar



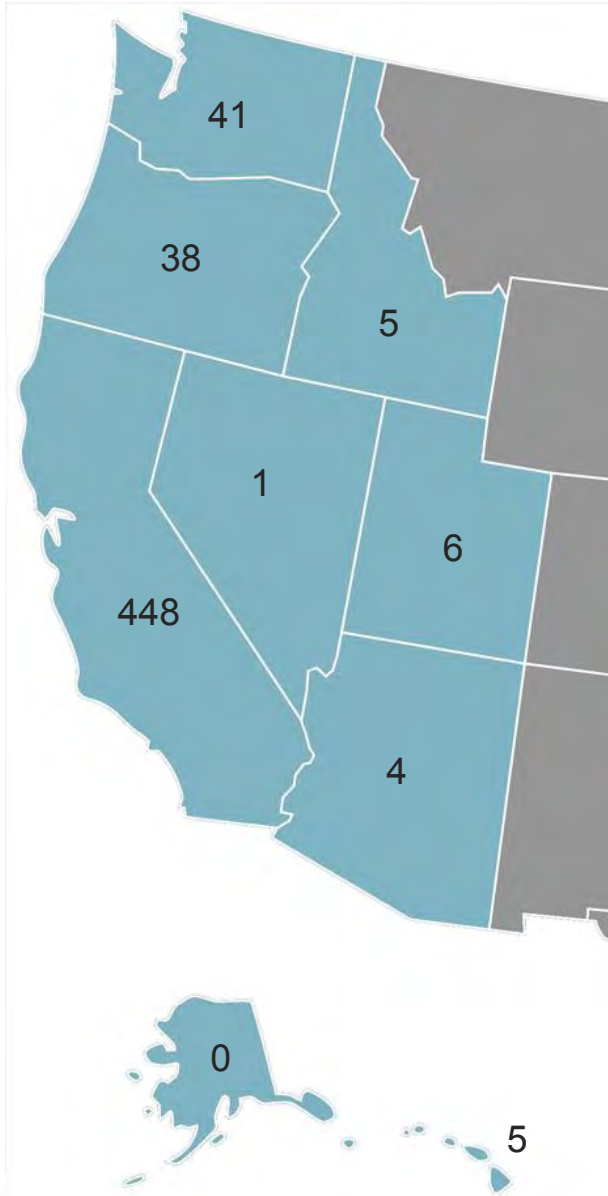
2 PG&E  
natural gas  
stations  
(D & E)

3 assorted  
electric vehicle  
charging stations  
(A, B & C)

Map courtesy of Google and the [Alternative Fuels & Advanced Vehicles Data Center](#).



# Charging Infrastructure – PEVs (2011)



Total U.S. public charging stations = 750

Relative to gasoline stations < 1%

About 60% of existing stations are in CA

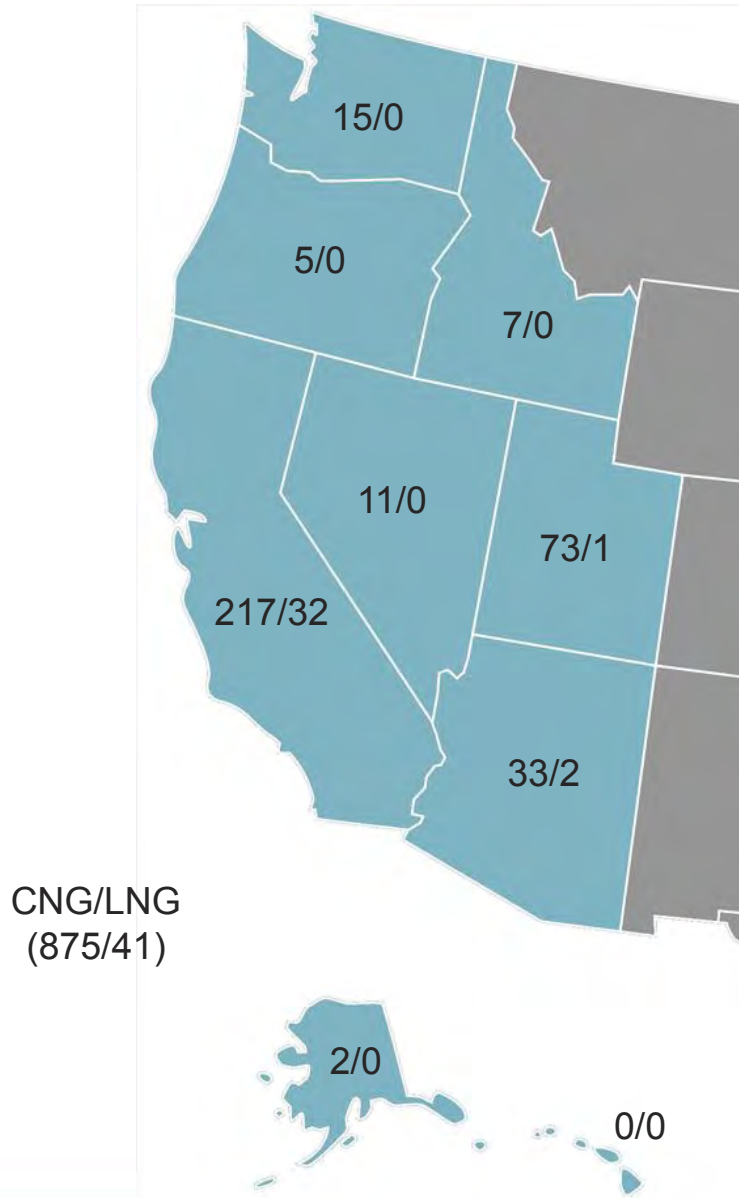
Does not include private stations or Level 1

20,000 by 2012??

Data from the DOE's [Alternative Fuels & Advanced Vehicles Data Center](http://www.e-source.com).



# Fueling Infrastructure – NGVs (2011)



Total U.S. public natural gas stations = 916

Relative to gasoline stations < 1%

About 27% of existing stations are in CA

Does not include private fueling stations

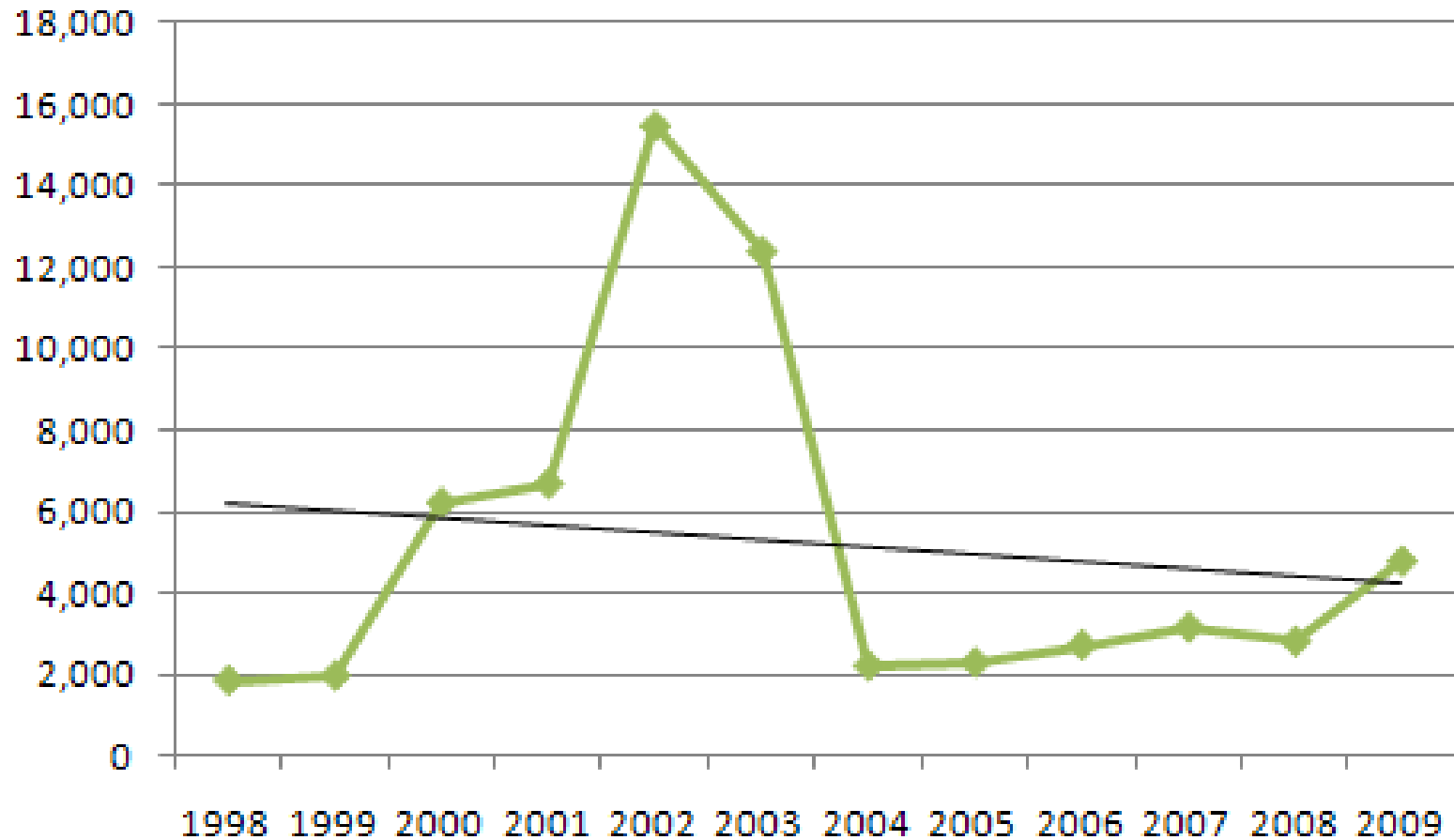
**No Signs of Growth**

Data from the DOE's [Alternative Fuels & Advanced Vehicles Data Center](http://www.e-source.com).



