



Building an EV

TOPIC #5

How Fast and How Far?

<http://www.evalbum.com>

<http://www.diyelectriccar.com>

Topics

- What is the best car to convert?
- What kind of motor should I use?
- What kind of batteries do I use?
- What are controllers?
- Where can I buy the parts?
- Are there any books on how to do a conversion?
- *How far can I go on a charge?*
- *How fast will it go?*
- How much will it cost?
- How to make battery cables?
- How do I charge the batteries?
- How to add power brakes and power steering?
- How to add safety?
- How to add air conditioning?
- How about solar panels?
- Is there anyway to make it recharge itself while driving?
- How about adding a generator?
- How about EV kits?

How far can I go on a charge?

- This depends on many factors including terrain, speed, temperature, driving style, and of course the design of the car. Most conversions average around 50 miles, with some less and some much more.



How far can I go on a charge?

- A pack can be designed for your needs, generally a car set up for Lead Acid may only get 20-50miles another set up with Lithium batteries can go 200 miles or more.



How far can I go on a charge?

■ 40 MILES on AC or DC

□ AC



- **Controller and Motor:** ACP
- **Batteries:** 28 Sealed Optima 55 Ah
- **System Voltage:** 336 Volts
- **Battery Capacity :**
 - efficiency : 250 wh/mile (average for EVs)
 - energy required : 250x40miles = 10kWh
 - Ah rating : 10kWh/336V = 29.76 Ah
 - Battery rating needed : 29.76 X 1.8 = 53.57 Ah

-VS-

DC

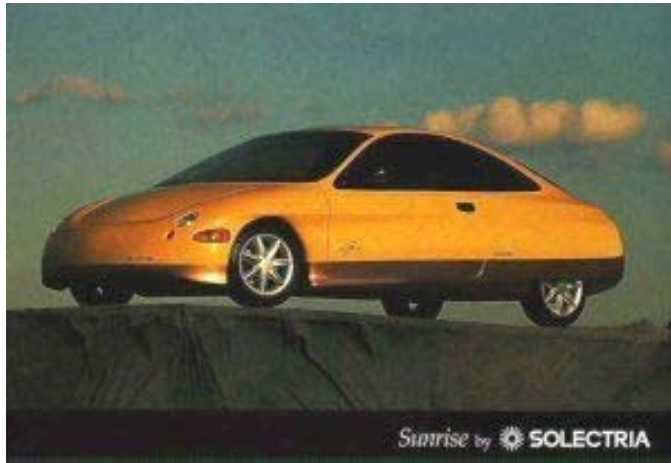


Zilla and ADC Motor
18 Trojan T-875 flooded 180ah
144 Volts

250 wh/mile (average for EVs)
250x40miles = 10kWh
10kWh/144V = 69.44 Ah
69.44 X 1.8 = 125 Ah

How far can I go on a charge?

- Some EVs can exceed 100 miles on a single charge using advanced batteries.
- ZAT recorded 478 miles on a single charge in a delivery van using Zinc Air batteries.



- The documented distance record is 375 miles in a Solectria Sunrise.



- Most production vehicle are now using advanced batteries which have a range between 80 and 120 miles. However, 90% of the cars in the U.S. travel 30 miles or less in a day. We recommend you check your average daily mileage for two weeks to see if you are a candidate for an electric car.

How far can I go on a charge?

■ 135 MILES on Elite Power Solutions DC



- **Controller and Motor:** 9" Advanced DC & Curtis Controller
- **Batteries:** 40 Thundersky 200ah Lithium Iron Phosphate
- **System Voltage:** 144 Volts
- **Battery Capacity :**

efficiency : 250 wh/mile (average for EVs)

- energy required : $250 \times 40 \text{ miles} = 10 \text{ kWh}$
- Ah rating : $10 \text{ kWh} / 144 \text{ V} = 69.45 \text{ Ah}$
- Battery rating needed : $69.45 \times 1.05 = 72.92 \text{ Ah}$
- **ESTIMATE OF 80 MILES WITH A 70 Ah Lithium**

LETS CALCULATE BATTERY CAPACITY NEEDED BASED ON MILES

efficiency : 250 wh/mile (average for EVs)

- energy required : $250 \times 135 \text{ miles} = 33.75 \text{ kWh}$
- Ah rating : $33.75 \text{ kWh} / 144 \text{ V} = 234.38 \text{ Ah}$
- Battery rating needed : $234.38 \times 1.05 = 246.1 \text{ Ah}$
- REAL 135 MILES WITH A 200 Ah Lithium**

How fast will it go?

- Again this depends a lot on the design. Most conversions are fast enough to get a speeding ticket on any highway in the US.



- On the other hand, some conversions are wickedly quick, and have far more horsepower than they did as gas cars.

How fast will it go?

- An electric drag car recently managed **7.956 seconds at 159.85 miles per hour** in the quarter mile!



SOME SECRETS OF HIGH MILEAGE PER CHARGE BY Gene Cosmano and Jim Stack

- For the best efficiency start with a light weight vehicle.
- If possible install close ratio gears in your transmission or lower your wheel size 1 to 2 inches
- Aluminum wheels keep un-sprung weight lower and will add 2 to 5 % more mileage.
- Keep tires inflated to about 8 pounds over factory specks.
- No wide tires
- Look for low rolling resistance tires. This can give you 2 to 3% extra mileage.



SOME SECRETS OF HIGH MILAGE PER CHARGE BY Gene Cosmano and Jim Stack

- 1-a Weight- this is key. check the eBox and Tesla both done because of light weight. It's the key to any conversion. aero dynamic and LRR is 3-5% but weight is really key.
- 1-b This is why lithium batteries are so good, very light, very powerful and long lasting on top of reducing weight.
- 2- Regen- this is worth 80% recovered energy in the AC Propulsion system. On any stop or downhill it helps. Coming from Flagstaff could refuel an EV !
- 3- The way you drive is also big. Slower speeds and no racing starts saves a lot. slowing gradually with regen is very good and can avoid a complete stop. You can probably go twice as far at 40 mpg as you could at 60. 1/3 slower 50% farther.



Tips For Efficiency

- Any old car develops inefficiencies over time.
- Get a 4-wheel alignment, have it set as close to 0 toe in as possible. Fix any problems if they exist.
- Replace rubber brake hoses and rebuild brake calipers to help retract pads.
- Check wheel bearings for smoothness and replace as necessary.
- Close up front of car and add a belly pan.
- Use a low friction oil in transmission and differentials.
- In general you should be able to push the car by hand.



Low Rolling Resistance Tires

- How to find a LRR tire? Not easy.
- Eventually we might have readily available numbers, but not currently.
- http://www.greenseal.org/resources/reports/CGR_LowTireResistance.pdf -Mar 2003
- Look at OEM tires on hybrids and other vehicles. Manufacturers often use tires to gain an extra MPG for their CAFE numbers.
- Michelin has their Energy Line of tires that claim to be the lowest rolling resistance.
- These tires usually have a silica rubber formulation and stiffer sidewalls.



Bridgestone's Ecopia EP100 is new to the US.

Sources:

- <http://www.evalbum.com/build.html>
- <http://www.diyelectriccar.com/forums/showthread.php?t=669>