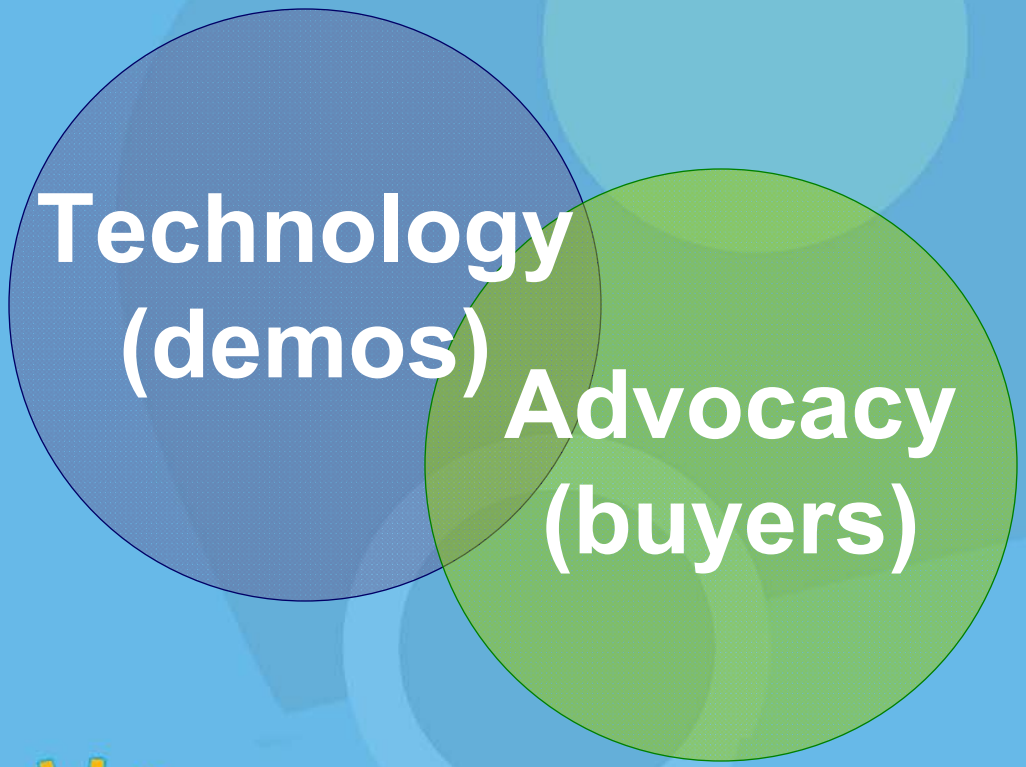
Commercializing Plug-In Hybrids

February 2, 2009

Felix Kramer, Founder
The California Cars Initiative
info@calcars.org

PDF of latest presentation always at
www.calcars.org/downloads

Nonprofit Startup: CalCars' hybrid goals/members

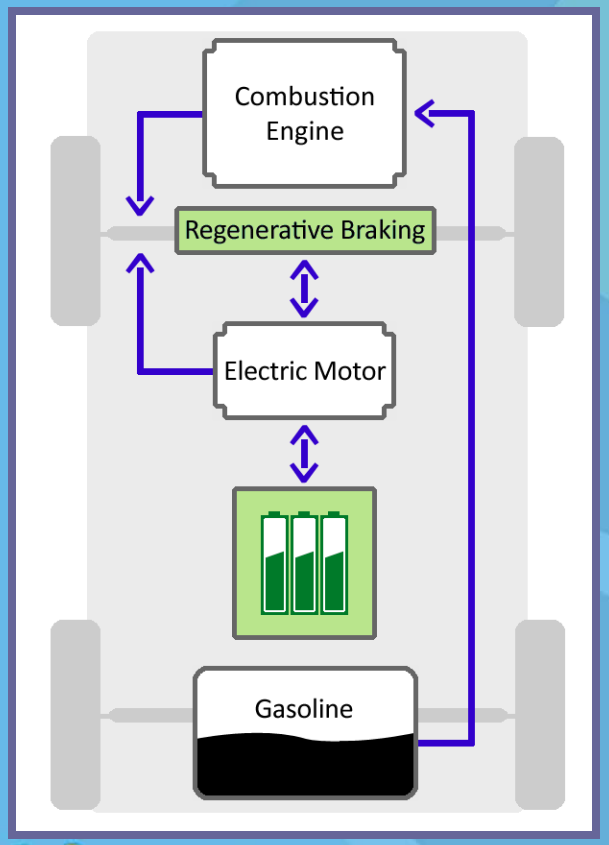


- Entrepreneurs
- Engineers
- Environmentalists
- Consumers/drivers

- Expanding decisionmaking
- New models for partners/ Open Source innovation
- Approaching success!
- Giving messages of hope