# PEV Historical Sales Trends, U.S.

## PEV On-Road Vehicle Sales



Data from the DOE's [Alternative Fuels & Advanced Vehicles Data Center](#).



# NGV Historical Sales Trends, U.S.

## CNG + LNG On-Road Vehicle Sales



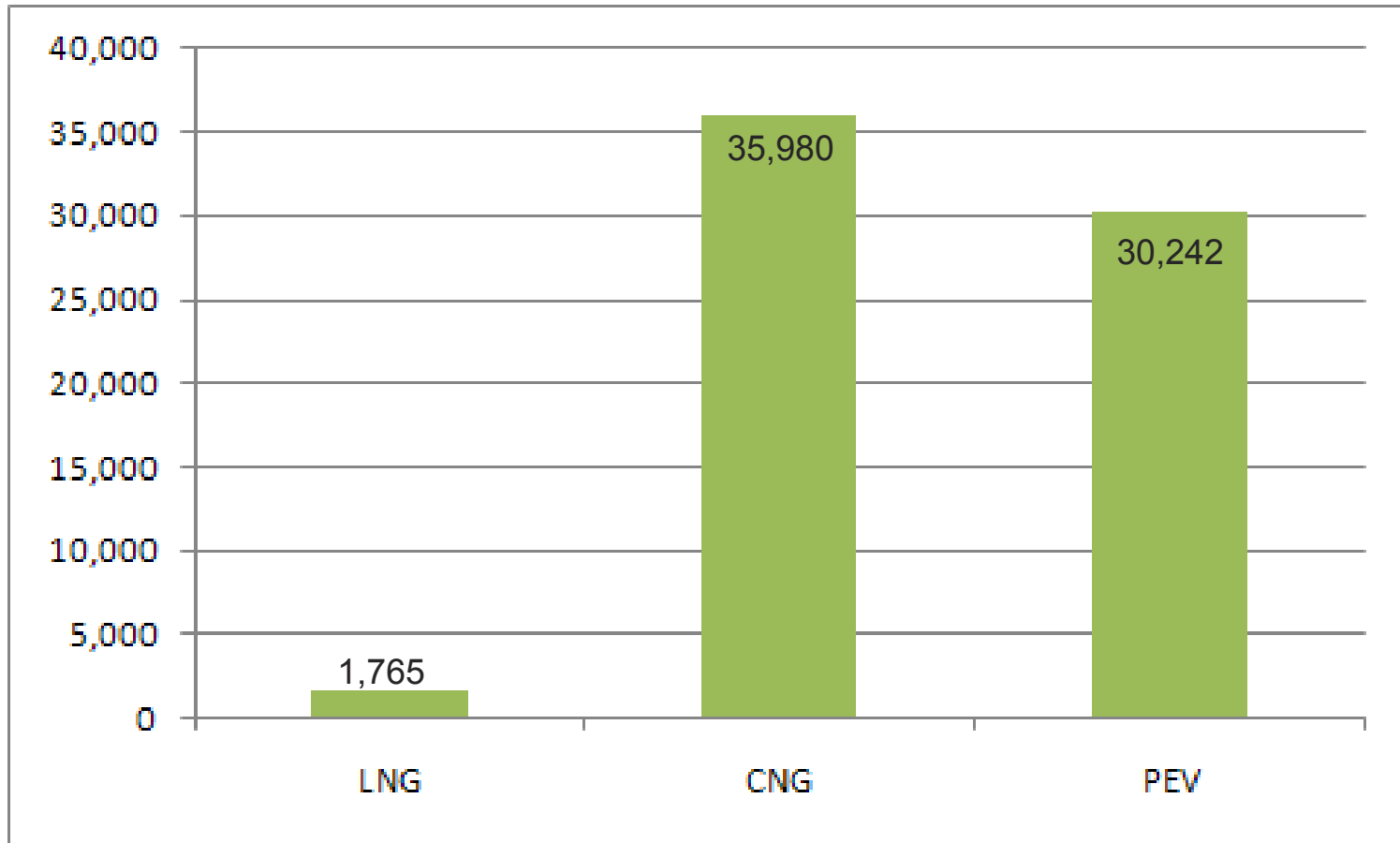
Data from the DOE's [Alternative Fuels & Advanced Vehicles Data Center](#).





# Alt-Fueled Vehicles in California

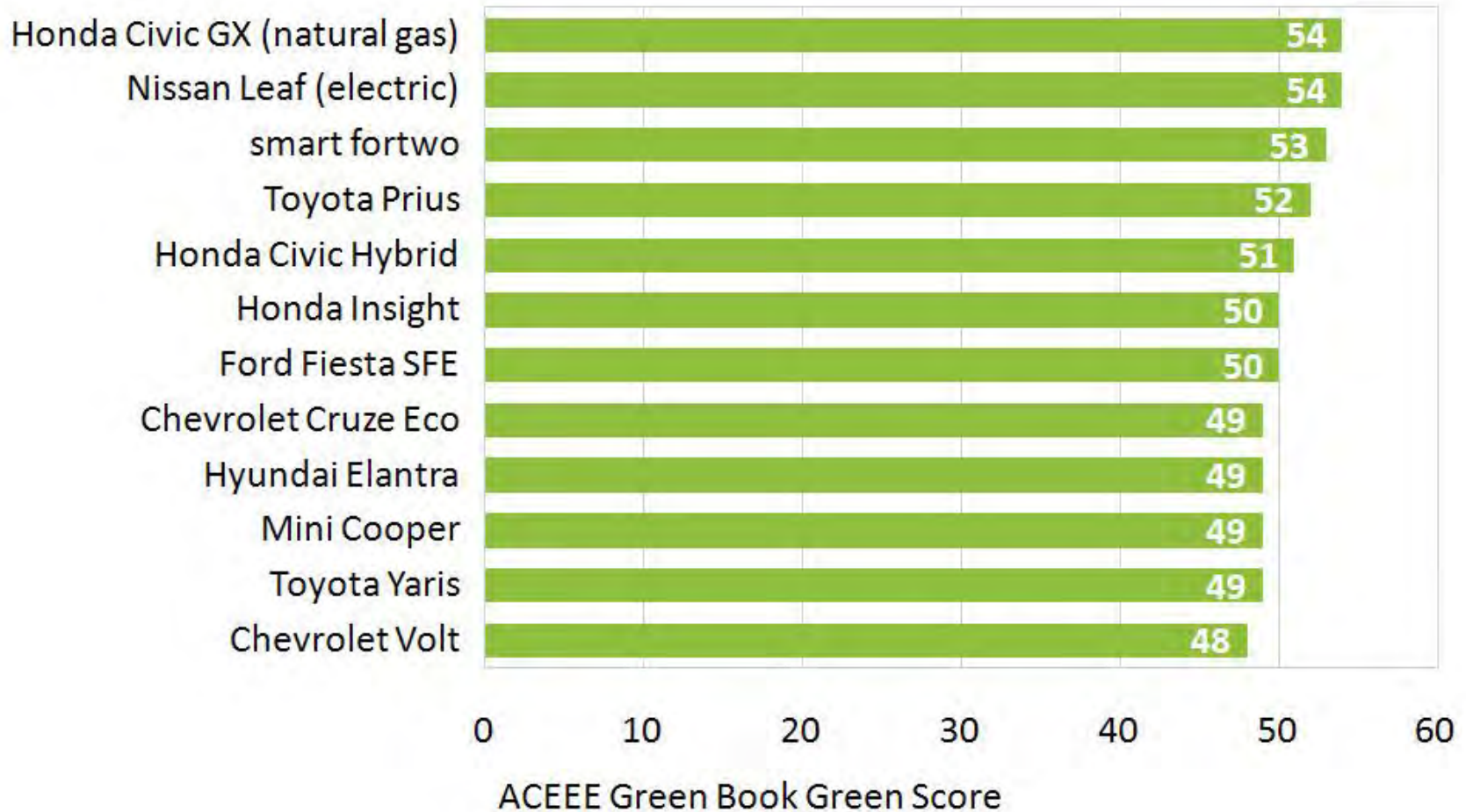
## Estimated Number of Natural Gas & Electric Vehicles in 2008



Data from the DOE's [Alternative Fuels & Advanced Vehicles Data Center](http://www.e-source.com).



# Green Car Ratings for 2011



Data from the ACEEE's [Green Book](#).













