

EFFICIENT DRIVETRAINS INC.

A PRIVATELY HELD INDEPENDENT COMPANY

Impact of the PHEV on Society

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Societies current problems



- Peak oil and rising price of fuel
- Global warming and vanishing species
- Global solutions are not immediately available

- Potential solution: PHEV
 - Electrification of transportation and society
- Use of Renewable Solar and Wind energy



PHEV Engineering: Timeline



1965

UW Madison



“Aftershock”

UC Davis

1993



1998 “Coulomb”



2002 “Yosemite”

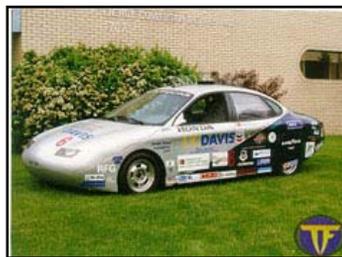
1972

Urban Car Challenge



“Joule”

1996



“Sequoia”

2000

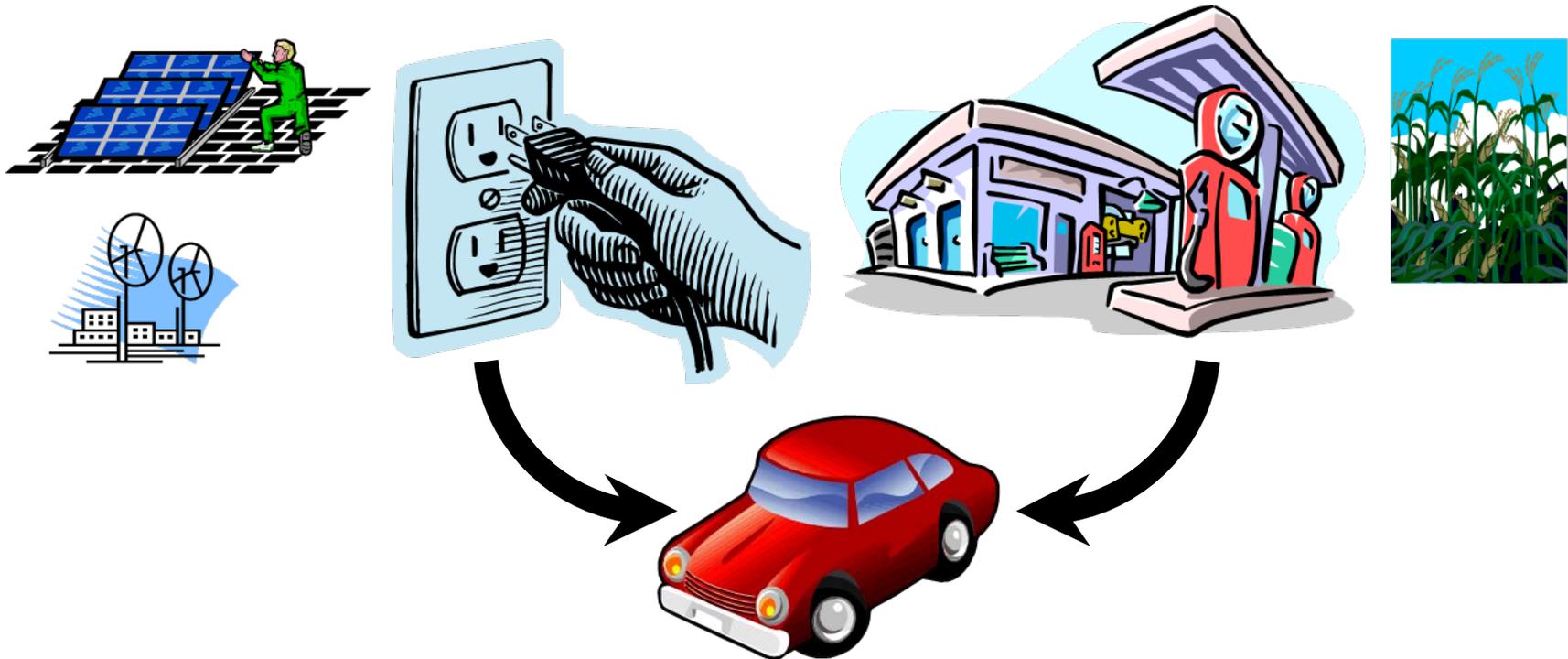


“Trinity” 2008



Why PHEV is most viable solution for reducing oil consumption

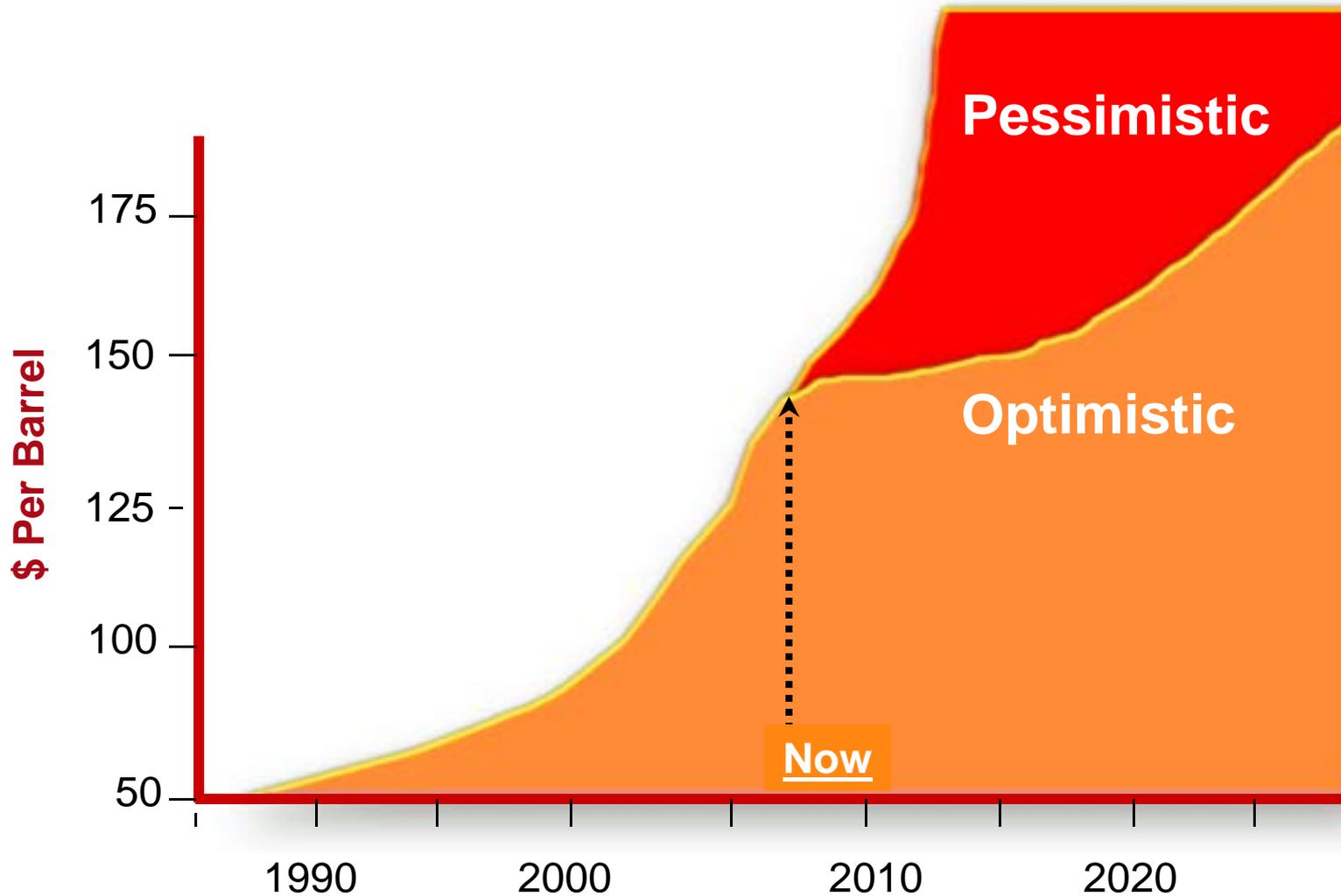
- Phase I: Use existing Infrastructure
- Phase II: Sustainable renewable energy



PHEV - best alternative because:

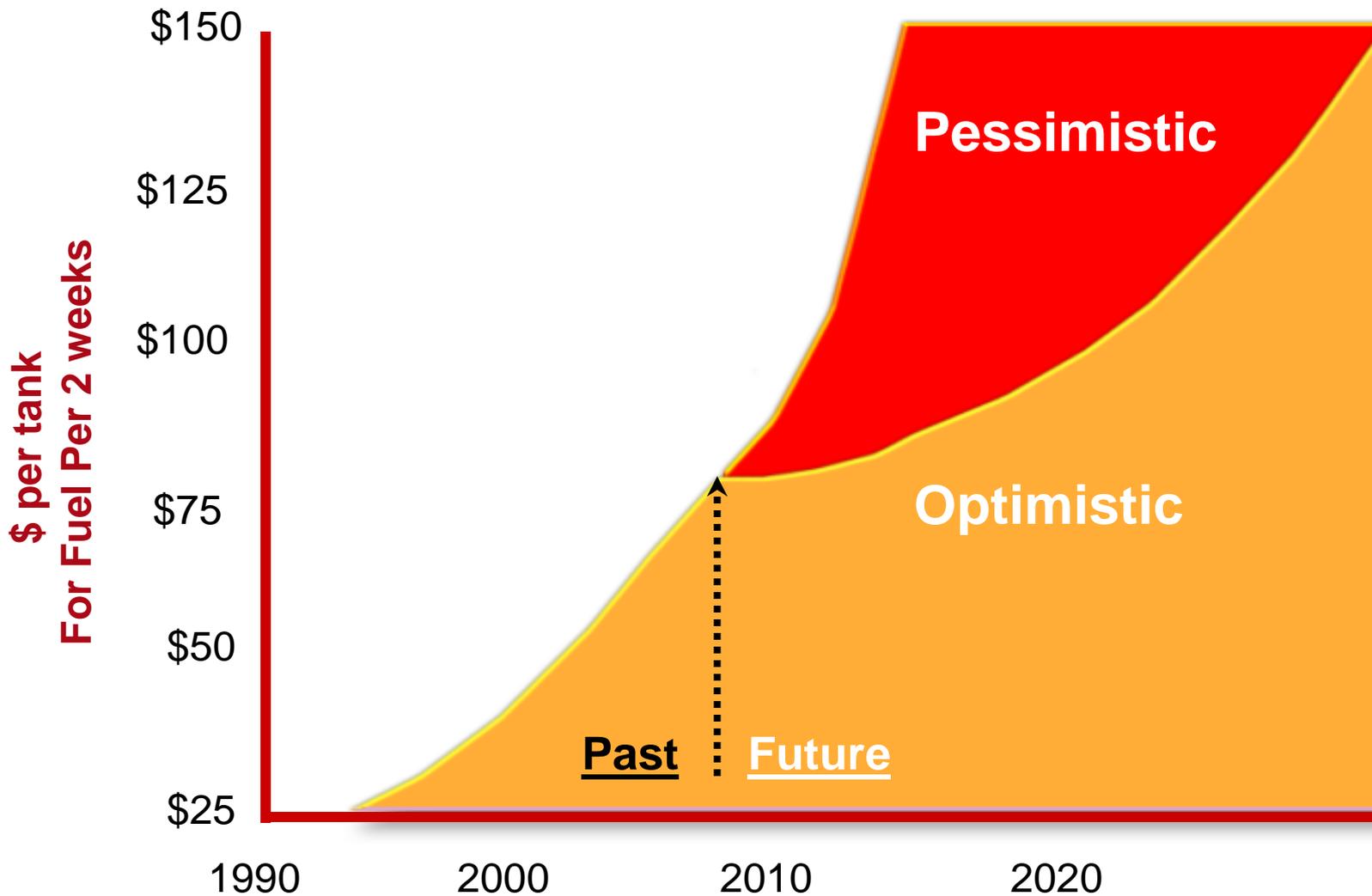
- No infrastructure issues, such as, with H₂
- All Electric Vehicle's require high power charge
- Liquid fuel dispensing and storage-unchanged
- Use of Direct Wind and Solar Renewable Energy
 - 4 Times the effectiveness of H₂ from electricity
 - EV's can use direct renewable energy, but needs high power
- Range is not a problem
- Cost of Zero CO₂ substitution for gasoline is less than all other concepts