Progress since October 2003

Todays hybrid evolves into the plug-in hybrid



HYBRID to PLUG-IN HYBRID

SMALLER gasoline engine

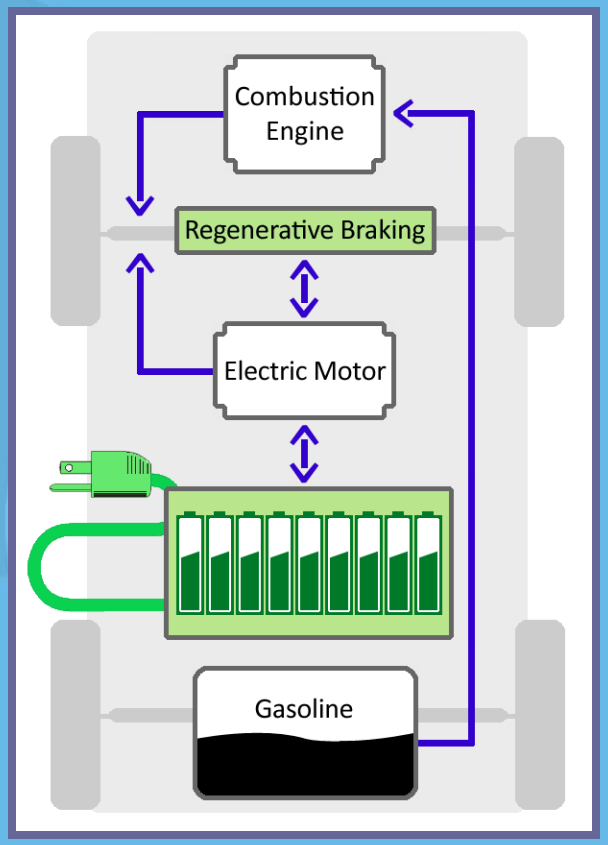
(same regeneration)

