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)
  o Electric fuel tank you use first for local travel/commute
  o Standard HEV thereafter: best of both worlds; no performance sacrifice
- PHEVs can average well over 100 miles-per-gallon of gasoline (+ electricity)
  o Electric miles at the equivalent of under $1/gallon
- No new infrastructure; existing technology; prototypes already here
  o Prof. Andy Frank at UC Davis has built PHEVs for more than a decade
  o PRIUS+ prototypes use lead-acid and nickel-metal hydride batteries
  o Aftermarket conversion companies EDrive and Hymotion use lithium-ion
  o Daimler-Chrysler-EPRI Sprinter test vans use both NiMH and Li-Ion
  o 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:
  o Government/municipal resolutions (Baltimore, Boston, Dallas, Denver, Fort Worth, Los Angeles, Philadelphia, Salt Lake City, San Francisco, Seattle already)
  o Soft fleet orders from nonprofits/corporations/government
  o Petitions from individuals
  o 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 NOx 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 NOx/ROG
  - 6 tons/year PM
- **1,000,000 PHEVs remove:**
  - 4.5 million tons/year GHG
  - 460 million gallons/year gasoline
  - 1250 tons/year NOx/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, NOx + 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