Mike Keefe THE DENVER POST 8-14-10



# Market Outlook for NGVs

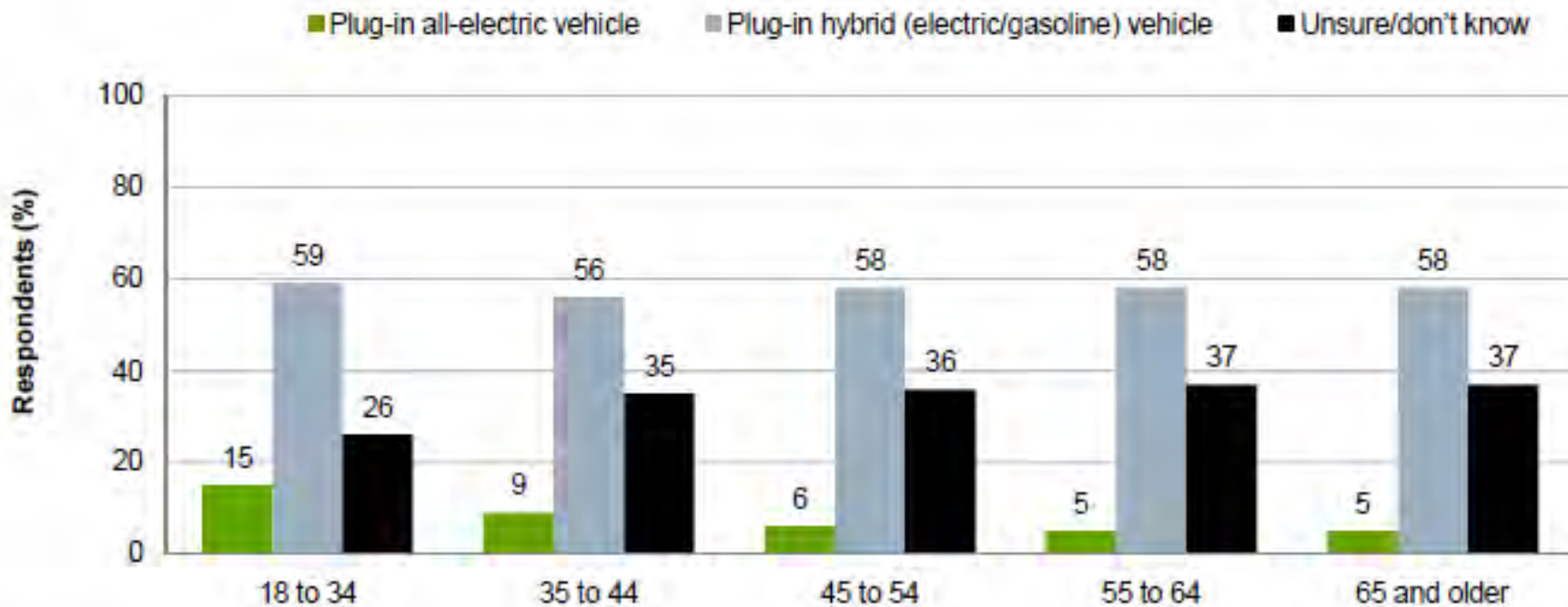
| Truck Type  | Classification                 | # of Trucks in MI <sup>1</sup> | Avg. Annual Truck Miles <sup>1</sup> |                              |
|---|--------------------------------|--------------------------------|--------------------------------------|------------------------------|
|    | Class 1<br>< 6,000 lbs         | 2,700,000                      | 14,000                               | Low Potential Market         |
|    | Class 2<br>6,000 – 10,000 lbs  | 700,000                        | 15,000                               |                              |
|    | Class 3<br>10,001 – 14,000 lbs | 20,000                         | 10,000                               | High Potential Market        |
|    | Class 4<br>14,001 – 16,000 lbs | 6,000                          | 17,000                               |                              |
|    | Class 5<br>16,001 – 19,500 lbs | 5,000                          | 20,000                               | Medium-High Potential Market |
|    | Class 6<br>19,501 – 26,000 lbs | 30,000                         | 13,000                               |                              |
|   | Class 7<br>26,001 – 33,000 lbs | 14,000                         | 14,000                               |                              |
|  | Class 8<br>> 33,001 lbs        | 65,000                         | 20,000                               | Medium Potential Market      |

Adapted from U.S. Census Bureau, "2002 Economic Census: Vehicle Inventory and Use Survey Michigan" (2004) for [DTE's NGV Discussion](#) at AGA Meeting (2009)



# Market Outlook for PEVs

7:1 favor  
PHEVs over  
BEVs



Question text: If you were going to buy one of these new vehicles, which one would you prefer?

Age

© E Source; data from Nielsen Claritas 2010 Energy Audit

**We surveyed 32,142 people across the U.S.**

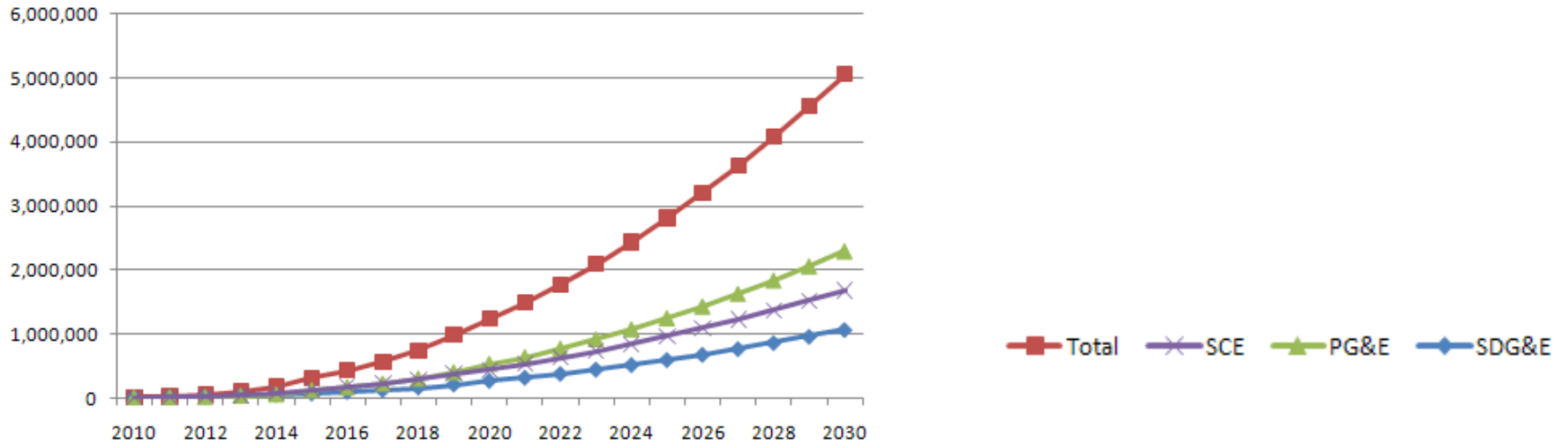
**93% of respondents say they drive < 50 mi/day**

**4% definitely going to purchase a PEV, 12% very likely, 35% somewhat likely**

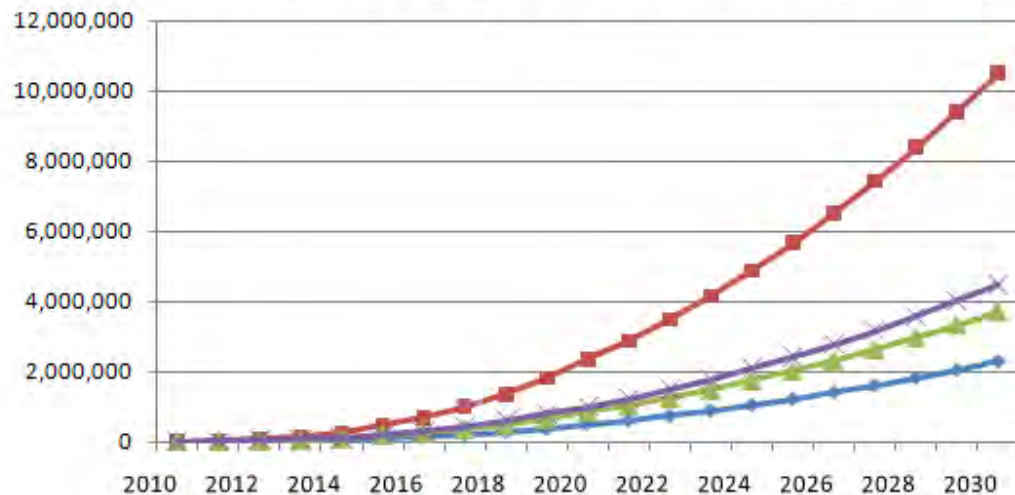


# PEV Adoption: How Many In California?

## Cumulative PEVs (Medium Adoption)



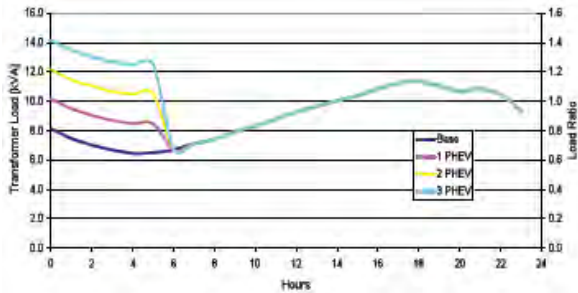
## Cumulative PEVs (High Adoption)



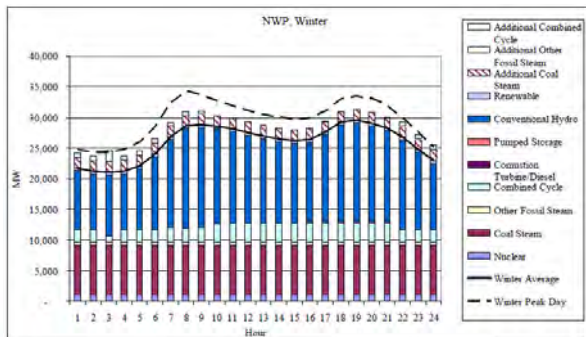
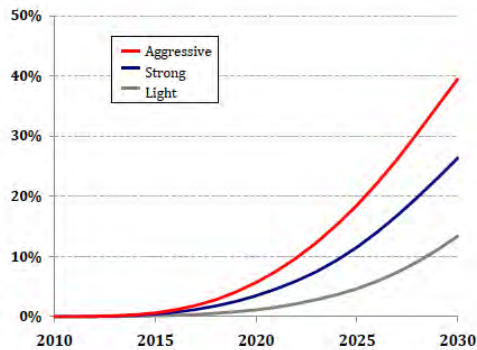
# Utility Grid Impacts