SAME/LARGER electric motor

MUCH LARGER battery

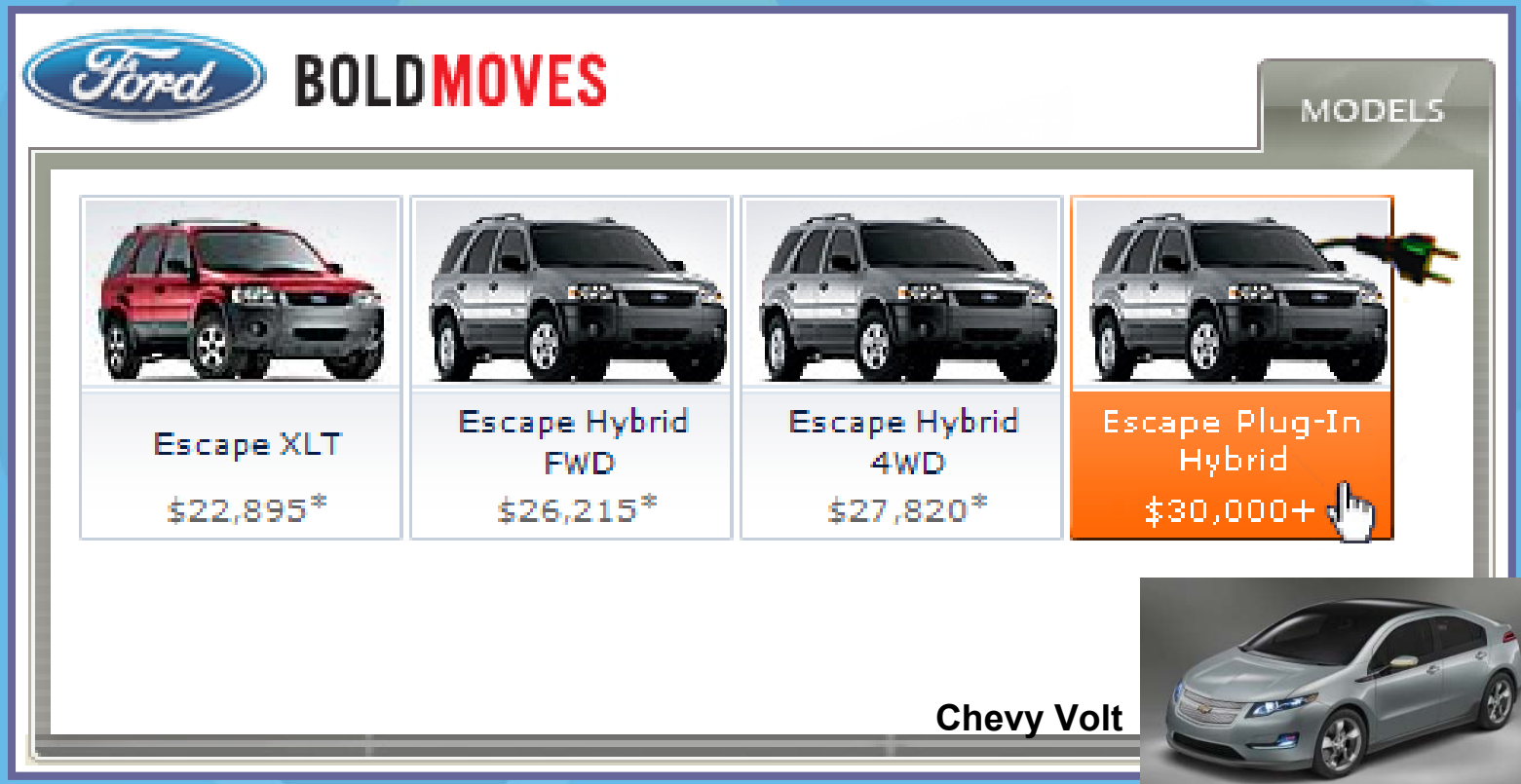
NEW: Plug into the grid

(same gas tank)



Modified from an EDTA diagram concept

Expand driver choice via line extensions…



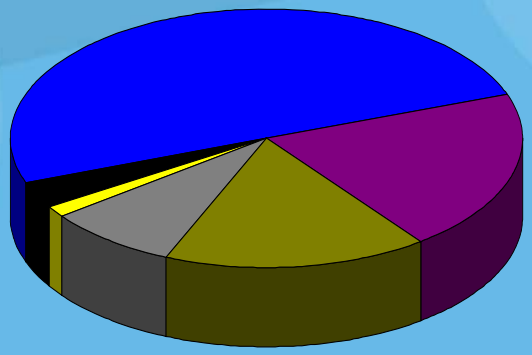
Chevy Volt

…and from the ground-up vehicles

Electricity isn't just different—it's better than gas

1. ECONOMICS: <u>CHEAPER</u> -- electric miles at a quarter the cost

2. CLIMATE: <u>CLEANER</u> -- 50% less CO2, even on our half-coal national power grid



3. ENERGY SECURITY: <u>DOMESTIC</u> -- Only 1.5% of electricity comes from oil in US

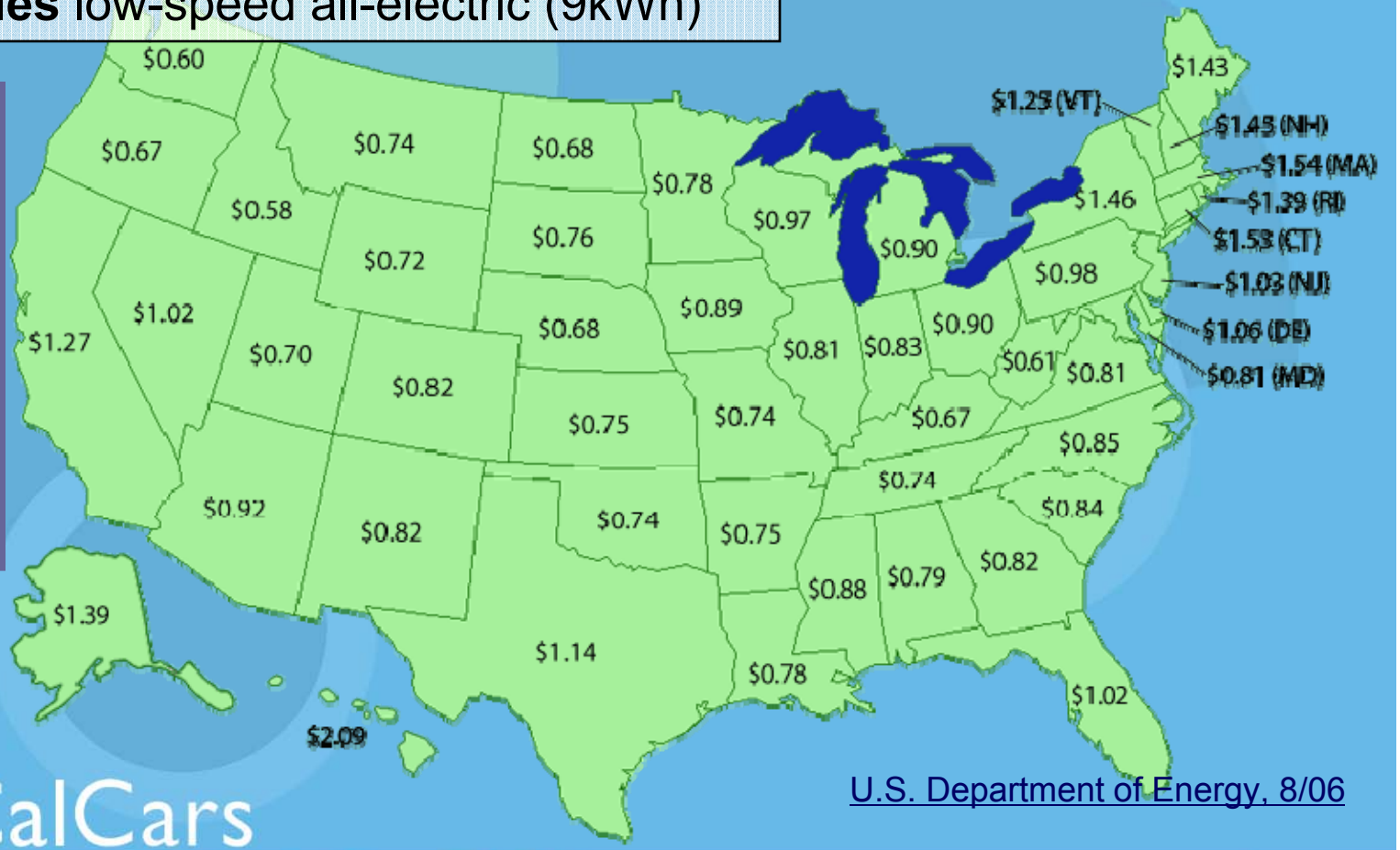
How much cheaper per day?

