



National Alternative Fuels Training Consortium

Energy Efficiency Global Forum

Washington, DC

November 11, 2007

Al Ebron, NAFTC Executive Director

Hybrid Vehicles and Efficient Driving



The National Alternative Fuels Training Consortium

- ◆ Headquartered at West Virginia University
- ◆ Presently Consists of
 - ✧ 29 Training Centers throughout the U.S.
 - ✧ 70+ Affiliate and Associate Members
 - Fuel Providers
 - Industry Partners
 - Federal & State Agencies
 - Local Clean Cities Coalitions
 - High Schools





NAFTC Mission Statement

“To improve air quality and decrease U.S. dependence on foreign oil by promoting, supporting, and expanding the use of advanced technology vehicles and alternative fuel vehicles.”



NAFTC Headquarters – Morgantown, WV



Over 20 Courses and Workshops!

The National Alternative Fuels Training Consortium is the only nationwide alternative fuel vehicle and advanced technology vehicle training organization in the U.S.!

- The National Alternative Fuels Training Consortium (NAFTC) develops curricula and disseminates training about alternative fuel vehicles (AFVs) and advanced technology vehicles.
- The NAFTC educates consumers about AFVs and advanced technology vehicles, which increases our nation's energy security and improves our air quality by reducing greenhouse gas emissions.



29 STATES

Curriculum Development

Our courses undergo a rigorous examination by professional automotive instructors and technicians before being released.

Courses & Workshops

Learn the basics or gain in-depth knowledge of alternative fuels and advanced technology vehicles by attending one of over 20 courses and workshops.

Educative & Outreach

The NAFTC attends and conducts multiple education and outreach events such as National AFV Day (October 8, 2009), nearly 40,000 people were in attendance at 60 sites and over 20 million were reached through media outlets.

Training with Impact

COURSES

- Clean Air and Energy Independence: An Overview of Alternative Fuels and Advanced Technology Vehicles
- Overview of Bioethanol
- National Gas Vehicles (NGV) Cylinder Inspection
- Light-Duty Natural Gas Vehicles
- Heavy-Duty Gasoline Fuel Applications
- Compressed Natural Gas Vehicles
- Transient Emissions Testing

COURSES CURRENTLY UNDER DEVELOPMENT

- A Guide for First Responders: Safety and Emergency Response Procedures for Advanced Technology Vehicles
- Hybrid Vehicle Technologies

WORKSHOPS

- Introduction to Alternative Fuels and Advanced Technology Vehicles
- Introduction to Battery-Powered Electric Vehicles
- Introduction to Hybrid Electric Vehicles
- Introduction to Hydrogen-Powered Vehicles
- Introduction to Fuel Cells and Fuel Cell Vehicles
- Introduction to Ethanol Vehicles
- Introduction to Bioethanol Vehicles
- Introduction to Natural Gas Vehicles
- Introduction to Propane Vehicles
- Overview of Ethanol and Other Fuel Vehicles for Technicians

www.naftc.wvu.edu

Courses and Workshops

- ◆ Presently offers over twenty courses and workshops
- ◆ Courses and/or workshops available on all types of alternative fuel and advanced technology vehicles
- ◆ Courses and workshops are customizable to meet needs and requirements of the audience
- ◆ Available at our National Training Centers or at your location



Example Client List

- ◆ U.S. Air Force
- ◆ U.S. Postal Service
- ◆ U.S. DOE
- ◆ U.S. EPA
- ◆ U.S. GSA
- ◆ U.S. National Park Services
- ◆ NASA
- ◆ Walt Disney World
- ◆ Atlanta MARTA
- ◆ CA Highway Patrol
- ◆ Baltimore Gas & Electric
- ◆ City of Phoenix
- ◆ Phoenix Valley Metro Bus Service
- ◆ Greater Cleveland Regional Transit Authority
- ◆ City of Louisville, KY





Today's Objectives:

- ◆ Facts about driving, tips for efficient driving, and hybrid vehicles
- ◆ How hybrids work
- ◆ How reliable are hybrids?
- ◆ Tax credits
- ◆ New hybrids coming soon!



