

**California Air Resources Board**

# **2006 ZEV Technology Review**

**Sacramento, CA  
September 27, 2006**

**Comments by Felix Kramer, Founder  
The California Cars Initiative**



**CalCars**

THE CALIFORNIA CARS INITIATIVE

[www.calcars.org](http://www.calcars.org)

## Prius PHEV Pioneers



Felix Kramer (right),  
CalCars Founder, in '06,  
world's first non-engineer  
consumer PHEV owner

Ron Gremban, CalCars Tech  
Lead, owner/ driver of world's  
first PHEV Prius in '04



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## What Does “100+MPG (+ Electricity)” Mean?



50.8 miles @124.1MPG = \$1.13 gasoline + \$0.71 electricity. Total: **\$1.84** or **3.6 cents/mile**, compared to **\$2.79** or **5.5 cents/mile** for Prius, **\$4.00-\$12.00** or **8-20 cents/mile** for 35-12 MPG non-hybrids. We get **566 mi@130MPG** with most driving boosted and some all-electric trips.

*SMUD assumptions: \$2.75/gallon, \$0.102/kWh, 50 MPG Prius. When roll in "electric miles" to gasoline, **76 MPG equivalent**; at Felix's \$3.00 & \$.086, **83 MPG equivalent***



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## Multiple and Evolving Reasons to Plug In

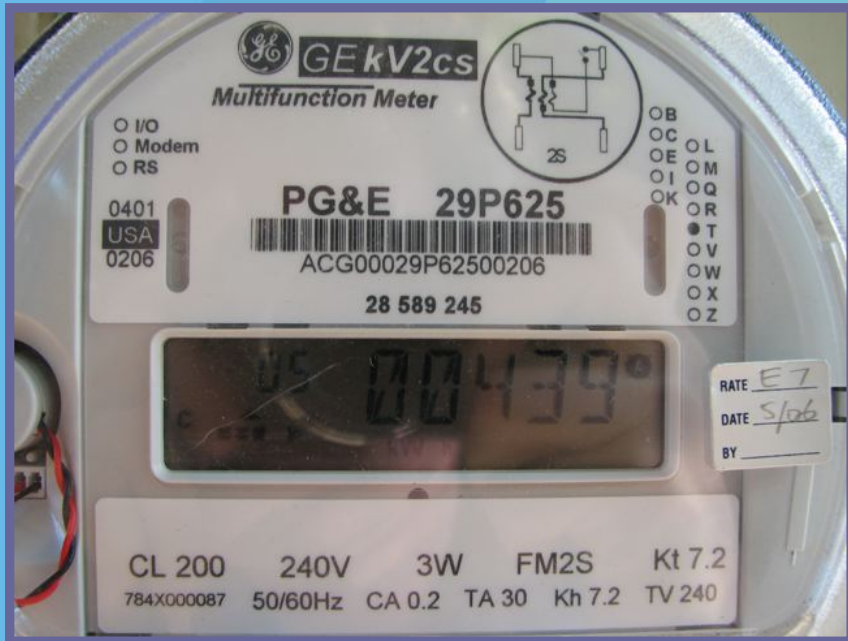
1. Saving money
2. Lower CO2
3. Energy independence
4. Silent driving
5. Avoid the pump
6. High-MPG "coolness"  
(not a joke)



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# Charging Calculus (after 9 Inconvenient Seconds)



- PG&E off-peak \$0.086/kwh = 2.2 cents/electric mile
- Summer on-peak \$0.293/kwh = 7.6c/e-mile
- Prius: 5.5 cents/mile
- "Opportunistic Charging" calls for rate-price signals at least for critical peaks



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## Evolving to V2H (Vehicle-to-Home)



**Phase 1:** Standard grid-connected system (car charges from grid)

**Phase 2:** Islanded off-grid system ties in PHEV for extended outages; battery + engine = emergency power

**Benefits:**

- Cleaner/cheaper than emergency generator
- PHEV enables use & storage of renewable energy



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# Growing Support and Optimistic Future Trends



Alan Greenspan, James Hansen, Senators Brownback/Clinton/Obama, Bill Ford, Bill Press, John Doerr



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**2004:** What's a PHEV?

**2005:** Prove demand & pricing

**2006:** How/when can I get one?

Recent praise for PHEVs from: George Bush,

**2007:** Incentives; 3<sup>rd</sup> parties manage battery costs and risks

**2008:** Volume production extending existing lines

**2009:** Optimized PHEVs

**2010:** Movement toward PHEVs as default vehicle drivetrain



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**[info@calcars.org](mailto:info@calcars.org)**



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