Day range: 50 miles at mixed-speeds, 124 MPG gasoline +1/8 kiloWatt (about $.01/mile) electricity

Cost for **30 miles** low-speed all-electric (9kWh)

National average: $0.94

Off-peak as low as **$0.45**



U.S. Department of Energy, 8/06

November 2004: open-source PRIUS+ demo

The New York Times

Hybrid-Car Tinkerers Scoff at No-Plug-In Rule

By DANNY HAKIM

DETROIT, March 31—Ron Gremban and Felix Kramer have modified a Toyota Prius so it can be plugged into a wall outlet.

This does not make **Toyota** happy. The company has spent millions of dollars persuading people that hybrid electric cars like the Prius never need to be plugged in and work just like normal cars. So has **Honda**, which even ran a commercial that showed a guy wandering around his Civic hybrid fruitlessly searching for a plug.

But the idea of making hybrid cars that have the option of being plugged in is supported by a diverse group of interests, from neoconservatives who support greater fuel efficiency to utilities salivating at the chance to supplant oil with electricity. If you were able to plug a hybrid in overnight, you could potentially use a lot less gas by cruising for long stretches on battery power only. But unlike purely electric cars, which take hours to charge and need frequent recharging, you would not have to plug in if you did not want to.

"I've gotten anywhere from 65 to over 100 miles per gallon," said Mr. Gremban, an engineer at CalCars, a small nonprofit group based in Palo Alto, Calif. He gets 40 to 45 miles per gallon driving his normal Prius. And EnergyCS, a small company that has collaborated with CalCars, has modified another Prius with more sophisticated batteries; they claim their Prius gets up to 180 m.p.g. and can travel more than 30 miles on battery power.

"If you cover people's daily commute, maybe they'll go to the gas station once a month," said Mr. Kramer, the founder of CalCars. "That's the whole idea."

Conventional hybrid electric cars already save gas. But if one looks at growth projections for oil consumption, hybrids will slow the growth rate of oil imports only marginall
pending o
actually s
potentiall
makers h
powered b

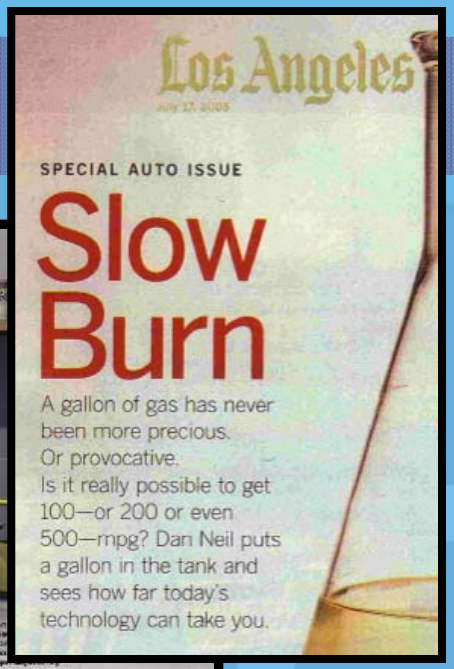
But fue
reinventio
tion the na
nology to p
way from
brids say
is availabl

building them in garages.