## Five Factors of Vehicle-Grid Impacts

1. **How much:** Vehicle fueling/charging rate
2. **How many:** Regional vehicle adoption
3. **When:** The wildcard, can be influenced (?)
4. **Where:** Home, work, or public access
5. **Everything else:** The state of the grid



U.S. PEVs on the Road (%) Scenarios



# Utility Grid Impacts – PEVs



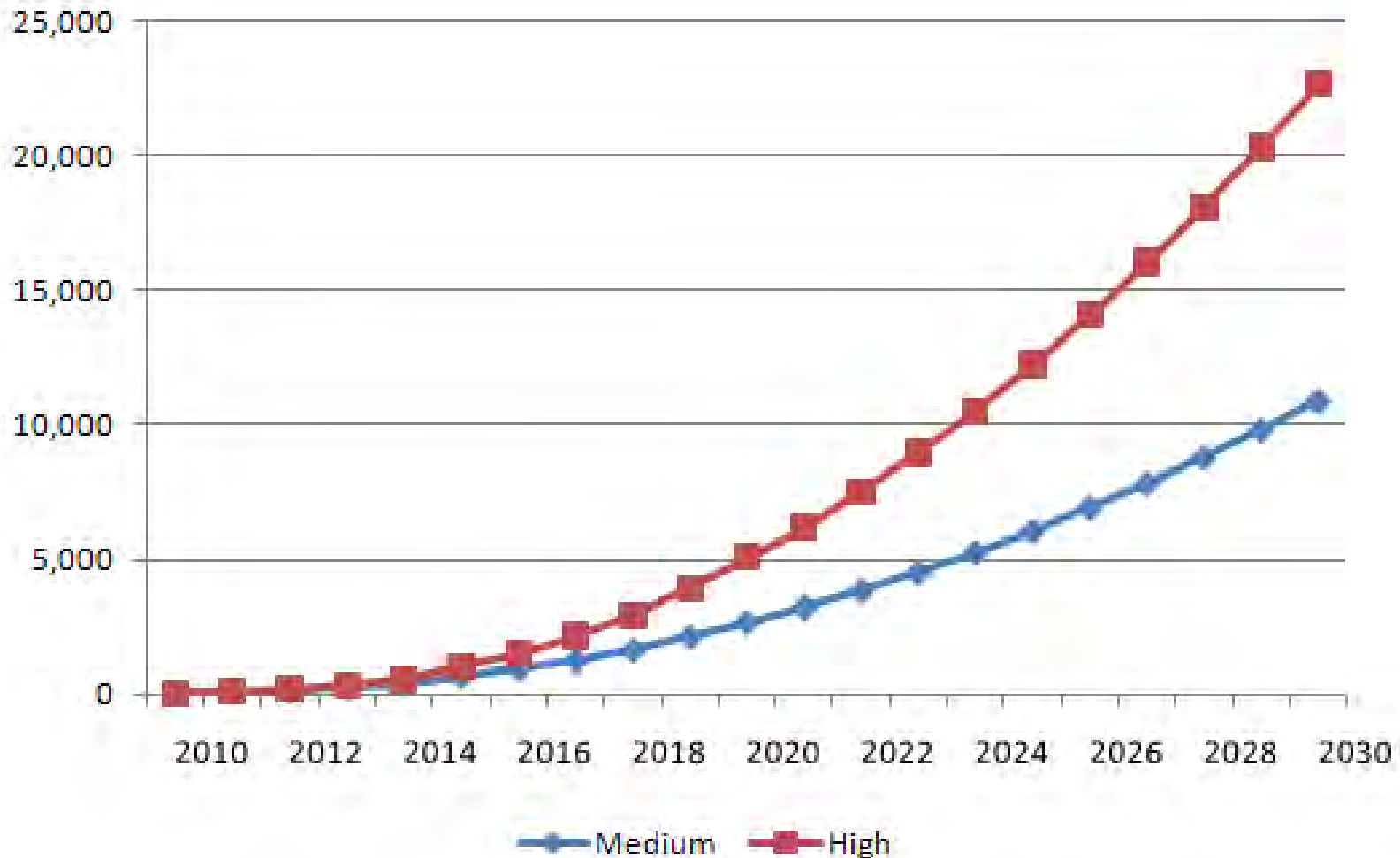
Let's take California as an example, the largest PEV market by most estimates

1. *How much*: 1 to 7 kW per car
2. *How many*: Up to 50,000 by the end of 2011; could see 10 million by 2030.
3. *When*: Hopefully late at night, but could be any time
4. *Where*: Wherever they can, but mostly at home (we think)
5. *Added load*: Up to 230 MW soon and 22,000 MW in 2030

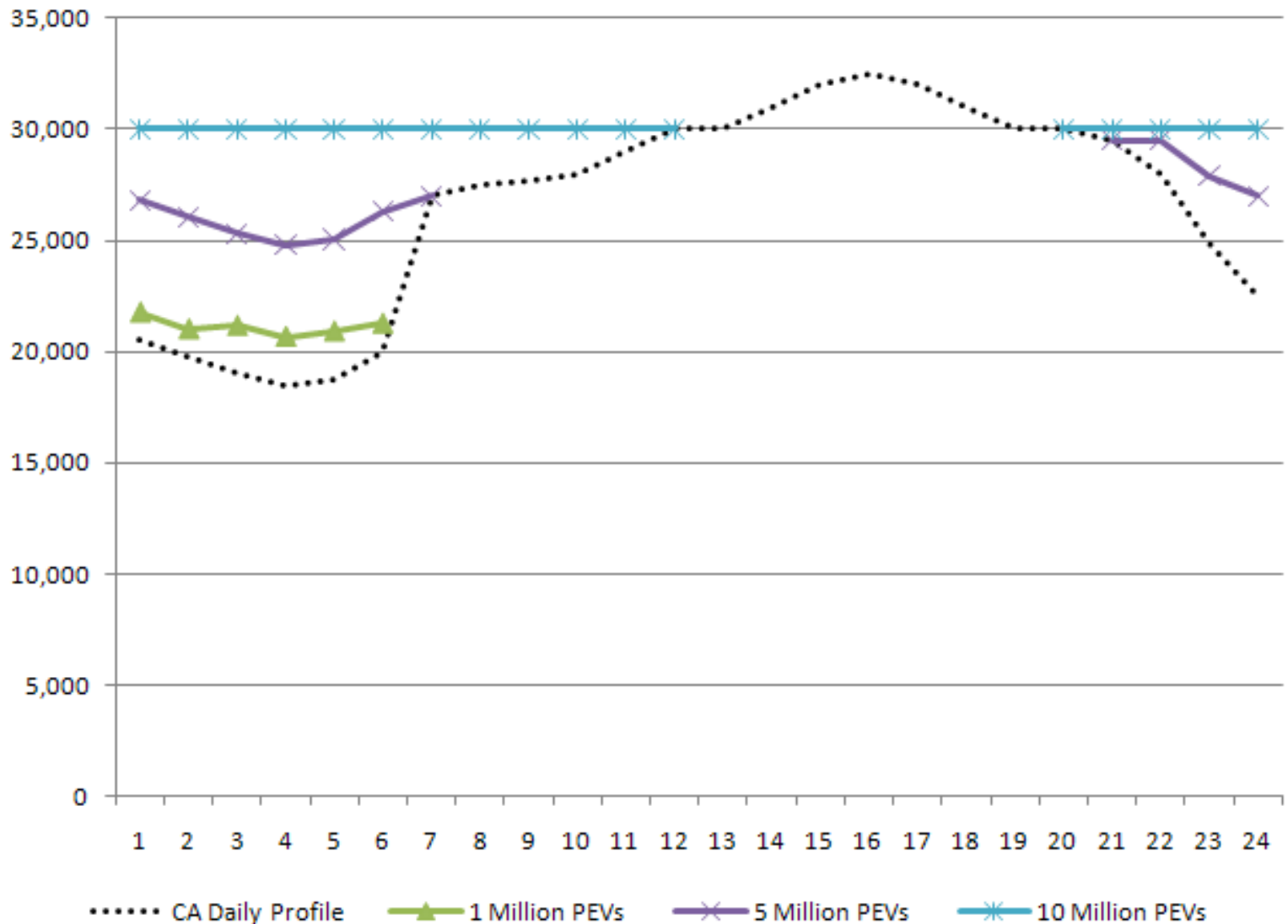


# CA Grid Impacts – Medium & High

Cumulative Electricity Demand for PEVs in CA (MW)



