



PLUG-IN HYBRID ELECTRIC VEHICLES SUMMARIZED

Regular hybrids – with extension cords

- 120-volt off-peak recharging using cleaner, cheaper, domestic electricity
- 20-60 miles of all-electric range (HEV20, HEV40, HEV60)
 - Electric fuel tank you use first for local travel/commute
 - Standard HEV thereafter: best of both worlds; no performance sacrifice
- PHEVs can average well over 100 miles-per-gallon of gasoline (+ electricity)
 - Electric miles at the equivalent of under \$1/gallon
- No new infrastructure; existing technology; prototypes already here
 - Prof. Andy Frank at UC Davis has built PHEVs for more than a decade
 - PRIUS+ prototypes use lead-acid and nickel-metal hydride batteries
 - Aftermarket conversion companies EDrive and Hymotion use lithium-ion
 - Daimler-Chrysler-EPRI Sprinter test vans use both NiMH and Li-Ion
 - EPRI working with Eaton on utility trouble truck

Flex-Fuel PHEVs: 500+ MPG vehicles are in sight

- Cellulosic ethanol PHEVs approach oil-free, "zero-carbon" cars
- Beneficial pairing: plug in for local miles, E85 for range extension fuel

What's happening with PHEVs?

- Endorsements from both sides of the aisle: Senators Obama, Lieberman, Hatch, Chafee; NY Governor Pataki; President Bush & Advanced Energy Initiative
- Conversion companies emerging to meet growing individual and fleet demand
- Focusing on bringing OEMs into process: Ford, Toyota others show some receptivity
- Additional media coverage expected in coming months; animation at www.bettah.org
- Washington, DC day of "demonstration/rides" for Members of Congress in April
- CalCars working to demonstrate the existing technology, create the market, partner with OEM
- Despite greatly increased awareness and support, PHEVs not a "done deal" – additional efforts needed to involve automakers, first in demonstration programs, then production vehicles

Plug-In Partners (the 2005 IEPR recommended state support)

- Nationwide effort launched January 2006 has four-pronged approach:
 - Government/municipal resolutions (Baltimore, Boston, Dallas, Denver, Fort Worth, Los Angeles, Philadelphia, Salt Lake City, San Francisco, Seattle already)
 - Soft fleet orders from nonprofits/corporations/government
 - Petitions from individuals
 - Incentive programs

THE IMPACT OF PHEVS

Plug-In hybrids have myriad far-reaching benefits:

- Significant advantages of PHEVs (HEV20-60) even compared to non-plug-in hybrids (HEV0) *(along the lines of previous CEC, TIAX studies, CEC/ARB Petroleum Dependence Study)*
 - 25% - 55% reduction in NO_x and ROG
 - 40% - 80% reduction in petroleum
 - 35% - 65% reduction in greenhouse gases
- Relatively quick turnover of transportation capital stock (compared, for example, with buildings) means opportunity for more rapid impact on GHGs
- Vehicles get cleaner as the grid becomes increasingly renewable
- Job creation potential: directly if production facilities are sited in-state, indirectly from component suppliers and from an advanced vehicle technology infrastructure based at companies and universities
- **Vehicle-to-Grid**
 - PHEVs as mobile generators during power outages and emergencies
 - Future V2G vision integrates parked cars into electric power system for regulation services, load leveling (peak shaving, valley filling)

California could establish future PHEV target goals. Example: 100,000 PHEVs on the road by 2012; 1,000,000 by 2016.

- **100,000 PHEVs remove:**
 - 500,000 tons/year GHG
 - 46 million gallons/year gasoline
 - 125 tons/year NO_x/ROG
 - 6 tons/year PM
- **1,000,000 PHEVs remove:**
 - 4.5 million tons/year GHG
 - 460 million gallons/year gasoline
 - 1250 tons/year NO_x/ROG
 - 60 tons/year PM
- **If half of all light-duty vehicles were PHEVs, GHG reductions would be 60 million tons/year.**

ACTION ITEM #1

Create Plug-In Hybrid State/Industry Working Group (as recommended in 2005 IEPR)

- Similar to EV working group in 1990s.
- Mission:
 - Identify PHEV barriers and opportunities and work to resolve them.
 - Establish 1, 3, 5, and 10-year landmark goals.
 - Develop California PHEV Plan for RD&D leading to commercialization.
 - Coordinate with/support Plug-In Partners campaign.
 - Work to integrate E85 and/or other non-petroleum fuels.
 - Work to make state and federal smog and mileage testing protocols and regulations realistically favorable to PHEVs, flex-fuel vehicles and combinations.
 - Explore regulatory and financial incentives for PHEVs and broader mechanisms to target multiple goals (GHG/PM, NO_x + ROG, petroleum reduction) simultaneously. This should include consideration of feebates, battery leasing and other ways to mitigate market mechanisms that focus on up-front costs and ignore life-cycle costs.
- Members:
 - State Agencies
 - CEC/Resources
 - ARB/CalEPA
 - CPUC
 - General Services
 - BT&H/CalTrans
 - Local Agencies
 - SCAQMD & other interested air districts.
 - Plug-In Partners city, county endorsers.
 - Utilities
 - EPRI
 - SCE
 - SMUD
 - PG&E
 - CalETC
 - NGOs or Non-Profit Groups
 - CalCars
 - Bluewater Network & other environmental/sustainability and citizens groups
 - Plug-In America
 - Plug-In Partners
 - Set America Free
 - Automakers & Other Industry
 - As decided by the working group
 - Plug-In Hybrid Consortium (component supplier group)
- Schedule founding meeting, send out invitations, and host first meeting ASAP in 2006.
- Staffing: Technical Consultant hired using PIER funds.
- Work of this group would flow into the AB 1007 Report.

FUNDING OPPORTUNITIES

- Staff PHEV state/industry working group above

Technical Assessment and Application

- Support planned CalCars/Andy Frank development program for Ford Escape E85 PHEV demonstration vehicle
- Acquire PHEVs from aftermarket companies for evaluation and use in state fleet
- Join EPRI/DaimlerChrysler Sprinter RD&D
- Explore ways to leverage X Prize and other private programs aimed at creating early markets and incentives to increase impact
- Support any developing Qualified Vehicle Modifier partnerships with OEMs (which CalCars is currently working to establish)
- Other RD&D as identified by the Working Group

Evaluation and Testing

- Support Vehicle-to-Grid demonstration project from BART or other entities
- Battery testing program, specifically re: PHEV lifetime & vehicle safety testing, possibly in cooperation with USABC and others
- Battery warranty assistance program, including evaluation and possible pilot program with utilities for "unbundling" vehicle components with leased batteries
- Impact- and Ecostar-type deployment evaluations (with an OEM supplying PHEVs)

Studies

- Developing state/federal smog and mileage protocols and regulations realistically favorable to PHEVs, flex-fuel vehicles, and combined flex-fuel PHEVs
- Update the 2001-02 HEV Working Group PHEV market potential and market research studies
- Explore ways to address PHEVs' higher first costs, including: battery leasing, V2G contracts with ISOs, feebate programs, transfer of carbon credits

Education

- Series of statewide conferences to educate CA re: petroleum dependence, climate change, transportation and available solutions, including PHEVs and E85 PHEVs
- Events in partnership with Plug-In Partners endorsers