"All of the relevant technology is at hand," said Frank Gaffney, founder of the Center for Security Policy and an assistant defense secretary in the Reagan administration. His group was among a coalition of right-leaning organizations that released an energy plan this year promoting plug-ins as one way to increase fuel efficiency in light of the instability of the Middle East.

"If you're thinking about this as an environmental issue first and foremost, you're missing the point," Mr. Gaffney said. Curbing dependence on
he added, "is a national
ergency."
owever, says the plug-in
for prime time.
this is the next great
just isn't," said David
an executive engineer at
e electric utilities really
electricity and they want
he transportation sector
t expands their market.
n agenda."
lug-in hybrid is not just
f the garages of enthusi-

Media avalanche 2005



TIME

npr

RED HERRING

THE CHRISTIAN SCIENCE MONITOR

abc NEWS

The Economist

WIRED NEWS

San Francisco Chronicle
NORTHERN CALIFORNIA'S LARGEST NEWSPAPER

BusinessWeek

Detroit Free Press

AP Associated Press

CalCars
THE CALIFORNIA CARS INITIATIVE

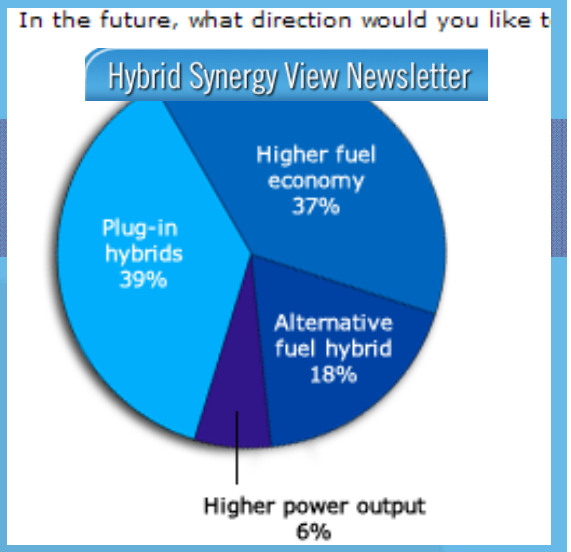
www.calcars.org

Plug-in hybrids go to Washington 2006

You pull in and you plug it right into the wall…

Amazing breakthrough...

Momentum grows 2006-2007



npr
Hourly News Summary
24-hour Program Stream | Schedule
Search NPR.org
May 6, 2007
PROGRAMS | STATIONS | TRANSCRIPTS | ARCHIVES
LOCAL STATIONS
Listen Live to 300+ Stations
THE LONG VIEW
Iacocca Says Detroit Is Living in the Past
Listen

The legendary CEO says he's become a big fan of the hybrid cars that Toyota has been marketing for years. Plug-in hybrids are the wave of the next five years, Iacocca predicts.

Special Report: The Truth About Plug-in Hybrid Cars

Garage tinkerers have been turning hybrids int
for years, but somehow no one paid attention.
clean-car alternatives (like those below) got all
But, really—hydrogen? Maybe, someday. Now,
carmakers say plug-in hybrid electric vehicles
coming, if the engineers can get the batteries r
will. Because it's hard to argue with 100 mpg.

- BACK STORY: PM's Reporter on Hybrid Skep
- QUIZ: Test Your Plug-in Smarts!
- COMPARISON: How Much Are Hybrids Savin
- HOW IT WORKS: GM's Volt Concept (with Ani

PopularMechanics
Cover Story May 2007

VentureBeat

BE PART OF
Get the fa

DIGG THIS | BOOKMARK THIS | PRINT VERSION | EMAIL STORY | SPHERE IT

Google gives $200,000 to plug-in hybrid car group

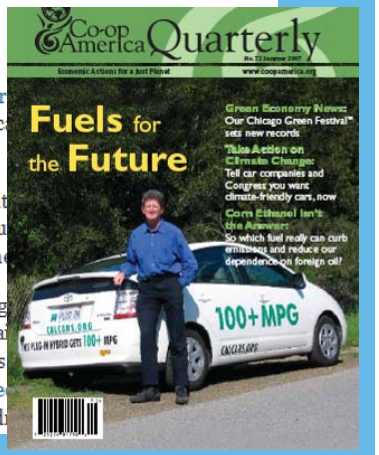
BY MATT MARSHALL 05.2.07

google.org
CalCars

Google's for-profit foundation Google.or
grant to CalCars.org, a group that advoc
hybrid electric cars.

