

PLUG IN AMERICA













Plug-in Vehicle History and Status

A Presentation to the California Air Resources Board
ZEV Technical Review Panel

September 27, 2006

ZEV Mandate Produced Real ZEVs

		<u>Leased/Sold</u>	<u>On Road Today</u>
	Toyota RAV4-EV	1485	820
	Ford Ranger EV	1312	~400
	GM EV-1	800	0 ²
	Ford Postal Van	495	0
	Chevrolet S-10 Electric	450	55
	Ford Th!nk City	440	~100 ³
	Honda EV Plus	300	0 ²
	Chrysler EPIC Mini-Van	207	5
	Nissan Altra	130	0 ²
	Nissan Hypermini	50	0 ²
	Toyota eCom	<u>15</u>	<u>0</u> ²
		5599 ¹	1380

Source: Various industry and private sources

¹ nationwide deployments of vehicles resulting from ZEV regulation.

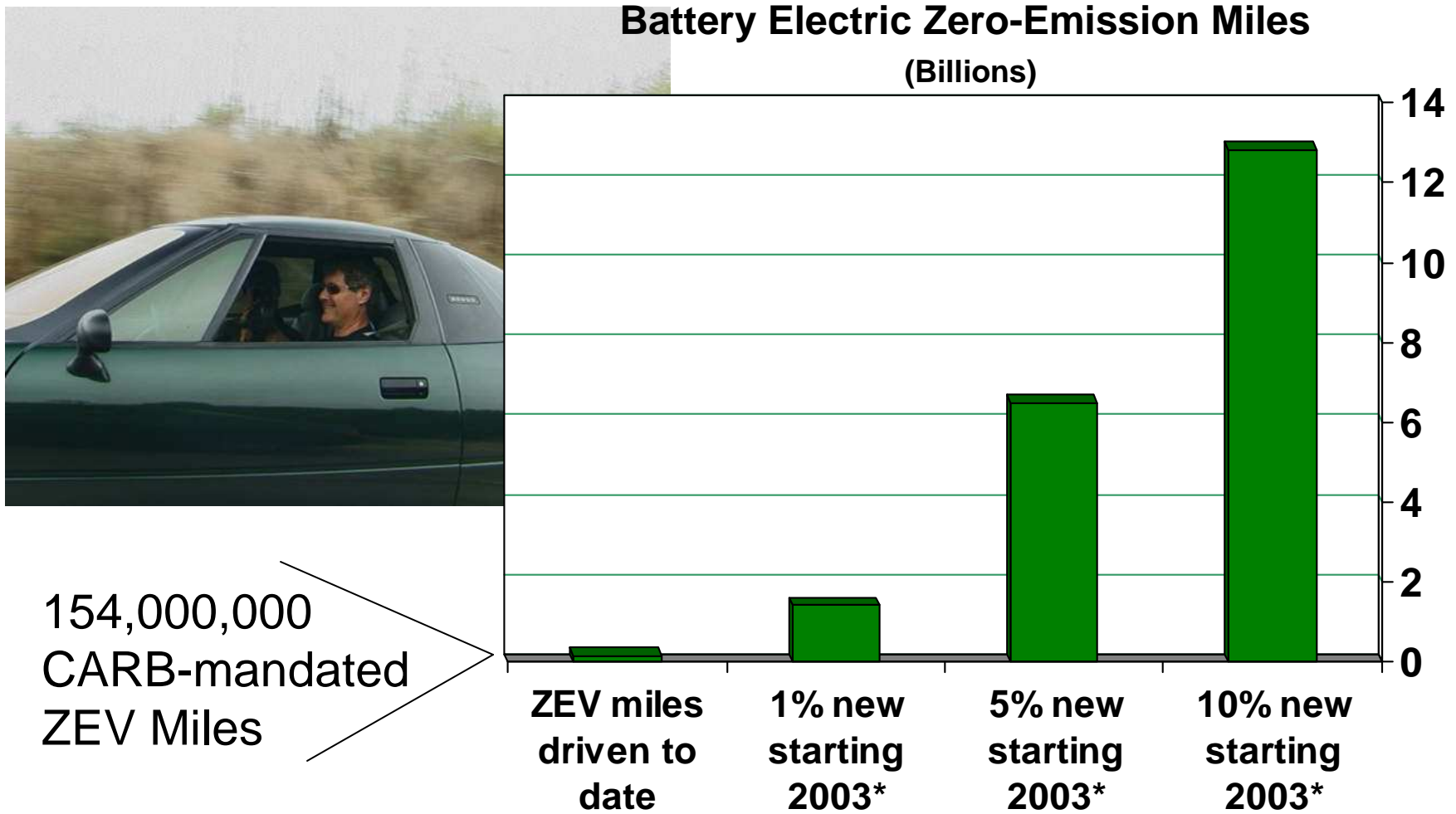
CA deployments = 4400

² excludes small numbers potentially still in use by OEMs for testing

³ redeployed in Norway – none on US roads



CARB Mandate Plug-in Zero-Emission Miles: Achievement & Promise



* Assuming mandate had resulted in new ZEV sales starting in 2003



Emissions Avoided*

- Battery Electric ZEV miles to date:

- 2.3 billion pounds of CO₂
- 257 million grams CO
- 778 thousand grams NO_x



- If 1% of sales in 2003 were ZEVs:

- 21 billion pounds of CO₂
- 2.4 billion grams CO
- 7.2 million grams NO_x

- If 10% of sales in 2003 were ZEVs:

- 189 billion pounds of CO₂
- 21 billion grams CO
- 65 million grams NO_x

***Well-to-wheels comparison, with charging on California electrical grid**



Sources: CARB LEV II Exhaust Emission Standards
Argonne National Labs GREET 1.6 Fuel-Cycle Model for Transportation Fuels... June 2001

Positive User Experiences

- BEV driver experience overwhelmingly positive
 - home charging a major benefit
 - safe, convenient, reliable
 - public charging useful for occasional longer trips
 - lower refueling and operating costs
 - less regular maintenance
 - no oil changes
 - no smog checks



- Purchase/lease experience often was largest negative
 - cumbersome sales process, long waits for vehicles
- Repairs, in general, resulted from implementation issues, not intrinsic technology issues
- NiMH batteries have proven very reliable in real world driving
 - robust, predictable, durable

Consumers Want Plug-in Cars

- 33% of new car buyers serious about alternative-fuel cars, and 92% of these willing to pay \$9,258 extra for one

The Wall Street Journal / Harris Interactive Poll 2006

- 75% have heard of plug-in hybrids, 55% think they're good idea

Opinion Research Corp. 2005



- 3 to 5 year-old RAV4-EVs are currently selling for a premium of \$10K to \$20K over the original retail price without any rebates or tax incentives



City of Austin, Texas

www.pluginpartners.org

- 6,900 “soft” fleet orders gathered
- 32 U.S. cities signed on, orders pending
- 18 counties and local governments
- 2 biofuel associations
- 56 environmental and security groups
- 12 businesses
- 126 public and private utilities



The Straus Family Creamery

- Marin County, CA
- 2002 RAV4-EV
- 56,000 zero-emission miles
- Personal transportation and farm utility vehicle



- Farm's methane digester powers RAV4-EV and farm equipment
- No repair issues other than flat tires

Avi Hershkovitz

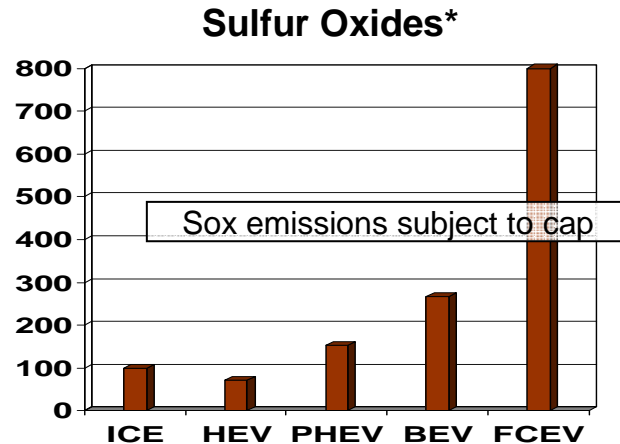
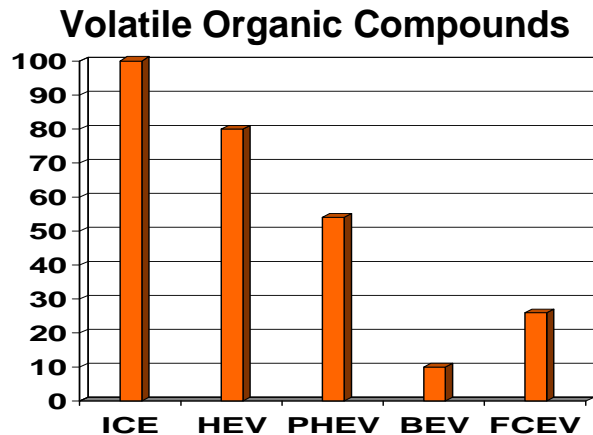
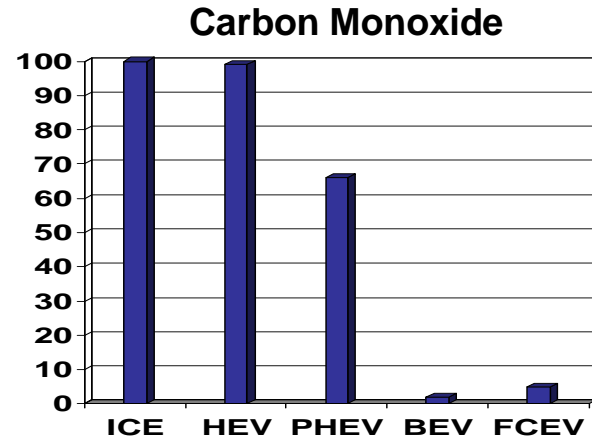
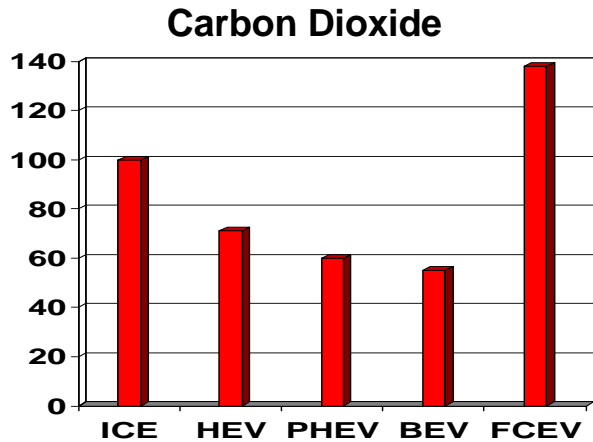
- Claremont, Ca
- 2002 RAV4-EV
- 105,135 zero-emission miles



