Building an Electric Car

A Little History

- The early 1900s
- EVs held the land-speed record, and had greater range than Gasoline cars
- Gasoline was cheap (1/cent litre), electricity was expensive (20 cents/kWh)
- The Model-T was powered by Gasoline
- 100 years of development
- Gasoline cars are an accident of history

My EV

- 1991 Daihatsu Charade
- 10-50 kW electric motor
- 12 lead acid deep cycle batteries (144V, 75AH)
- 50 km range, out accelerates original car
- conversion cost $14,000 ($6,000 - $25,000)
- 300-400 hours work (mechanical dummy)
- It really works!

EVs compared

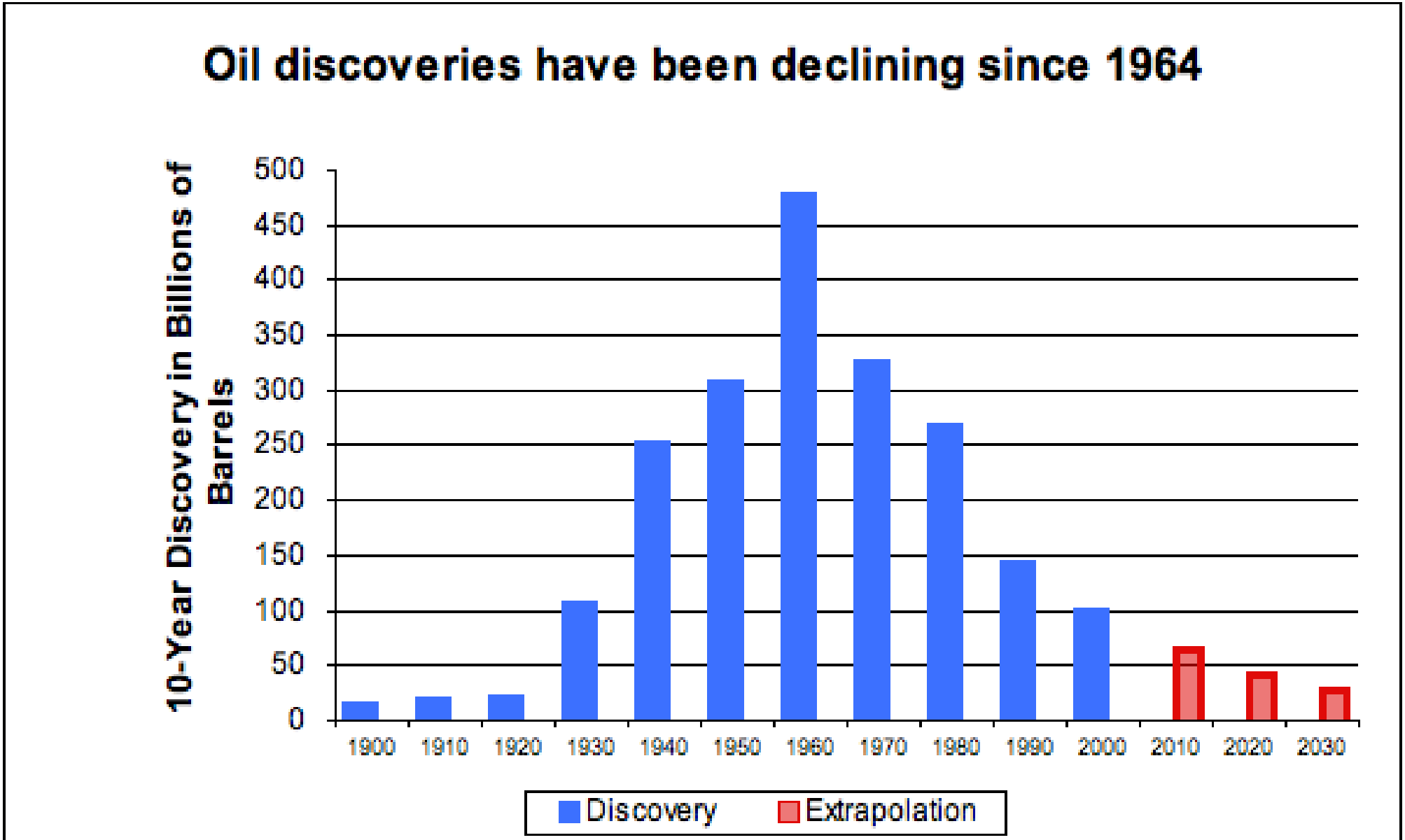
- 1 moving part
- low maintenance
- 90% efficient
- heavy
- 50-150km range
- clean
- renewable fuel