Facts About Driving: Average Annual Costs

- ◆ AAA Calculates Driving Cost at **52.2 Cents Per Mile** for 2007
 - ✦ AAA's *Your Driving Costs* looks at operating and ownership costs of five top-selling models in three popular size classes: small, medium, and large sedans.





Facts About Driving: Average Annual Costs

◆ Example Average Costs to Operate a Car in 2007

Operation & Ownership Cost:

✗ 12,000 miles x 52.2 cents = \$6,264/year*

Fuel Cost:

✗ 12,000 miles x \$3.20/gallon = \$2,560/year**

*Notes:

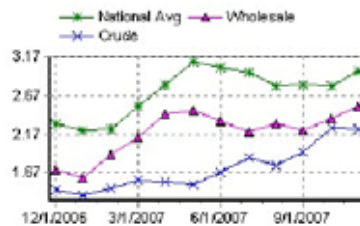
*AAA's driving costs

**Car Averages 15 miles/gallon = 800 gallons of fuel



Facts About Driving: Average Annual Costs

12 Month Average For Regular Unleaded



Credit: AAA
www.aaa.com



National Unleaded Average

	Regular	Mid	Premium	Diesel
Current Avg.	\$3.024	\$3.211	\$3.327	\$3.346
Yesterday Avg.	\$3.004	\$3.190	\$3.304	\$3.326
Month Ago Avg.	\$2.770	\$2.940	\$3.047	\$3.086
Year Ago Avg.	\$2.198	\$2.332	\$2.417	\$2.596

*Prices are in US dollars per gallon

Prices as of 11/7/07





Tips For Efficient Driving: Ways To Reduce Your Gasoline Expenses

- ◆ Tips to help lower fuel usage
 - ✓ Keep tires properly inflated
 - ✓ Obey the speed limit
 - ✓ Combine errands
 - ✓ Proper vehicle maintenance



Tips For Efficient Driving: Ways To Reduce Your Gasoline Expenses

- ◆ Tips to help lower fuel usage
 - ✓ Remove excess “baggage”
 - ✓ Use manufacturer’s recommended grade of motor oil
 - ✓ Avoid idling
 - ✓ Curtail “Road Rage”
 - ✓ Use cruise control

Or...You could purchase a Hybrid
or other AFV





History of HEVs

◆ Evolution of HEVs

- ✓ 1997 – first modern HEV introduced in Japan:
Toyota *Prius* (on left below)
- ✓ 1999 – first modern HEV sold in U.S.:
Honda *Insight* (on right below)



What Is a Hybrid Electric Vehicle (HEV)?

- ◆ The combination of an **internal combustion engine** (ICE) with one or more **electric motor/generators** and a **battery pack**
- ◆ An HEV uses less gasoline because the electric motor does some of the work.
- ◆ An HEV reduces air pollution and improves U.S. energy security by using less foreign oil.





Components of HEVs

Hybrid engine,
electric motor
and transmission
(Honda).



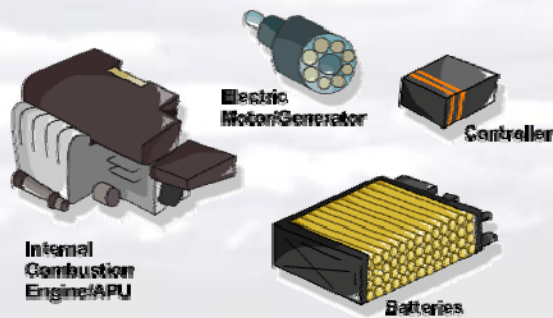
Hybrid battery pack
(Ford).
300 VOLTS



Basic Components of HEVs



Click
for
Flash





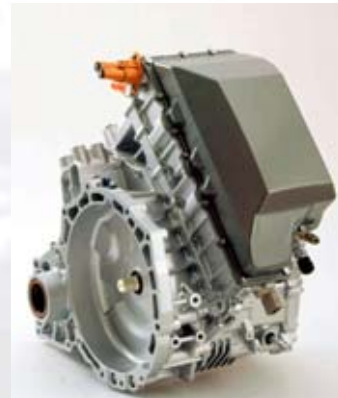
How HEVs Work

- ◆ HEVs offer the efficiency of electric-powered vehicles without having to recharge by using conventional engines and fuels.
- ◆ Efficiencies are gained from motor down-sizing and regenerative braking
- ◆ Inherent flexibility allows use for numerous applications