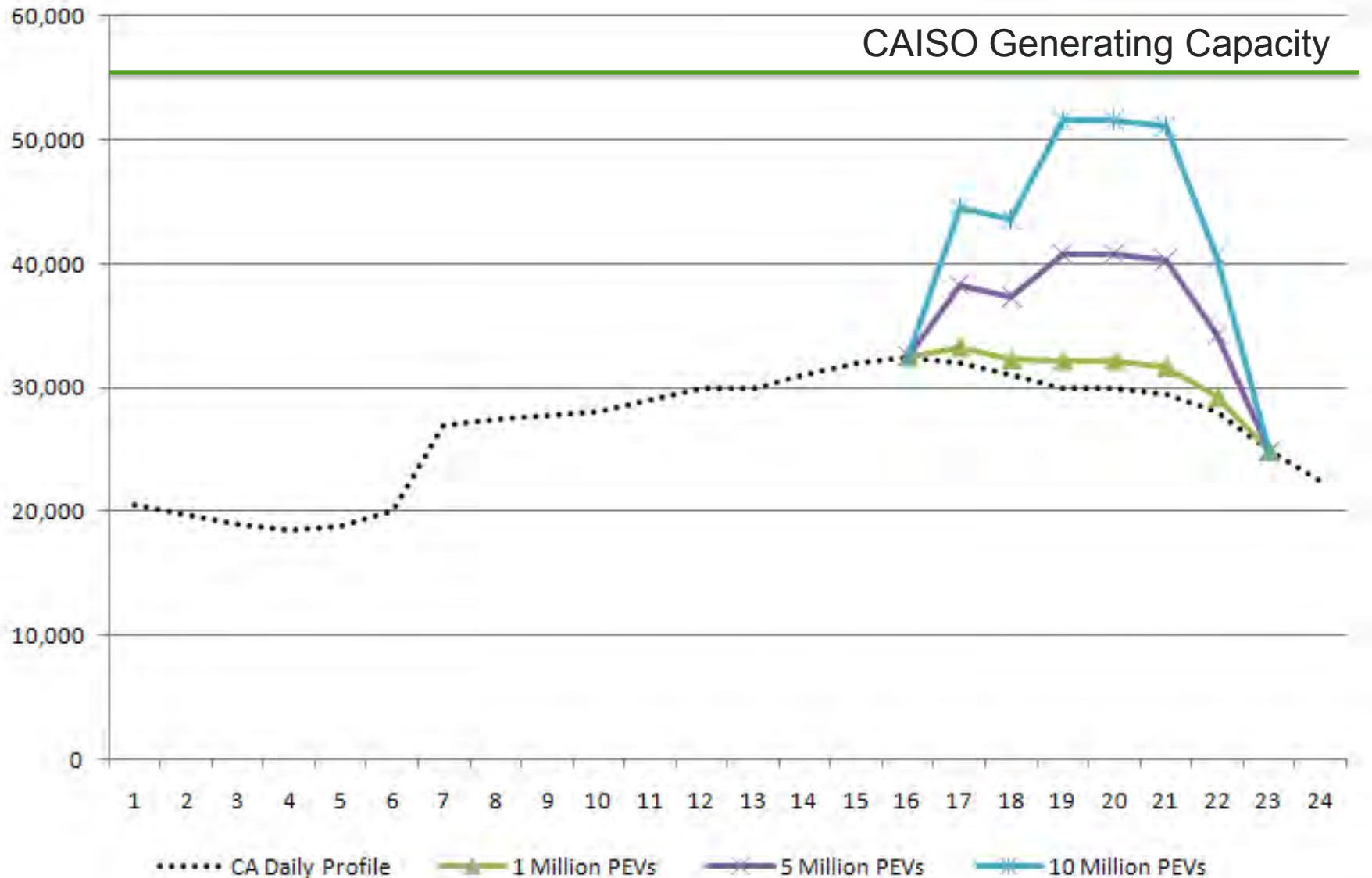
# CA Daily Load + Ideal Max PEV (MW)



Modeling approach adapted from [An Innovation and Policy Agenda for Commercially Competitive Plug-in Hybrid Electric Vehicles](#).



# CA Daily Load + Peak Max PEVs (MW)

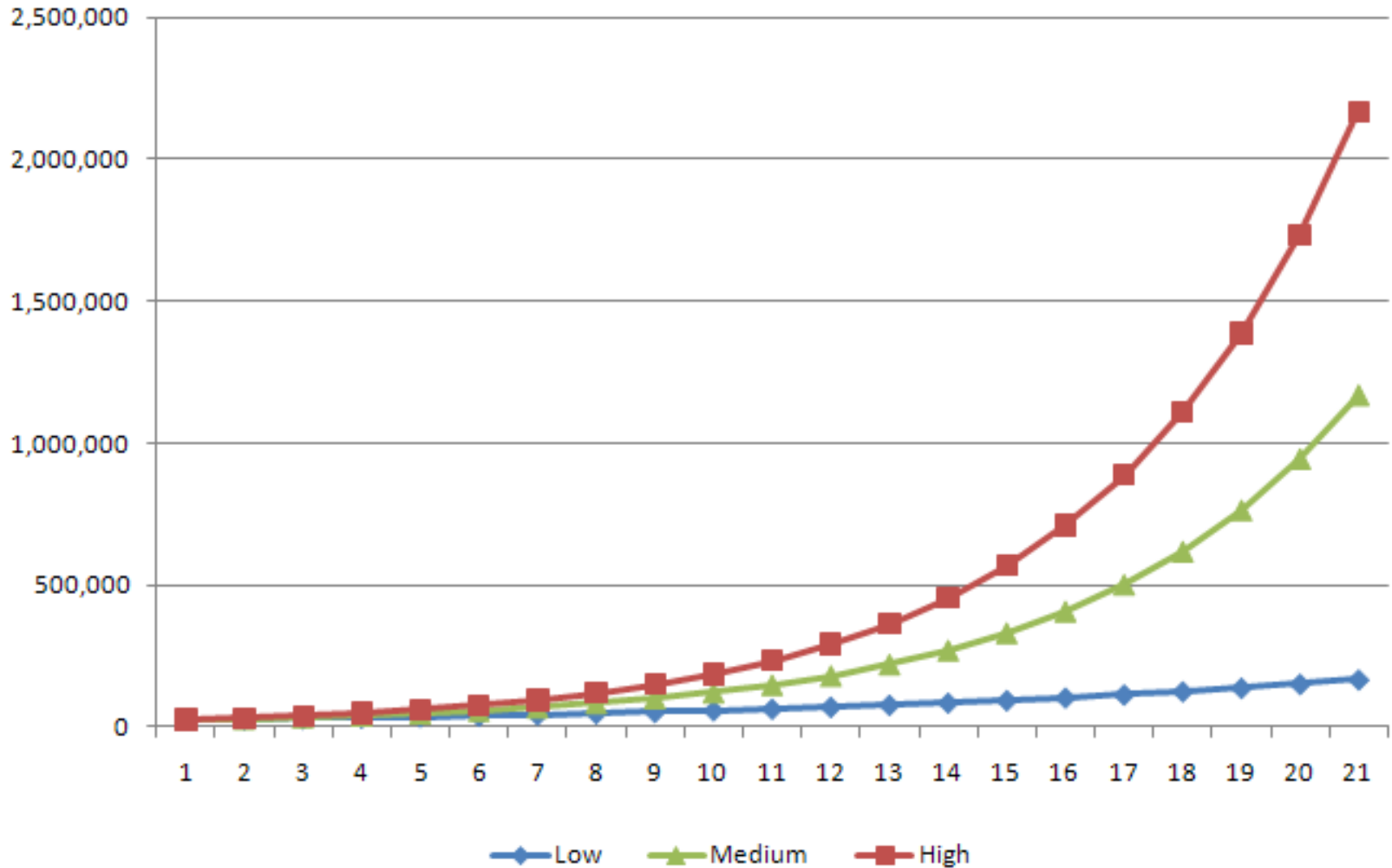


Modeling approach adapted from [An Innovation and Policy Agenda for Commercially Competitive Plug-in Hybrid Electric Vehicles](#).



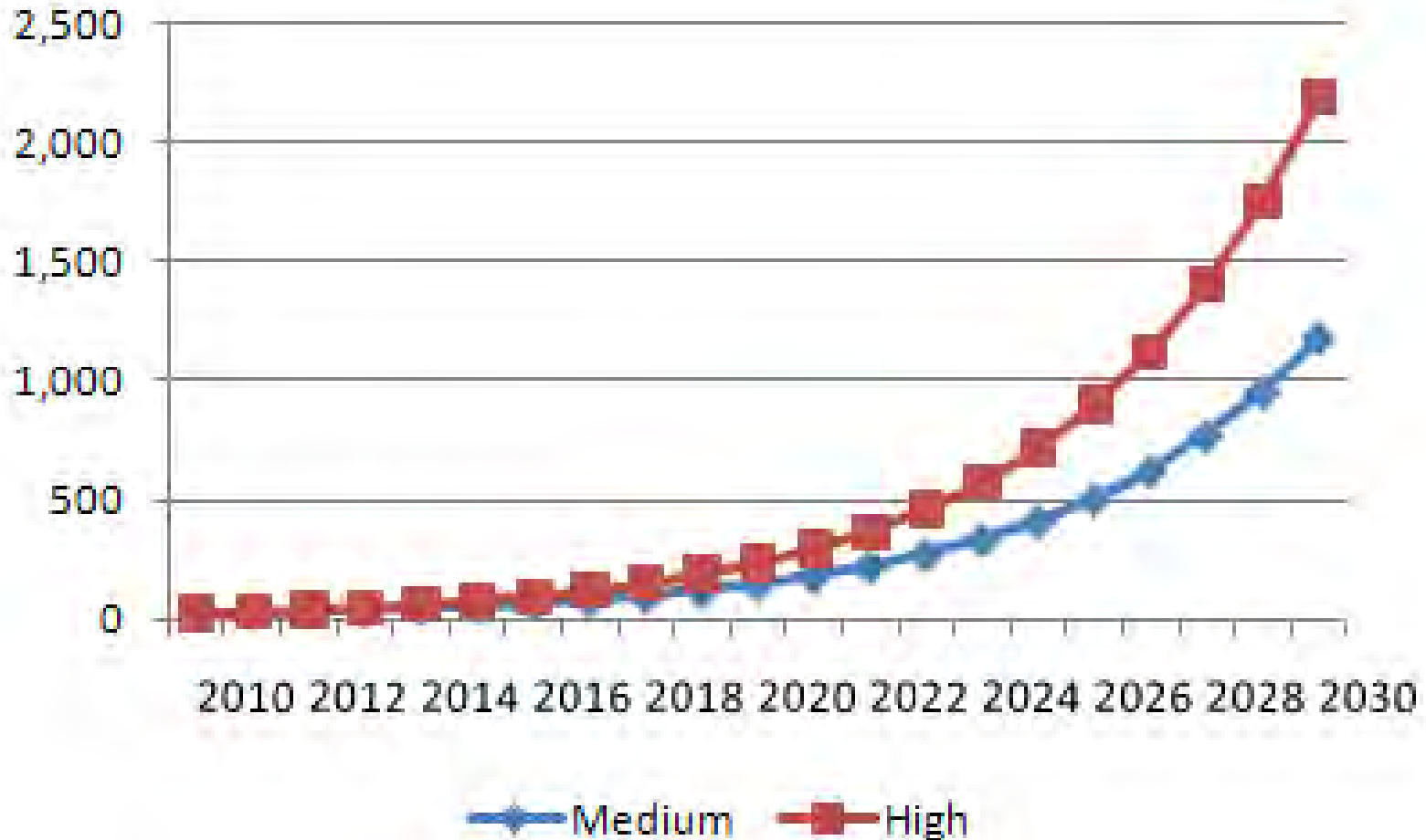
# NGV Adoption: How Many in California?