The cost of fuel in Society

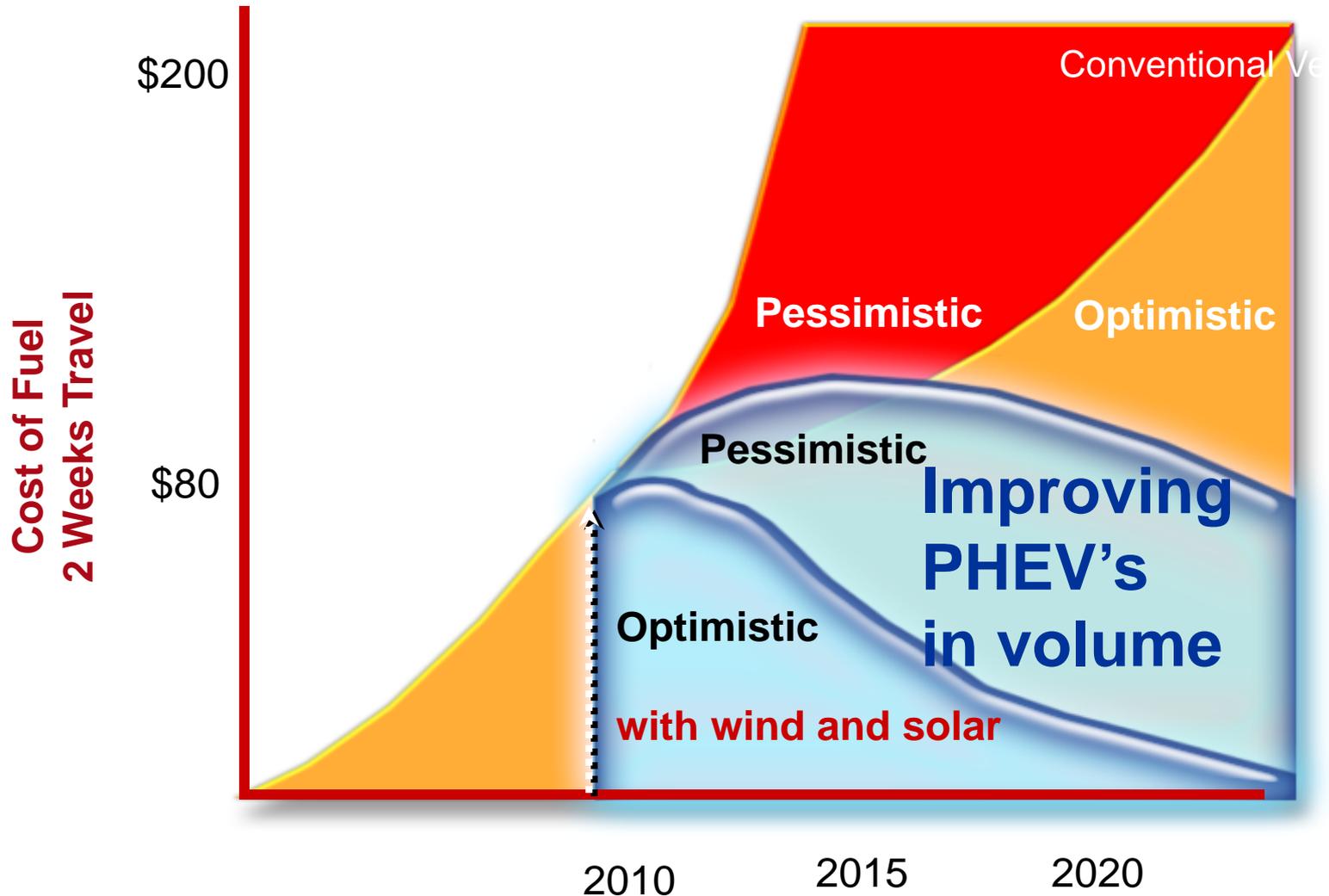




US Cost: tank of gasoline



Cost of fuel using PHEV's





The current movement of PHEV

- **GM, Toyota, Ford, Nissan, and many others are all exploring high volume production of PHEV**

But *issues are:*

- **Need to introduce PHEV much faster than can be done simply by the new car fleet!**
- **~200 million US vehicles in society**
- **15 million new US cars per year~10 years ~ 5% of the new car market in PHEV's or only 750k!**
- **Can't get to 10 million PHEV's in 4 years as needed to slow gasoline consumption ala Andy Grove's objectives!!**