HEV Efficiency

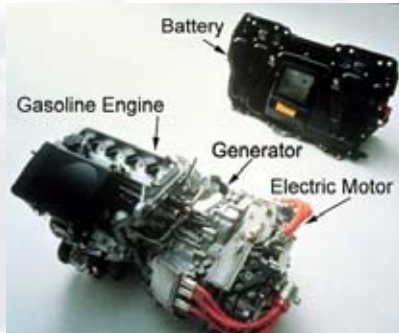
- ◆ Three key factors:
 - ✓ Regenerative braking
 - ✓ Engine size
 - ✓ Vehicle weight & aerodynamic design





HEV Efficiency

- ◆ Engine size = may be smaller than in a conventional vehicle
 - ✎ Engine is sized to accommodate **average load** – not **peak load**
- ◆ Vehicle weight/aerodynamic design:
 - ✎ Built using special lightweight materials
 - ✎ Uses advanced aerodynamics to reduce drag



Regenerative Braking

- ◆ Recaptures **kinetic energy** normally lost as heat during braking
 - ✎ Kinetic energy = energy of motion
- ◆ Electric motor acts as a generator when brakes applied
- ◆ Converts kinetic energy to electrical energy, stored in batteries
 - ✎ It becomes **potential energy** – available for use
 - ✎ No system is 100% efficient





HEVs and Air Pollution

- ◆ Decreased fuel consumption results in reduced vehicle emissions
- ◆ Ability to operate with smaller, more efficient motor maximizes emission management strategies
- ◆ Result is reduction of harmful pollutants in atmosphere



HEVs in Transportation

- ◆ Increasing gasoline prices are making HEVs very attractive to consumers
- ◆ HEVs are already available today, and their use will become more widespread as production picks up





Hybrid Reliability

- ◆ Hybrids have some of the highest safety ratings of all vehicles
- ◆ High-voltage system contains many safety features
- ◆ Battery charge is computer controlled – extends battery life
- ◆ Batteries under warranty for 100,000 miles, is your engine?



Hybrid Reliability

- ◆ The cost of maintenance is reduced due to operation of hybrid technology
- ◆ Regenerative braking reduces wear on brakes
- ◆ Idle stop extends engine life
- ◆ Electric accessories reduce load on engine





HEV Advantages

- ◆ Reduced fuel consumption
 - ✎ Excellent gas mileage
 - ✎ Fewer tailpipe emissions

- ◆ Lighter batteries than electric vehicles
 - ✎ Regenerative braking system stores electrical energy in batteries
 - ✎ Uses less fuel to recharge batteries



Hybrid Electric Vehicles: Energy and Money Saving Benefits

Example:

- ◆ Annual fuel costs gasoline/hybrid
 - ✎ \$2149/\$1413
 - ✎ 312 miles per tank-full/432 miles per tank-full

- ◆ Ford Escape: Gasoline/Hybrid
 - ✎ Average city MPG 19/34
 - ✎ Average highway MPG 24/30
 - ✎ Average combined MPG 21/32

EPA estimated figures 11/7/07 Source:
www.fueleconomy.gov





HEV Disadvantages

- ◆ Reduced, but not emission-free
 - ↘ HEVs are partial zero-emission vehicles (PZEVs) – they produce zero emissions only when engine is not running
- ◆ More expensive than conventional vehicles
 - ↘ Has a payback period in average use
 - ↘ Tax incentives may offset initial cost



Current Models of HEVs

- ◆ More manufacturers are designing and marketing hybrid vehicles
 - Chevrolet Tahoe Hybrid
 - Honda Accord Hybrid
 - Honda Civic Hybrid
 - Ford Escape Hybrid
 - GMC Silverado Hybrid
 - GMC Sierra Hybrid
 - Toyota Prius
 - Toyota Highlander Hybrid
 - Lexus 400h