Plug-in hybrids are cars you can plug int
recharge their batteries, and national au
to develop them. PG&E and GM plan to enter the market over the n

CalCars' Felix Kramer (left) is the g
around Palo Alto, Calif. that he cla
Google grant comes seven months
support plug-in hybrids first leake
that piece was speculative and did



CalCars
THE CALIFORNIA CARS INITIATIVE
www.calcars.org

Unprecedented broad support & alliances

CONVERSION COMPANIES

Hymotion
Plug-In Supply
GREEN GEARS
HybridsPlus

SUPPLIERS & COMPONENT-MAKERS

HybridConsortium.org
Plug-In Hybrid Development
Coulomb Technologies
EDTA Electric Drive Transportation Association

JOBS & FACTORY CONVERSIONs

Editorial: Minnesota lays a bet on cars of the future

ApolloAlliance

ENVIRONMENTALISTS & EV FANS

Plug In America
Rainforest Action Network
Friends of the Earth
NRDC The Earth's Best Defense

UTILITIES & FLEET BUYERS

Become a Plug-In Partner
Plug In Bay Area
Southern California Edison
Pacific Gas and Electric Company
SMUD Sacramento Municipal

NEO-CONS / GEO-GREENS

Set America Free
Cut dependence on foreign oil. Secure America.

RechargeIT

enterprise
Google

A coalition between the tree-huggers, the do-gooders, the sod-busters, the cheap hawks, and the evangelicals. – *former CIA Director James Woolsey*

Gore, Stanford's Schneider, Batter Place's Thesen, Google's Brin+Page, Toyota's Knight+Miller, Costa Rica Env Minister Dobles

More @ CalCars Photos pages

Schwarzenegger, GM's Weverstad, Clinton, Intel's Grove, SF's Newsom, Rainforest's Krill, Friends of Earth's Fugere

2005-2008: 18 books with major focus on PHEVs

Link for info/ordering at CalCars.org home page

Kudos for Plug-In Hybrids

- The plug-in hybrid approach, as being pursued by CalCars, seems to be our **best bet** for controlling vehicle CO2 emissions in the near-term. *Dr. James Hansen*
- We should help America's automobile industry to **convert quickly to plug-in hybrids** that can run on the renewable electricity that will be available. *Al Gore*
- The drumbeat of electrical transportation is **accelerating like nothing I've ever seen**. *Andy Grove*
- Plug in hybrids are a **really big deal**… practical, profitable and urgently needed. *John Doerr*
- The **most notable technological advancement** of the past 50 years, *David Cole/CAR*
- GM's **most important model in decades** -- and possibly the key to its survival. *Wall Street Journal*
- The first step toward a **new kind of car for everyone**. *Mark Phelan/Detroit Free Press*
- The Volt has joined baseball and apple pie as an unassailable, non-partisan **symbol of American can-do and know-how**….the most important political accessory since the flag lapel pin. *Wired*
- "Felix Kramer has made plug-in electric cars not only his passion but an i**mminent American reality**." *Thomas Friedman, Hot, Flat and Crowded*
- Possibly the **most sought-after technological innovation** since Captain Kirk first flipped open his communicator is the plug-in hybrid. *Matthew Wald, NY Times*