But there is a range of PHEV's with varying benefits

PHEV10

PHEV60

10 mile AER

PHEV RANGE

60 mile AER

10% Electricity

90% Gasoline use

Decreasing gasoline use per year

90% Electricity

10% Gasoline use

Simple
Conversions
of
Conventional
Vehicles--
Only add
Motor
and
Batteries

Conversions
WITH engine
and
transmission
modifications
And some
Accessory
Electrification

OEM designs
Including smaller
Engine
CVT
Transmission
Motor (s)
Batteries
And all
Electric
Accessories



Consequence of PHEV introduction

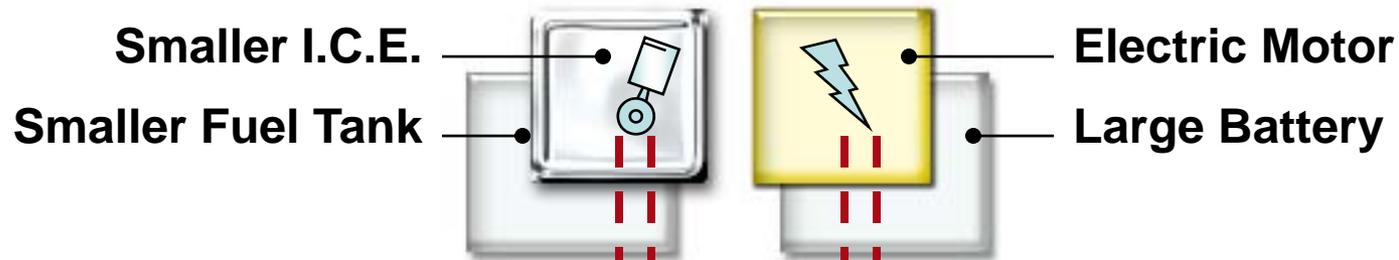
- Displacement of gasoline as soon as possible
- Provide comfortable adoption rate ie start with simple conversions for introduction PHEV's
- Gasoline use of PHEV's decreases with longer electric range but costs actually come down due to simplicity of long electric range designs!!
- Cost of making a PHEV10 from a conventional car ~+ \$15k-\$20k due to added parts (conversion)
- Cost of making an OEM PHEV40 in high volume is on par with a Conventional car \$0 to + \$2k or 0% to 10% depending on electric range in city driving

How do we accelerate PHEV introduction?

- Need to Replace **and** Modify existing vehicles
- Replace @ 1%-5%/year, Modify @ 10%-15%/year
- Cost must be carried by someone since savings in current cost of energy cannot fully justify current incremental cost of PHEV Modifications
(but the time is coming soon due gasoline prices)
- Short run Government subsidies for the purchasing of PHEV's because we have to increase the PHEV volume to make a difference to the general public
- Adding plugs and solar into parking lots with free electricity may be necessary to create the big pull now on a mass scale- Canada already has plugs in every parking space for free electricity!!



Requirements for success



SOFTWARE

Customizable:
Front wheel drive
Rear wheel drive
All wheel drive
Series and Parallel

Scalable:
2 wheel
3 wheel
Sedans
Trucks
Buses

HARDWARE

Continuous Variable Transmission:
Reliable
Optimized for PHEV
Easy to Service

**Proven
Reliable**

CVT

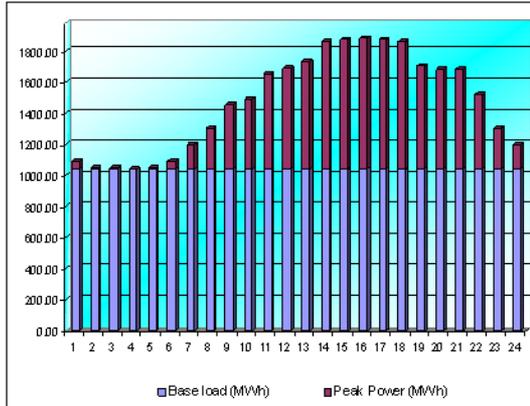
What we need to do to accomplish PHEV projections:

- **Need to accelerate the introduction of PHEV Plug In infrastructure to assist in fuel replacement**
 - Manual or automated charging at parking spaces!!
- **Leads automatically to V2G and improved efficiency of the grid**
- **Leads to Solar and Wind Charged parking spaces**