Current Models of HEVs

- ✓ Lexus GS 450h
- ✓ Lexus 600h
- ✓ Mazda Tribute Hybrid
- ✓ Mercury Mariner Hybrid
- ✓ Saturn Aura Green Line
- ✓ Saturn VUE Green Line
- ✓ Chevrolet Malibu Hybrid
- ✓ GMC Yukon Hybrid



Toyota *Prius* Hybrid





Tax Credits

- ◆ Hybrids purchased after December 31, 2005, are eligible for Federal Tax Credit of up to \$3,400
- ◆ Credit amounts phase out after manufacturer sells 60,000 eligible vehicles
- ◆ IRS form 8910 to apply for credit
- ◆ Visit www.fueleconomy.gov or www.electricdrive.org for more information



Tax Credits

- ◆ Some individual states offer additional state tax credits and/or incentives
 - ✎ Wash, DC - Exemption of vehicle excise taxes for owners of HEVs; vehicle registration fees for HEVs are reduced to \$36 per year
 - ✎ Maryland - Qualified HEVs vehicles are exempt from certain mandatory motor vehicle emissions and inspection testing requirements for the first three years after the vehicle is originally registered in the state
 - ✎ Virginia – Some hybrid electric vehicles may qualify for the Virginia 'Clean Special Fuels' license plate which allows cars to use the Virginia HOV lanes, regardless of the number of occupants, until July 1, 2008.





Tax Credits Cont'd

- ◆ Visit the Department of Energy for a complete listing of State incentives

www.eere.energy.gov/afdc/incentives_laws.html



New Hybrids Coming Soon!

◆ Examples:

- ✎ Dodge Durango Hybrid (2008)
- ✎ Mercedes S-Class 2008
- ✎ Cadillac Escalade Hybrid 2008
- ✎ Ford Fusion/Mercury Milan Hybrid 2008
- ✎ Smart Hybrid 2009
- ✎ Porsche Panamera Hybrid 2009
- ✎ Porsche Cayenne SUV 2009





2009 Ford PIHEV Announced Nov. 7



2009 Ford PIHEV

Ford Hybrid Escape Plug In

Description:

Plug In Hybrid Electric Vehicle (PIHEV)
A Hybrid Electric Vehicle equipped with a high-capacity battery that can be charged from the electrical grid and discharged during driving to reduce fuel consumption. Once the charge of the high-capacity battery has been depleted, the vehicle continues to operate as a standard Hybrid Electric Vehicle (including the added fuel economy benefits).

Benefits:

Plug in operation shifts a significant amount of energy used for vehicle propulsion from petroleum to electric generation resources.

- ✓ Energy security - reduced petroleum imports
- ✓ CO₂ climate change - opportunity for CO₂ reductions by shifting propulsion energy from onboard fuel to electric utility industry with growing portfolio of green energy (wind, solar, hydro, nuclear)
- ✓ Cost of high energy battery partially offset by reduced fuel requirements



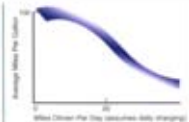
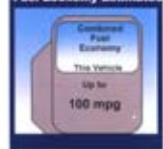
Features:

- ✓ Incredible fuel economy when operated in plug in mode
- ✓ Overnight recharging from standard home electrical outlet
- ✓ Two thirds less trips to the gas station
- ✓ Regenerative braking
- ✓ Engine off operation during low speed driving
- ✓ Interactive vehicle powertrain display
- ✓ Capless fuel filler

Overall Vehicle Specifications:

- ✓ Engine: High efficiency 2.3 liter Atkinson cycle
- ✓ High Energy Li-Ion HV Battery: 10 kW - hr
- ✓ Fuel Capacity: 15 gallons
- ✓ Seating: 5 passenger
- ✓ Fuel Economy: Up to 100 mpg in plug in mode 32 mpg in hybrid mode
- ✓ Weight: 3900 lbs
- ✓ Max Speed: 102 mph
- ✓ Acceleration (0 - 60 mph): 10.3 seconds
- ✓ Maximum Range (one tank of fuel): 420 miles

Fuel Economy Estimates





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Questions?