Vehicle Penetration Scenario, Cumulative NGVs

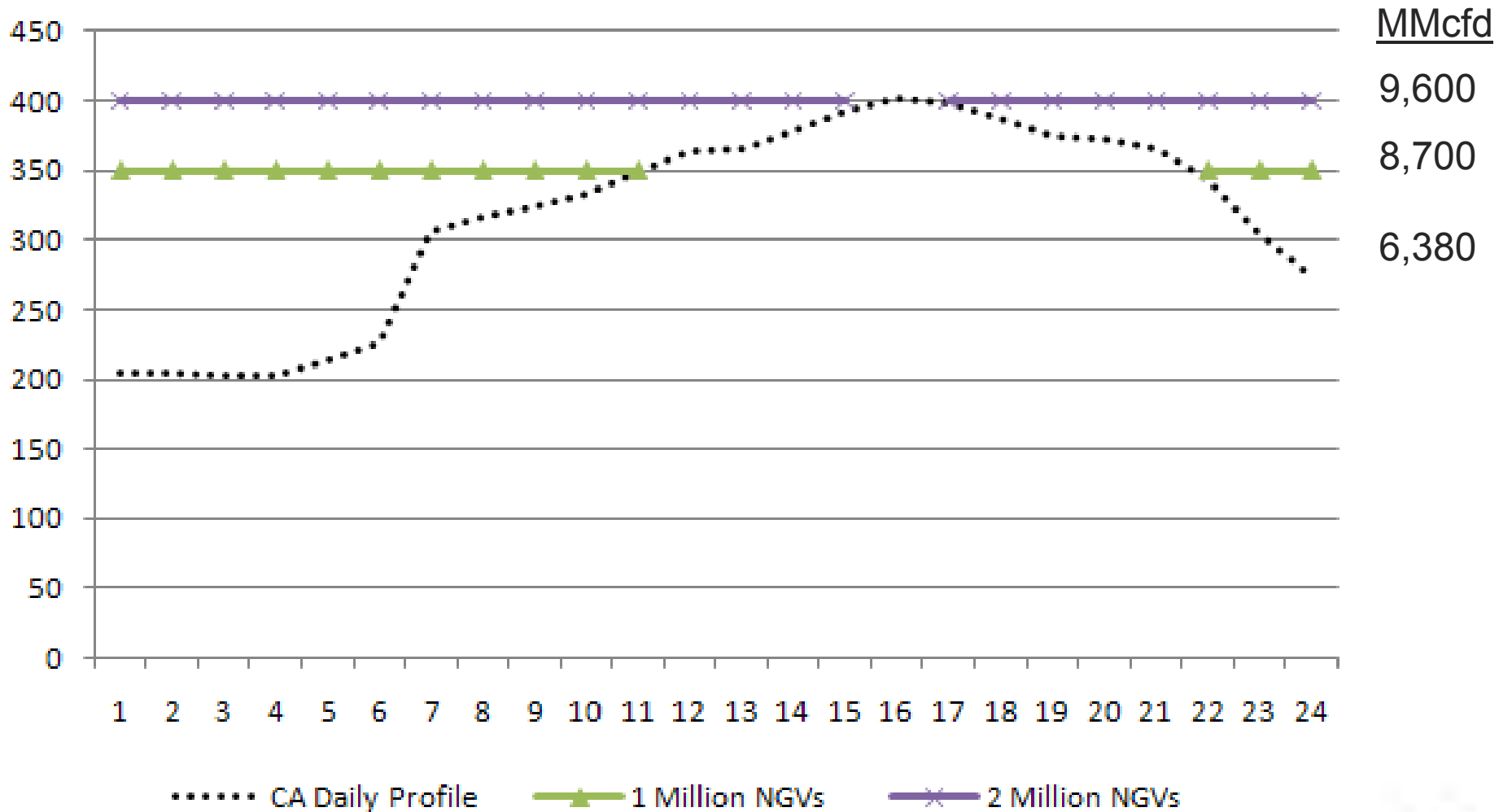


# CA Grid Impacts – Medium & High

Cumulative Natural Gas Demand for NGVs in CA (MMcfd)



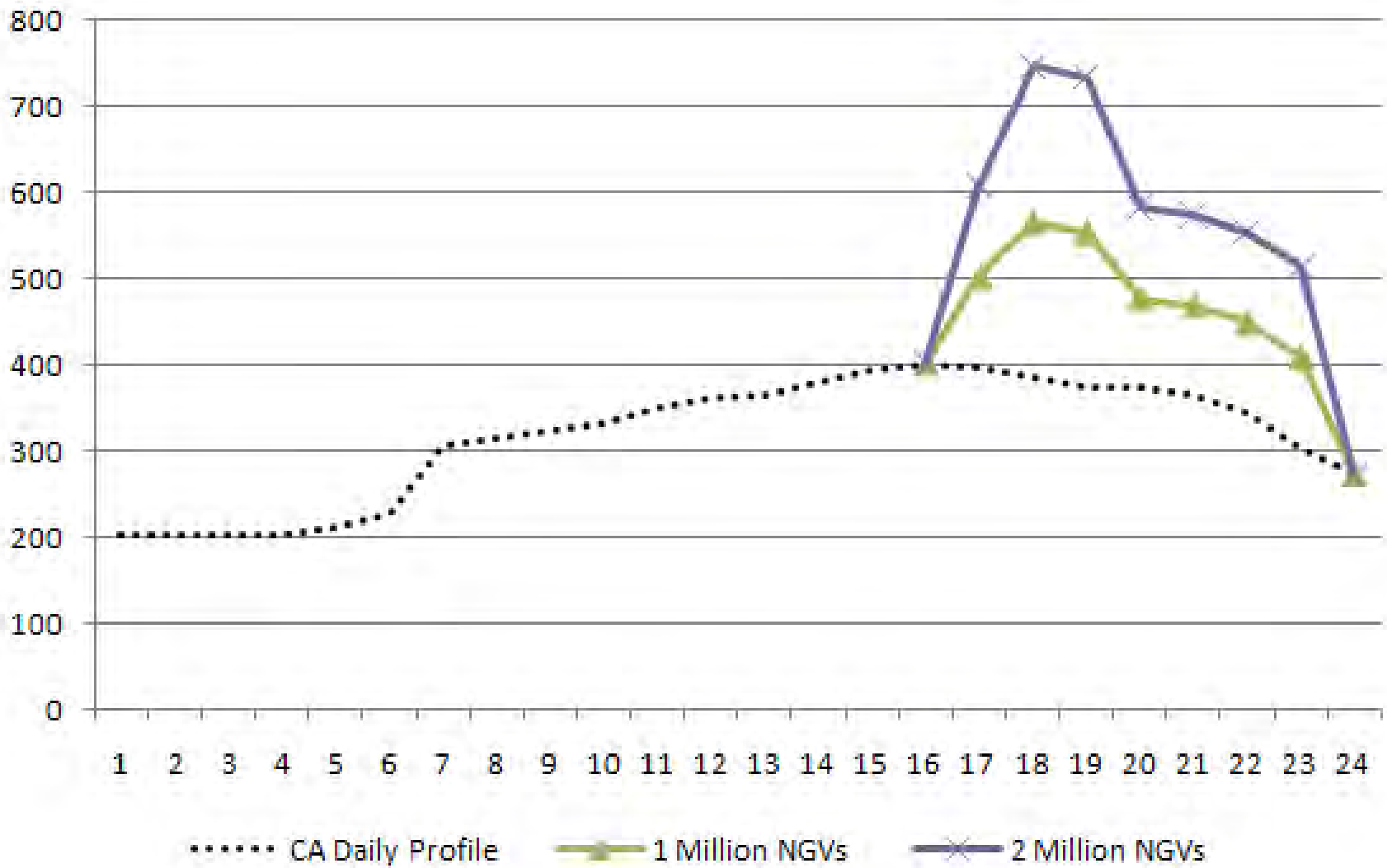
# CA Daily Load + Ideal Max NGV (MMcfh)