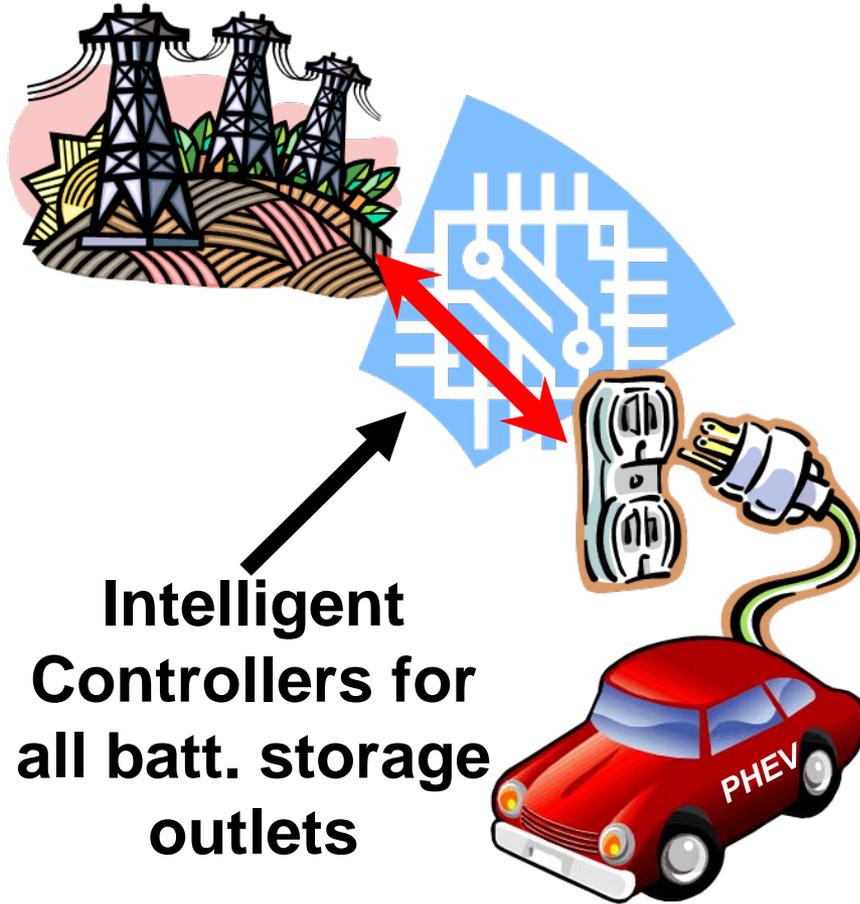
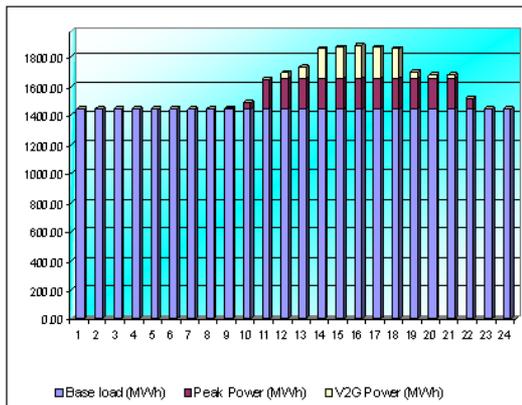