Beating the European Union's 120gm CO_2 target

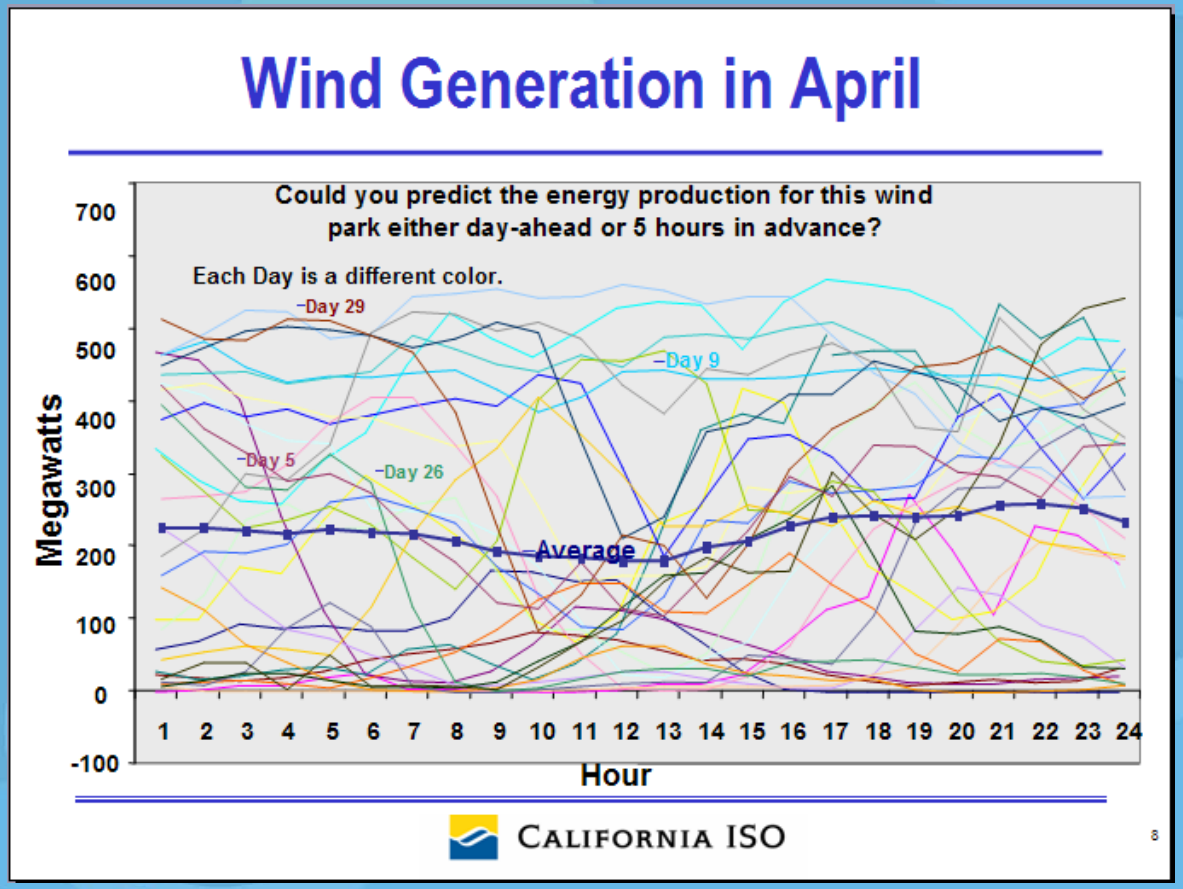
Source-to-wheels CO_2 EMISSIONS and FUEL ECONOMY (litres/100km) for mid-sized passenger car:

216 gm/km, **gasoline @ 9.2 l/100km (26 mpg)**
194 gm/km, **diesel @ 7.2 l/100km (33 mpg)**
127 gm/km, **hybrid @ 5.4 l/100km (44 mpg)**
114 gm/km, **PHEV-20km @ 3.8 l/100km** at 30% EV -- with higher EV%, conversions can get
97 gm/km, **PHEV-96km @ 1.6 l/100km** at 70% EV **<2.5 l/100km** or 40 km/l or **100+mpg)**

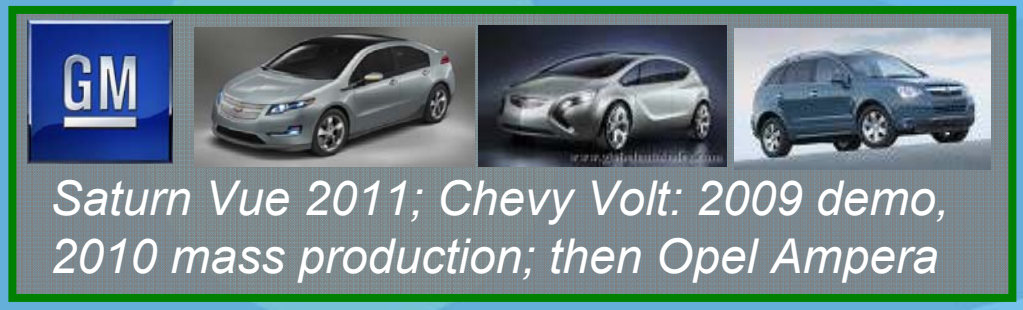
ElectGrid Location	EV g/kWh	EV g/km	PHEV-32 gm/km	PHEV-96 gm/km	EV as % of ICE	EV as % of diesel	EV as % of HEV
U.S. 2004	615	103	120	110	48%	53%	81%
U.S. 2010	500	84	114	97	36%	43%	66%
U.S. 2050	375	63	108	82	29%	32%	50%
Calif 2004	236	39	101	65	18%	20%	31%

2010/2050 grid emissions from 2007 EPRI/NRDC Study
EV/PHEV electric miles: 16.7 kWh/100km Analysis: CalCars Tech Lead Ron Gremban, Presentations at EEET-2007(see Downloads Page)

Car Batteries + Night Wind = 24/7 Clean Energy



18+ carmakers interested; race to be first; few timetables *(see CalCars Carmakers page summary)*



Automakers still holding out for perfect batteries

- **40 mile range/life of vehicle/price-competitive**
- **NiMH:** Proven in hybrid, RAV4 EV (125K+ miles)
- **Lithium-Ion** (75K+ miles)

  Good enough for

  Version 1.0 demo fleets

Left: nano-phosphate lithium (A123Systems)
Above: lead-acid (EAA-PHEV/Plug In Supply)

What's taking so long? The wait for Version 1.0

Without The Brick for $3,995,
would we have the Razr & iPhone?