PG&E + SoCalGas + SDG&E Capacities = 7,127 MMcfd



# CA Daily Load + Peak Max NGV (MMcfh)



# Utility Rate Programs: PEVs

| Utility   | Rate Plan   | Rate Period  | Rate Type                               | Rate                                    | Off-Peak   | Peak   | Special  |         |
|-----------|---|--|---|---|--|--|--|---------|
| NV Energy | Home & PEV Option A (with special off-peak rate for PEV only) | Jun - Sept   | 1 pm - 7 pm (general rate for PEV)      | \$0.3068                                | 7 pm - 2 pm (general rate for PEV)                                 | Special off-peak rate for PEV only                                 | Off-Peak: \$0.0805; TOU rate not specific to PEV; special off-peak rate for PEV only; \$0.0561 |         |
|           | Home & PEV Option A (with special off-peak rate for PEV only) | Oct - May  | All hours                               | \$0.0641                                | Special PEV recharge period 10 pm - 6 am                           | Special off-peak rate for PEV only                                 | Special off-peak rate for PEV only; \$0.0546   |         |
|           | Home & PEV Option B (with special off-peak rate for PEV only) | Jul - Aug  | 2 pm - 7 pm                             | \$0.4784                                | 7 pm - 2 pm (special PEV recharge period 10 pm - 6 am)             | Special off-peak rate for PEV only                                 | Off-Peak: \$0.0706; special off-peak rate for PEV only; \$0.0571                               |         |
|           | Home & PEV Option B (with special off-peak rate for PEV only) | Sept - Jun   | All hours                               | \$0.0987                                | Special PEV recharge period 10 pm - 6 am                           | Special off-peak rate for PEV only                                 | Special off-peak rate for PEV only; \$0.0678   |         |
|           | Home & PEV Option A (with special off-peak rate for PEV only) | Jun - Sept   | 1 pm - 7 pm                             | \$0.3217                                | 7 pm - 1 pm (special PEV recharge period 10 pm - 6 am)             | Special off-peak rate for PEV only                                 | Off-Peak: \$0.0870; special off-peak rate for PEV only; \$0.0584                               |         |
|           | Home & PEV Option A (with special off-peak rate for PEV only) | Oct - May  | All hours                               | \$0.0628                                | Special PEV recharge period 10 pm - 6 am                           | Special off-peak rate for PEV only                                 | Special off-peak rate for PEV only; \$0.0487   |         |
|           | Home & PEV Option B (with special off-peak rate for PEV only) | Jul - Aug  | 2 pm - 7 pm                             | \$0.5227                                | 7 pm - 2 pm (special PEV recharge period 10 pm - 6 am)             | Special off-peak rate for PEV only                                 | Off-Peak: \$0.0845; special off-peak rate for PEV only; \$0.0683                               |         |
|           | Home & PEV Option B (with special off-peak rate for PEV only) | Sept - Jun   | All hours                               | \$0.0942                                | Special PEV recharge period 10 pm - 6 am                           | Special off-peak rate for PEV only                                 | Special off-peak rate for PEV only; \$0.0692   |         |
|           | PG&E  | PEV & Home (with special off-peak rate for PEV only) | May - Oct                               | 7 am - 2 pm, 9 am - 12 pm, 12 pm - 7 pm | \$0.104  | 12 am - 7 am   | Special off-peak rate for PEV only   | \$0.050 |
|           |   | PEV & Home (with special off-peak rate for PEV only) | Nov - Apr                               | 7 am - 2 pm, 9 am - 12 pm, 12 pm - 7 pm | \$0.104  | 12 am - 7 am   | Special off-peak rate for PEV only   | \$0.050 |
| PEV Only  |   | May - Oct  | 7 am - 2 pm, 9 am - 12 pm, 12 pm - 7 pm | \$0.100                                 | 12 am - 7 am   | Special off-peak rate for PEV only                                 | \$0.050  |         |
| PEV Only  |   | Nov - Apr  | 7 am - 2 pm, 9 am - 12 pm, 12 pm - 7 pm | \$0.100                                 | 12 am - 7 am   | Special off-peak rate for PEV only                                 | \$0.050  |         |
| SCE       | PEV & Home (with special off-peak rate for PEV only)          | Jun - Oct  | 10 am - 4 pm M-F, except holidays       | \$ (0.0737)                             | Off-Peak: All other hours; Super Off-Peak: 12 am - 6 am            | Off-Peak: All other hours; Super Off-Peak: 12 am - 6 am            | Off-Peak: \$0.0534; Super Off-Peak: \$0.0609   |         |
|           | PEV & Home (with special off-peak rate for PEV only)          | Jun - Oct  | 10 am - 4 pm M-F, except holidays       | \$ (0.0737)                             | Off-Peak: All other hours; Super Off-Peak: 12 am - 6 am            | Off-Peak: All other hours; Super Off-Peak: 12 am - 6 am            | Off-Peak: \$0.0534; Super Off-Peak: \$0.0609   |         |
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| SDG&E     | PEV & Home (with special off-peak rate for PEV only)          | May - Oct  | 12 pm - 6 pm                            | \$0.2887                                | Off-Peak: 5 am - 12 pm, 6 pm - 12 am; Super Off-Peak: 12 am - 5 am | Off-Peak: 5 am - 12 pm, 6 pm - 12 am; Super Off-Peak: 12 am - 5 am | Off-Peak: \$0.0886; Super Off-Peak: \$0.1171   |         |
|           | PEV & Home (with special off-peak rate for PEV only)          | Nov - Apr  | 12 pm - 6 pm                            | \$0.1763                                | Off-Peak: 5 am - 12 pm, 6 pm - 12 am; Super Off-Peak: 12 am - 5 am | Off-Peak: 5 am - 12 pm, 6 pm - 12 am; Super Off-Peak: 12 am - 5 am | Off-Peak: \$0.0686; Super Off-Peak: \$0.0971   |         |
|           | PEV & Home (with special off-peak rate for PEV only)          | May - Oct  | 12 pm - 6 pm                            | \$0.1763                                | Off-Peak: 5 am - 12 pm, 6 pm - 12 am; Super Off-Peak: 12 am - 5 am | Off-Peak: 5 am - 12 pm, 6 pm - 12 am; Super Off-Peak: 12 am - 5 am | Off-Peak: \$0.0686; Super Off-Peak: \$0.0971   |         |
|           | PEV & Home (with special off-peak rate for PEV only)          | Nov - Apr  | 12 pm - 6 pm                            | \$0.1763                                | Off-Peak: 5 am - 12 pm, 6 pm - 12 am; Super Off-Peak: 12 am - 5 am | Off-Peak: 5 am - 12 pm, 6 pm - 12 am; Super Off-Peak: 12 am - 5 am | Off-Peak: \$0.0686; Super Off-Peak: \$0.0971   |         |
| SMUD      | PEV & Home (with special off-peak rate for PEV only)          | May - Oct  | 7 am - 10 am, 5 pm - 8 pm               | \$0.2080                                | All other hours, weekends, & holidays                              | All other hours, weekends, & holidays                              | Off-Peak: \$0.1111; special off-peak rate for PEV only; \$0.0840                               |         |
|           | PEV & Home (with special off-peak rate for PEV only)          | Nov - Apr  | 7 am - 10 am, 5 pm - 8 pm               | \$0.2080                                | All other hours, weekends, & holidays                              | All other hours, weekends, & holidays                              | Off-Peak: \$0.0907; special off-peak rate for PEV only; \$0.0784                               |         |

## West Coast Utility Rate Programs

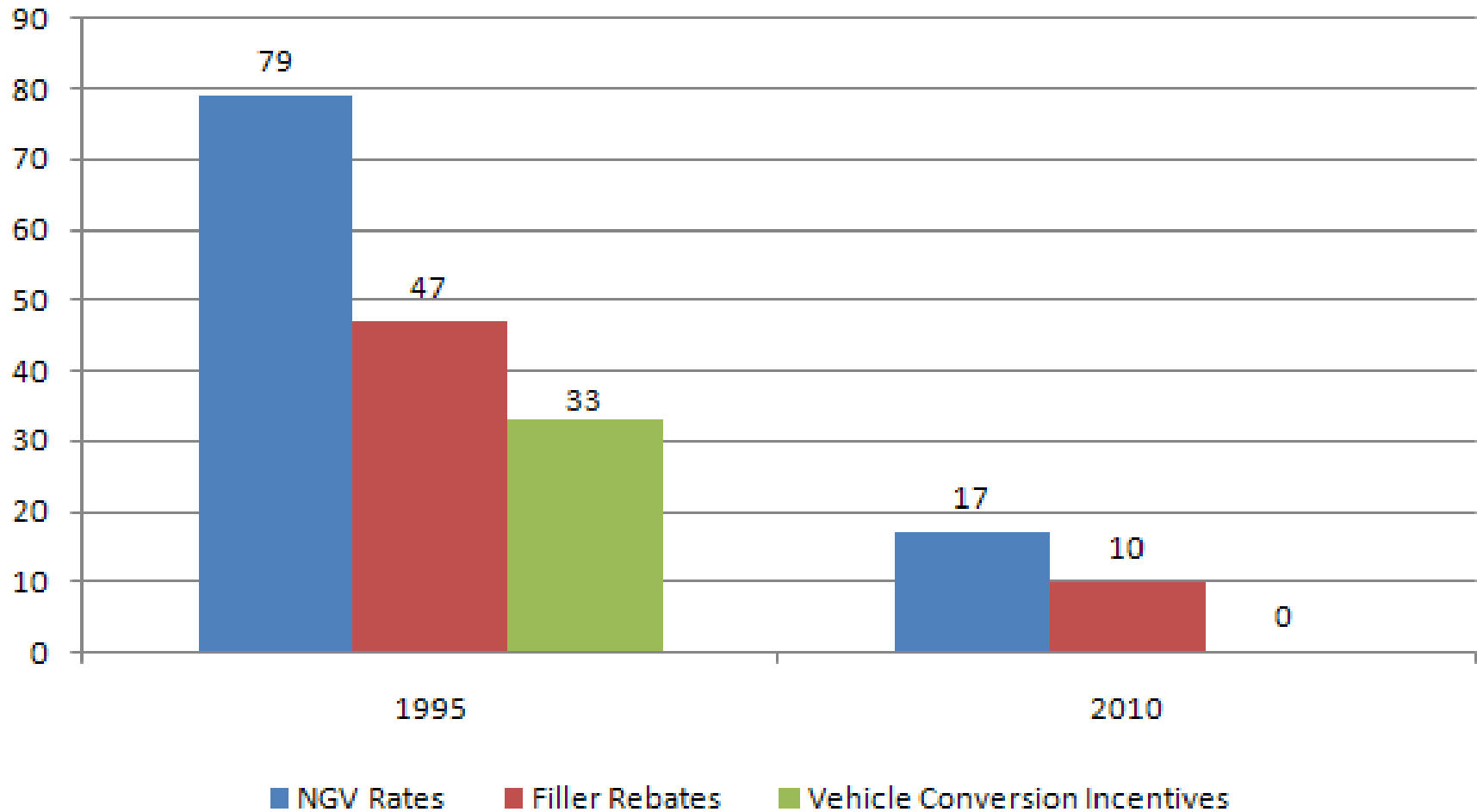
- *NV Energy*: Probably most complex
- *SCE, SDG&E*: Tied for second
- *SMUD*: Probably the simplest
- *PG&E*: A close second
- Overall: No C&I PEV rate plans
- Will these rate plans work to shift charging off-peak, and can they be streamlined/simplified further?