- 1000 moving parts
- regular maintenance
- 15% efficient
- light
- 400km range
- dirty
- non-renewable

Peak Oil

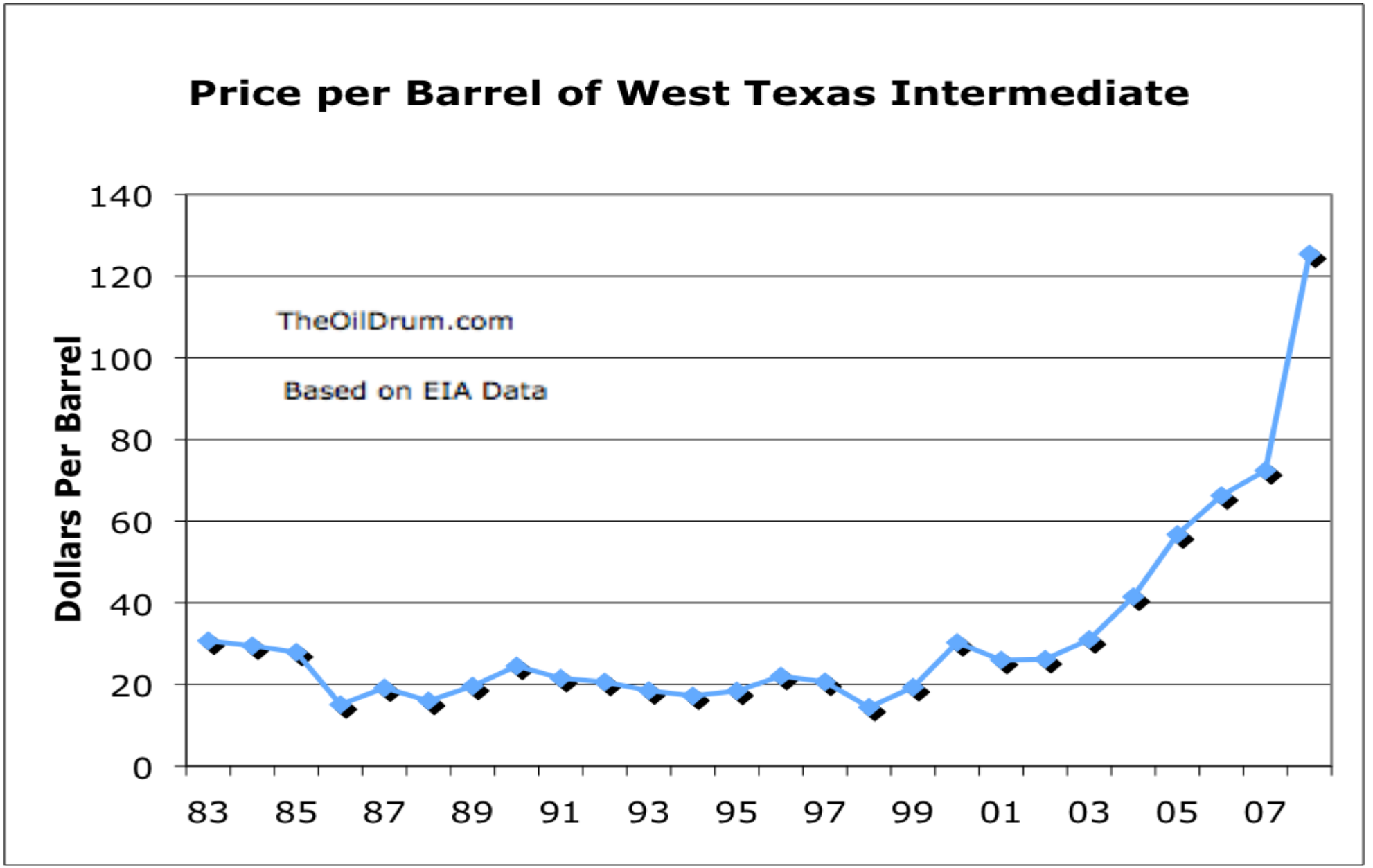
- The term “Non-renewable” has become a cliché
- It means this: one day it is going to stop
- Before then it will get scarce and very expensive
- If we really depend on that resource, it is going to really really hurt.
- Australia 1 Mb/day, world 85 Mb/day, 31 Bb/yr
- growth Growth GROWTH