Electric Grid Improvement with PHEV's

BEFORE Intelligent Control



After Intelligent Controller and 20% PHEV's

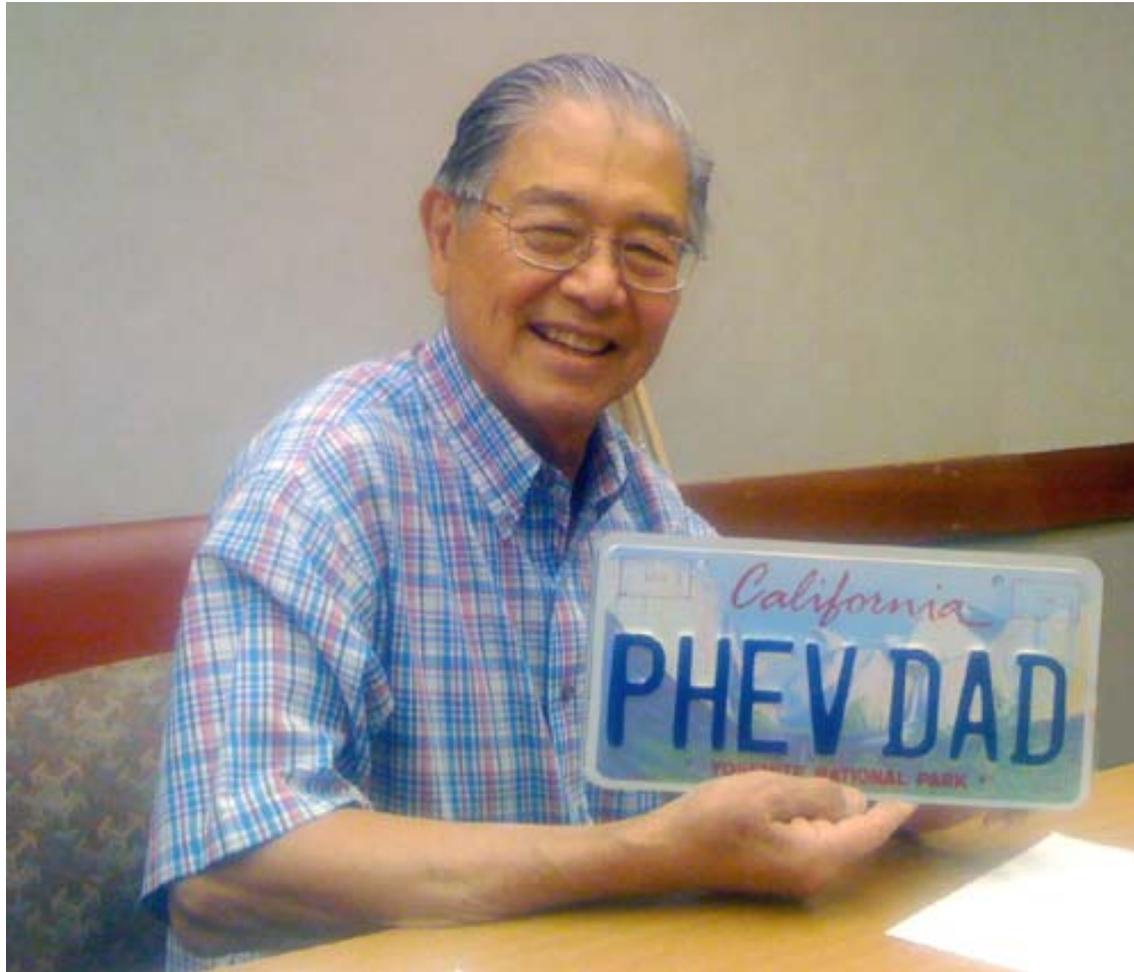




EDI PHEV Drivetrains

- **Uses current energy infrastructure**
- **Can displace 100% fossil today!**
 - Nationwide oil displacement
- **Makes grid more efficient**
 - Enables renewable grid.
- **Allows integration of Wind and Solar**
 - 100% renewable energy

Why I founded Efficient Drivetrains, Inc. (EDI)



How are we accelerating PHEV development?

EDI is:

- Collaborating with vehicle companies to develop PHEVs
- Supplying drivetrains and system components
- Licensing existing technology solutions
- Providing substantial saving of R&D budgets and time
- Focusing on World wide vehicles 2wheels to large trucks



Convert existing vehicles



Accelerate the development of new vehicles

PHEV: only immediate viable solution

- **Phase I:**

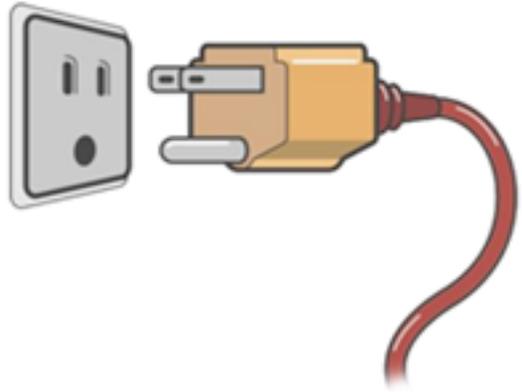
- Existing Infrastructure
- Improved grid

- **Phase II:**

- Renewable sustainable energy sources
- ZERO net CO₂



**Fuel
Reduction**



**Power
Grid**



**Solar
Energy**



**Wind
Energy**



**Alternative
Fuels**



Summary

My objectives are:

“To see that the world moves toward electrification of the entire society in an integrated fashion to enable greater energy efficiency for higher improvement in productivity and lifestyle with a zero CO₂ footprint”