Full PEV rate details available soon, in *Electric Vehicle Rates* (EDRP-RB-13).





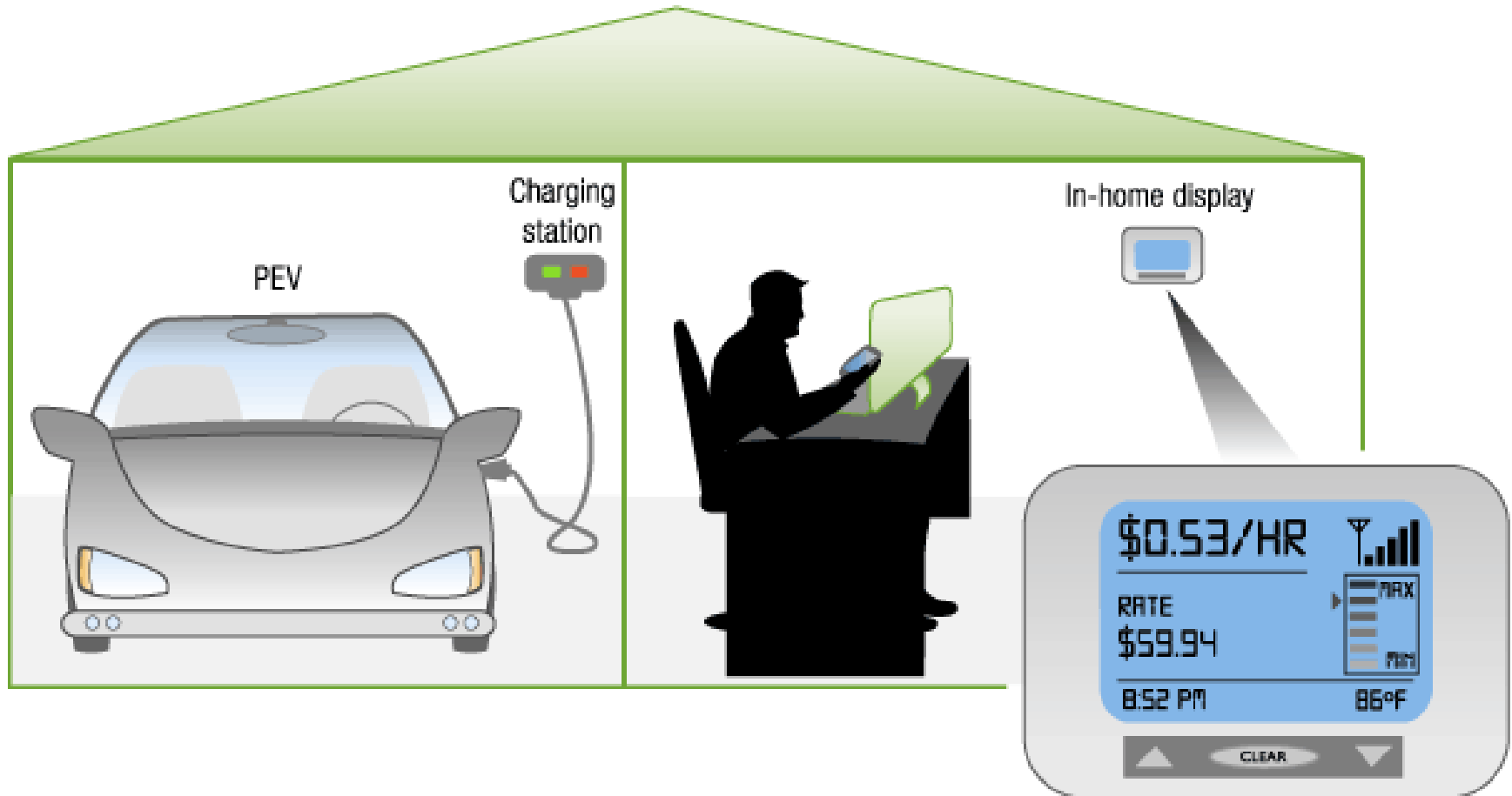
# Utility Rate Programs: NGVs



Data from the American Gas Association's [Natural Gas Vehicle Rate Report](#) (Nov. 2010).



# Business Opportunities: Touch Points

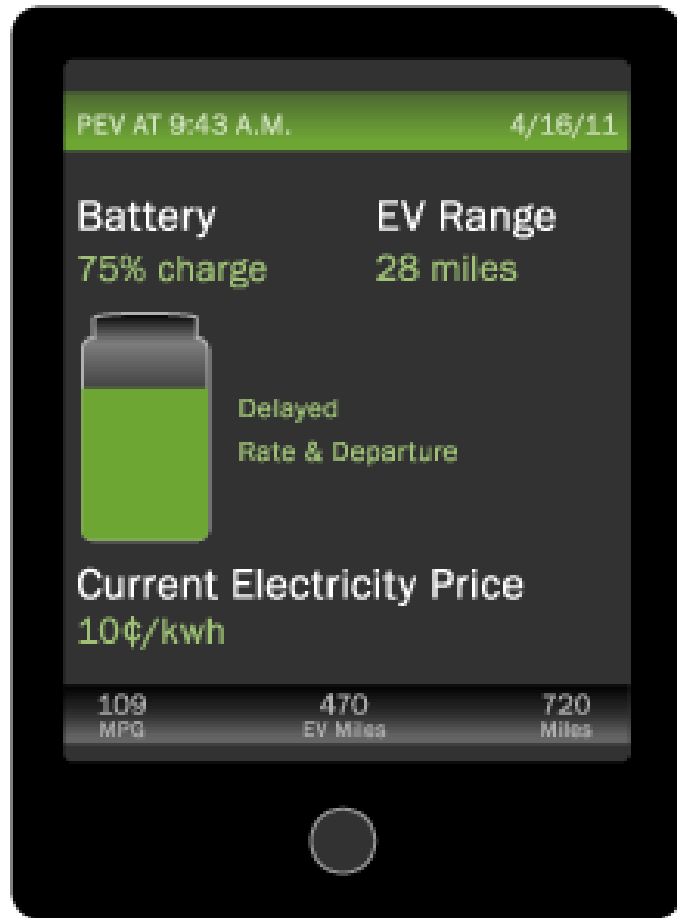


© E Source

Graphic excerpted from [Electric Vehicle Energy-Use Feedback](#) (Apr. 2011).



# Business Opportunities: Home Fueling



© E Source

## Utility-Owned Equipment

- More control (DR)
- Purchase power
- Communications
- Built-in incentives

## Utility-Subsidized Equipment

- Some control (DR)
- Lower investment

## Just Another Appliance

- Lowest investment
- Potentially high risk

Graphic excerpted from [Electric Vehicle Energy-Use Feedback](#) (Apr. 2011).



# In Summary

- *Infrastructure:*
  - PEVs: Data does not yet reflect the buzz, but there's still a lot of buzz
  - NGVs: Steady, but fuel prices are low and that could spur demand
- *Penetration:*
  - PEVs: Uncertain but definitely growing, lots of LDV models in the pipeline
  - NGVs: Will probably remain niche market, mainly buses and large trucks
- *Grid Impacts:*
  - PEVs: Issues should mostly be local (neighborhood transformers)
  - NGVs: If demand increases, could be sensitive to pipeline capacities
- *Rates:*
  - PEVs: Many exist, but should be simplified to avoid backlash
  - NGVs: Decrease in utility interest over the last decade, resurgence (?)
- *Business Opportunities*
  - PEVs: Multiple in-home opportunities, though growth may be slow
  - NGVs: Larger stations supply more fuel at lower cost



# Thank You!

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