Peak Oil



Note: World oil discovery over 10-year periods, by Association for the Study of Peak Oil and Gas.

Peak Oil


Price per Barrel of West Texas Intermediate
Dollars Per Barrel
140
120
100
80
60
40
20
0
TheOilDrum.com
Based on EIA Data
83
85
87
89
91
93
95
97
99
01
03
05
07

Best Thing About EVs

The Fuel is made **right here** in South Australia (in fact on my roof)

Parts for a Conversion

- Electric Motor ($1,900)
- Batteries ($5,400)
- Speed Controller ($2,100)
- Charger ($1,000)
- Adapter Plate & Coupling ($1,500)
- Vacuum pump, metal stock, welding cable
- Not counted (Donor car, tyres, brakes, tools)

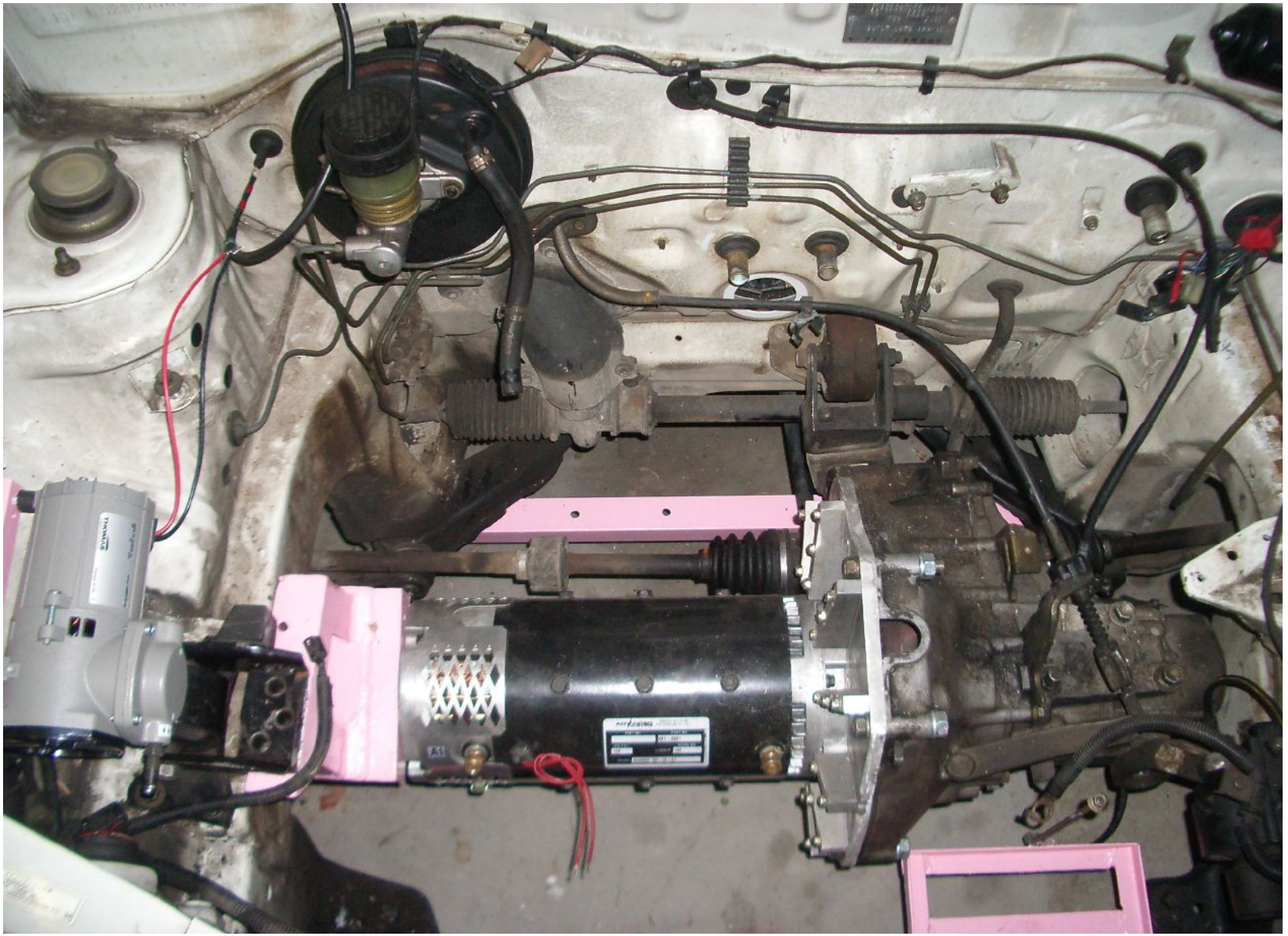
Challenges

- Low skill level with cars
- Welding
- Electrical engineering
- EVs
- Great community, just like open source
- Web resources
- Everyone is fascinated (mechanics, friends) and helpful