- Used as primary vehicle including 100-150 mile per day commute every working day
- No discernable loss of range after more than 100,000 miles

BEVs Really Do Produce Less Emissions

Well-to-wheels emissions based on total US electrical grid



* EV Charging on US grid should not result in additional SO₂ emissions due to regulatory emission caps on stationary sources already in place



Sources: Argonne National Labs GREET 1.6 Fuel-Cycle Model for Transportation Fuels... June 2001
FCEV based on US grid powered electrolysis fuel cycle

Plug-in Vehicles and Renewable Energy



- Plug-in Vehicles are the only practical vehicles that can be charged from renewable energy produced at home

- A 2 kW rooftop solar array provides all the electricity for typical 12,000 mi/yr
 - \$12 - 15,000 upfront cost
 - 180 - 260 square feet
 - 6 - 8 year payback
 - >30-year life

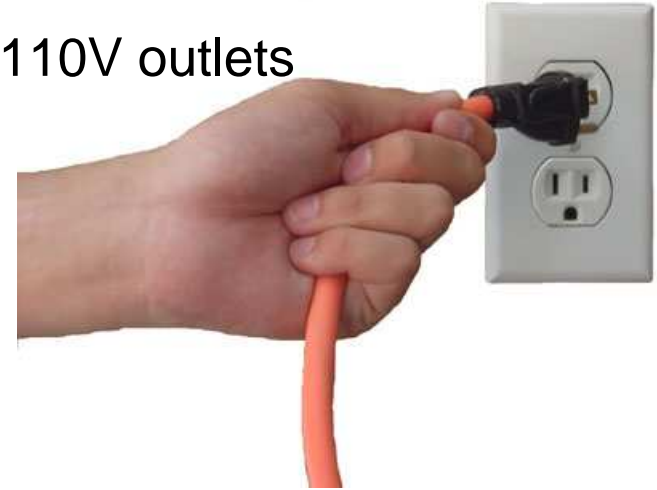


No New
Infrastructure
Needed!

Electricity is our most ubiquitous and economical energy source

- Hundreds of millions of existing 240V/110V outlets

*Plug-in Hybrid “charging stations”
already exist in most California garages*



- Over 500 public vehicle charging sites in service in California today
- Optional fast charging technology, already developed, could be rapidly deployed for under \$20,000 per site

New Life for Battery Electrics



- Tesla – Roadster

- 250 mi range
- 0-60 mph in 4 sec
- Charging - std 110 or 220v outlet
- First 100 units sold out in <30 days

- Redesigned Th!nk City

- Back on track



- AC Propulsion – eBox

- Based on Scion xB
- 140-180 mi range
- Charging - std 110 or 220v outlet

- Commuter Cars – Tango

- Now on the street



PHEVs are on the way



Saab 9-3 PHEV Biopower Convertible

- Rapid progress on plug-in hybrids
 - Numerous prototypes and demonstration vehicles
 - Real on-road testing underway
 - Significant durability testing already completed



Daimler-Chrysler Plug-in Hybrid Sprinter Van



Plug-in Prius by eDrive Systems

Plug-in Vehicles

Practical, Proven, Ready

- Over 150 million emission-free *consumer* miles driven
- Cleanest personal automotive alternative available
- Only option that allows fueling from home-based renewable energy sources



- Consumer demand already demonstrated
- Continued battery advancements promise longer range BEV and PHEVs
- Plug-in hybrid vehicles provide lower cost entry point for plug-in vehicles and potentially wider initial market