FocusEV

Conversion of a Gasoline Powered Automobile to a Battery Powered Electric Vehicle

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Minnesota
Electric Auto Association
Land of 10,000 Outlets

Components Used in the Conversion

- Donor car - 2001 Ford Focus SE
  - One of Car and Driver's "10 Best" for multiple years
- Motor – Advanced DC 9 inch diameter series-wound brushed DC motor
  - Weight = 143 lbs.
- Batteries – Seventeen in series -> 8V wet cell lead acid golf cart batteries
  - 17 * 8V = 136 VDC
  - Total battery weight is 1,080 lbs.
- Battery Charger – Two Delta-Q Power QuiQ EV Chargers
  - Power Factor Corrected
  - Microprocessor Controlled
- Electronic motor controller - Curtis 1231 144V MOSFET controller
- Electric Power Brake Vacuum Pump - MES-DEA 70/6E
- Instrumentation – Voltmeter (180 VDC) and Ammeter (500 ADC)
- DC/DC Converter - IOTA 14V 55 Ampere power supply
  - Replaces the alternator

Components Removed and Installed

Removed

- Internal Combustion Engine (ICE)
- Alternator
- Gas tank
- Fuel pump
- Fuel filler tube
- Power steering pump
- Power steering hoses and cooler
- Exhaust pipe and muffler
- Catalytic converter
- Radiator
- Coolant hoses and reservoir
- Air conditioning compressor
- Air conditioning condenser
- Liquid heater core
- Floor of the trunk
- Rear springs
- Dashboard “idiot lights”

Installed

- Electric motor
- 4 battery racks
- Battery insulation and heaters
- 17 golf cart batteries
- High-power cables
- High-power circuit breaker
- Electronic Motor Controller
- PotBox (to accelerator pedal)
- Two high-voltage contactors
- Automotive relays
- Electric vacuum Pump
- DC/DC converter
- Electric heater element for passenger compartment
- Heavy duty rear springs
- Ammeter and Voltmeter
- Lots of wiring

Cost for Energy

Internal Combustion Engine vs. Electric Vehicle

ICE Powered Car

- 1 gallon of gas has approximately 36 KW-Hr of energy
- The energy that goes to moving a car down the road is about 20% (~80% is lost as heat)
- For a car that gets 25 MPG and gasoline at $2.00 per gallon, fuel cost is

  $2.00/25 = **$0.08 per mile**

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- The FocusEV battery pack has approximately 23 KW-Hr of energy, with about 12.5 KW-Hr usable (before degrading batteries)
- That's ~1/3 of a gallon of gas!
- The energy that goes to moving a car down the road is about 80% (~20% is lost as heat)
- For a car that uses 400 Wh per mile and electricity at $0.10 per KW-Hr, fuel cost is

  0.4 x $0.10 = **$0.04 per mile**

400 Wh/mile is energy equivalent to ~90 MPG

Greenhouse Gasses

Internal Combustion Engine vs. Electric Vehicle

ICE Powered Car

- 19.5 lbs of CO2 for every gallon of gas consumed in an ICE
- Assume 800 miles per month at 25 MPG (32 gallons)
- CO2 released into the atmosphere:

  19.5 lbs/gallon x 32 gallons

  = **624 lbs** CO2 per month
- Additional CO2 is released in the extraction and refinement of crude oil
  - CO2 per gallon is increasing as oil is recovered from undesirable sources such as oil sands

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- 1.4 lbs*of CO2 for every kW-hr of electricity generated in the US
- Assume 800 miles per month at 400 W-hr/mile (320 KW-Hr)
- CO2 released into the atmosphere:

  1.4 lbs/kW-Hr x 320 kW-Hr

  = 448 lbs CO2 per month
- This will improve as we generate more electricity from solar, wind, and geothermal sources.

** U.S. Environmental Protection Agency estimate, November, 2004*

FocusEV vs. “the Competition”

Which car would you drive for your daily commute?

	Tesla Roadster Performance EV	Zenn NEV	FocusEV Home-built
Drive Motor	185 KW AC Induction (Peak HP=248)	5.7 KW 3-phase AC (Peak HP=7.6)	50 KW Series Wound DC (Peak HP=67)
Battery Pack	53 KW-Hr Li-Ion 375V	5 KW-Hr Lead-Acid 72V - Gel	12.5 KW-Hr Lead-Acid 136V – Wet Cell
Top Speed	125 MPH	25 MPH	70 MPH
Acceleration	3.9 seconds (0 to 60)	Never (0 to 60)	~22 seconds (0 to 60)
Range	220 miles	35 miles	35 miles
Seats	2	2	5
Cost	$109,000	$15,995	~ $16,000
Hours of labor	None	None	Too many!

Tesla http://www.teslamotors.com/performance/tech_specs.php
Zenn http://www.zenncarsabq.com/pdf/zenn_2008specs.pdf

Resources

- The FocusEV Website (includes FAQs) http://www.simonfamily.us/FocusEV

- The Electric Auto Association (with links to local chapters) http://www.eaaev.org

- The EV Album – over 2,000 examples of vehicle conversions (skateboards, bikes, Porches, a Delorean, a Land Rover, etc.) http://www.evalbum.com/