Adaptor Plate

Build Battery Racks

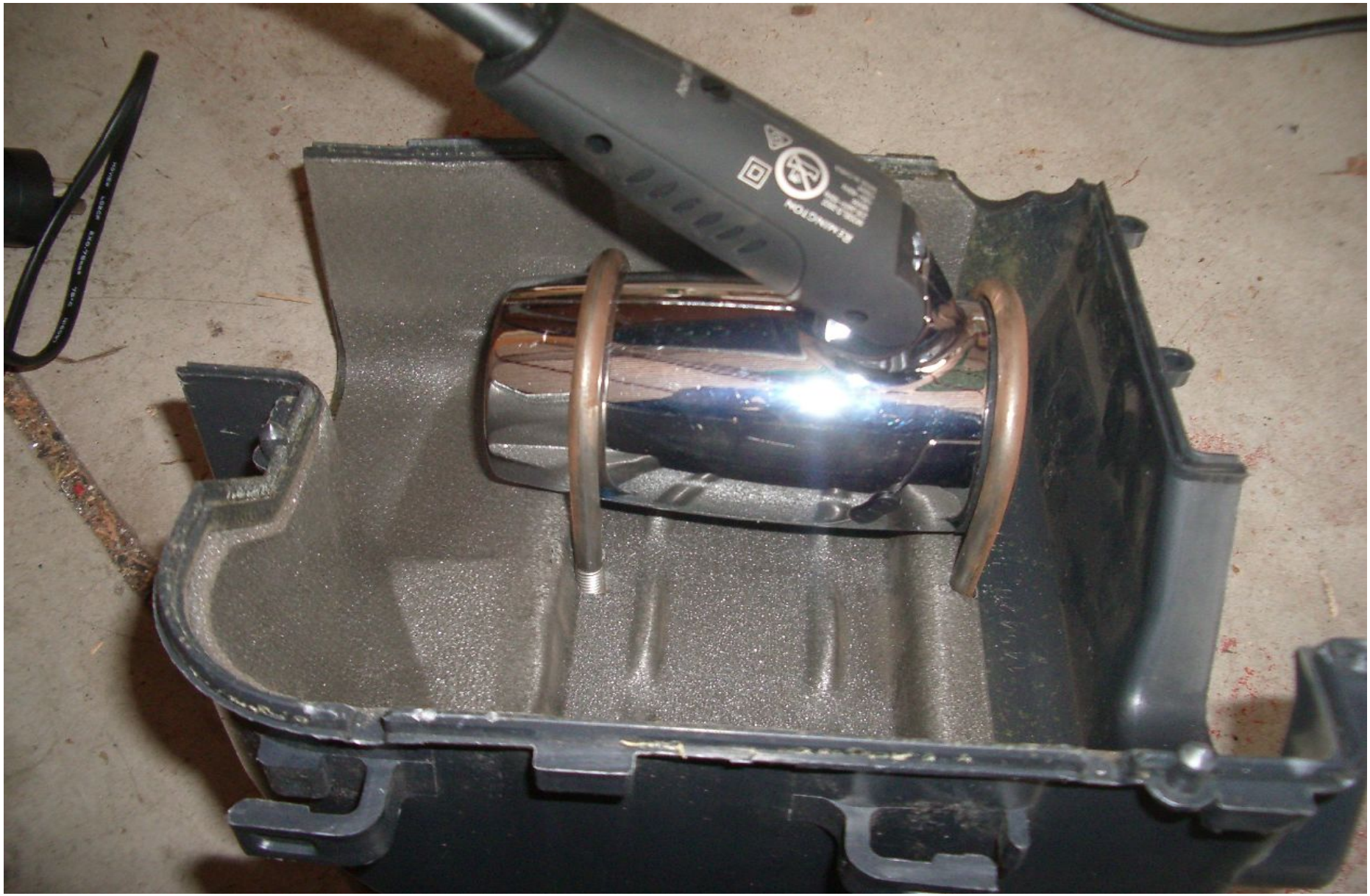
Under the Bonnet



Under The Bonnet

Charging

De-Misting



De-Misting

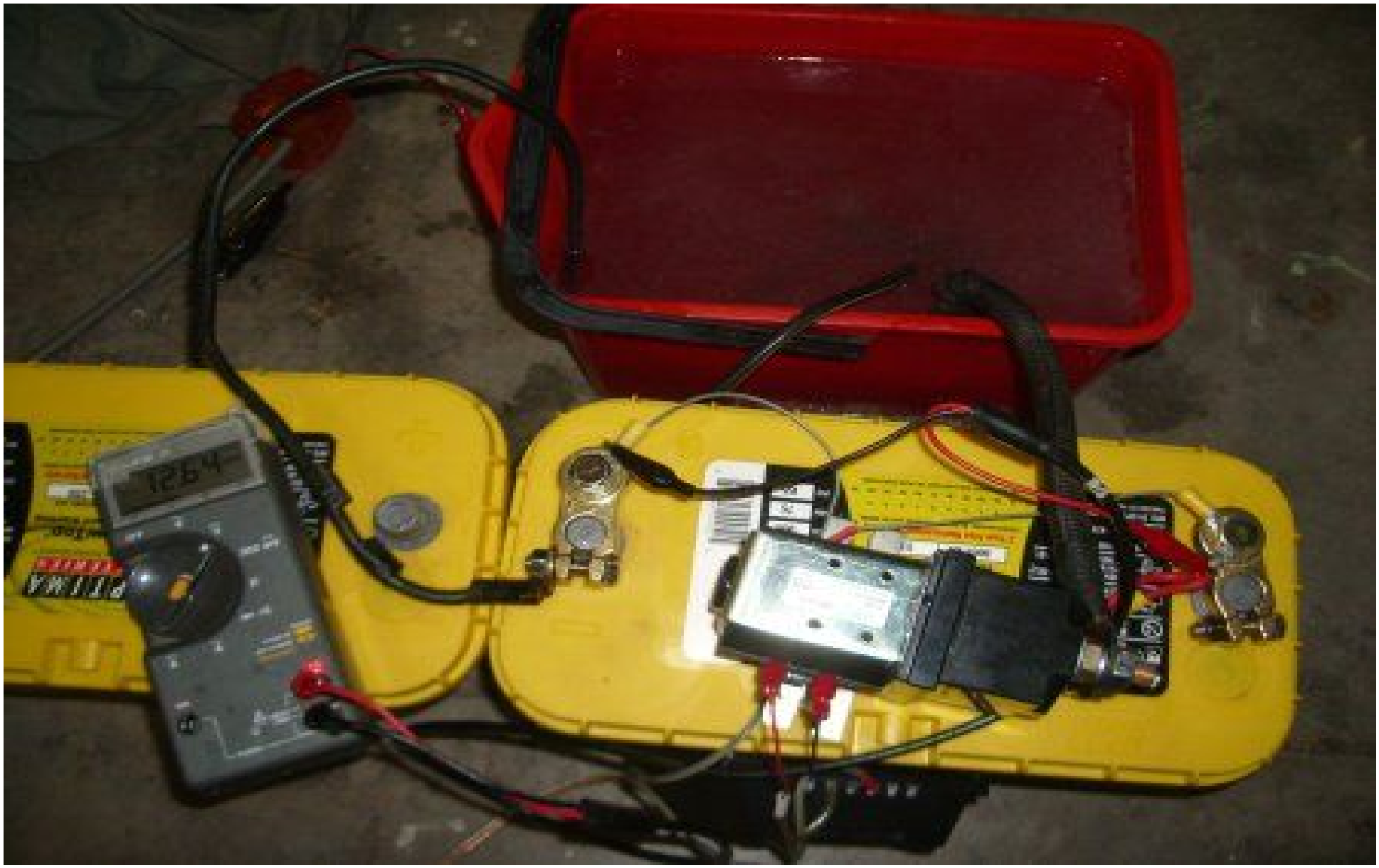
Batteries

- Most EVs to date have used lead-acid batteries
- Reliable, well understood, low-moderate cost, robust to charging errors.
- But heavy and poor cycle life
- Many EV conversions in progress are now using Lithium batteries
- Light and high cycle life
- higher capital cost (but better life-cycle cost), special care when charging

Debugging an EV

- Testing batteries, 12V @ 250A (3.6kW) kettle!
- Lots of torque, needed a new clutch
- Height, new rear springs
- Short to chassis – broken brush clip spring

Testing Batteries



Broken Brush Clip

Technical

- Acceleration: 144V at 330A = 47kW
- Cruises at 58 km/hr using 37A (5.3kW)