Today's $1,000 plasma TVs started at $10,000.

Toyota: maybe 2010 –
why not in 2009?

Chevy Volt : production in 2010 --
2009 demo fleets.

Almost 2 dozen other automakers:
PHEVs/EVs a good idea – someday.

President Obama on PHEV Policies

Nov '07 Googleplex. *"When it becomes possible in the coming years, we should make sure that every government car is a plug-in hybrid."* (2006)

Campaign & first weeks

- $7,500-$10,00 consumer tax credit for new plug-in cars
- Tax credits for conversions–maybe
- $4 billion in loans and tax credits to carmakers for factory retooling
- White House fleet all-plug-in within a year (as security permits)
- 50% of cars purchased for the federal fleet plug-in by 2012
- 1 million plug-in cars by 2015
- California waiver: likely approval
- Focus on "more efficient cars"

Conversions to electrify world's 900+ million cars

Chicago: F-150 PHEV, then …transit buses etc. hevt.com

Vancouver: Ford trucks
rapidelectricvehicles.com

Andy Frank's company
efficientdrivetrains.com

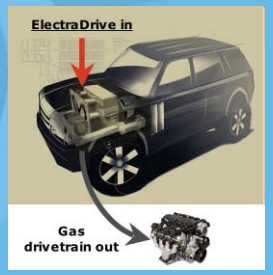
ElectraMount modular
electradrive.net

Supplementary drivetrains
evpowersystems.com

Partial power for sedans
poulsen.com

Neil Young
lincvolt.com

Mexico City: Nissan EV taxis clever-in.org



Key themes: why we can't wait, must start now

- Slow Pearl Harbor: we didn't wait for perfect planes & tanks
- End BAU (Business As Usual): CO2 wedge; ChIndia & coal
- All products need to become cleaner/cheaper
- Successful PHEV Commercialization ASAP
- Good enough welcomes but doesn't require future technologies
- Build realistic public expectations for market success
- Version 1.0 conversions/demo fleets help v.2.0 cars succeed
- Make OEMs offers so good they can't refuse: orders/warranties
- Small US & int'l startup competitors may help end limbo

Keeping up the pressure

Coming Up for CalCars:

- Tech demos
- Do-It-Yourself
- Federal policy
- SolarV2B
- Convert large ICEs
- Partners/companies
- Int'l campaigns

2002-04: What's a PHEV?
2005: Prove demand & pricing

2006: How/when can I get one?

2007: Expanding conversions; small company production plans

2008: Small demo & V2G fleets

<u>BEST CASE</u>: requires campaign

2009: Low-volume production; public incentives; battery warranties

2010: Mass production

2012: Optimized PHEVs

CalCars: a resource for this broad campaign

Watch News-Archive & Carmakers pages

09/24/08:	CEOs & Generals Plug In; Iceland Giving Up on Hydrogen
09/24/08:	Chrysler "Jolts" PHEV Race; PHEV Ads; V2Green Acquired
09/23/08:	Senate OKs Plug-In Credits, Toyota Frets; Free Press Lyrical about Plug-Ins
09/19/08:	TIME, Comedy Central, Chrysler Zeo, Another F-150; Another Book; Fisker $
09/17/08:	The Volt's Redesign: Pro/Neutral and Suspect
09/17/08:	Big-Picture Volt Coverage: Time/BizWeek/Forbes/Car+Green Sites
09/17/08:	Our 1,000th Posting: A Moment to Celebrate
09/16/08:	Big Day for GM Chevy Volt and Plug-In Cars
09/14/08:	GM's 100th Anniversary to Feature Volt: Watch Tues Sept 16
09/09/08:	Economist/Newsweek/Time on Plug-In Cars; Accenture on Biofuels vs. PHEVs
09/09/08:	T. Friedman's New Bestseller Hot, Flat & Crowded Touts Plug-Ins
09/04/08:	Presidential Candidates and PHEVs: Side-by-Side Matchup
09/03/08:	Nissan and Chrysler have PHEV Prototypes; May Join Race
09/02/08:	Hyundai/Mazda Developing PHEVs; GM Chooses Battery Supplier
09/02/08:	Toyota to Dealers: Slow Down! Plus Demo Fleets Explained
08/28/08:	GM Says "No Race" But One-Ups Toyota with Large '09 Volt Test Fleet

Subscribe to CalCars-News

Send people to Jobs page

Print/distribute PDFs from Downloads page

Donate!