- I average 15 km/day, uses 3kWh at the wall to charge (60 cents)
- “Economy” is 200 Wh/km
- Curb weight 1060kg up from 820kg (GVM 1240). Payload is 2 adults or 1 adult plus 2 kids
- 12V system charged from DC-DC converter

Driving an EV

- Power and Torque reverse of petrol engine
- Maximum torque at stall, so quick off the line
- Then power drops off as speed increases
- Quiet but not silent. Weird at traffic lights
- Charging more convenient than petrol station
- Start in 2nd, change to 3rd at 40 km/hr
- Really notice stink, waste and expense of petrol cars

Registration

- Around 5 registered EVs in S.A.
- Information Bulletin 74
- Full road worthiness inspection (painful)
- Demisting, braking system, weight, weight distribution, 12V system, wiring standards
- Ventilation and sealing of batteries
- Depends on Inspector on the day

Running Costs

- Very cheap per km (4 cents), 10% of petrol car
- Very little maintenance
- Dominated by cost of batteries, lead acid need replacing every few years.
- Roughly the same as a petrol vehicle in 2004
- Improving as we understand more about battery care
- Improving with better batteries
- Batteries 95% recyclable (try that with petrol)

Business Opportunities

- I can build an EV for one third the cost of a Prius and my EV uses no petrol.
- What could a real business (like Holden) do?
- Based on the simplicity EVs should cost 50% of a petrol car
- “EV conversion business” like LPG: $6,000 conversions
- Batteries, electronics, mass production, export
- $10B could convert 2M cars

EV Resources

- Australian Electric Vehicle Association (AEVA)
- Electric Vehicle Discussion list (EVDL)
- Lots of great conversion blogs
  electric-echo.com
  kiwiev.com