



Life with an EV

Andrew Chewter
kootenayEVfamily.ca

November 8, 2014
“The World We Want”
Castlegar, BC

Introduction

Personal

- Environmental engineer and owner of a Nissan Leaf EV for 6 months
- Active family of 4, two young kids
- Have had an active interest in EVs for several years



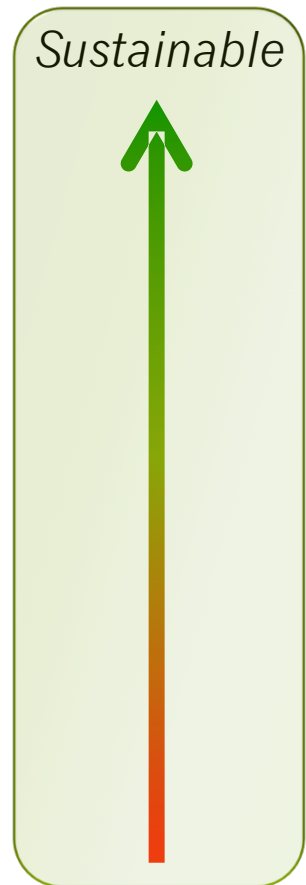
EVs/PHEVs

- EV = electric vehicle, battery only
 - Sometimes known as a BEV (battery EV)
- PHEV = plug-in hybrid electric vehicle
 - More limited range, but typical daily driving patter = can drive on electricity majority of the time

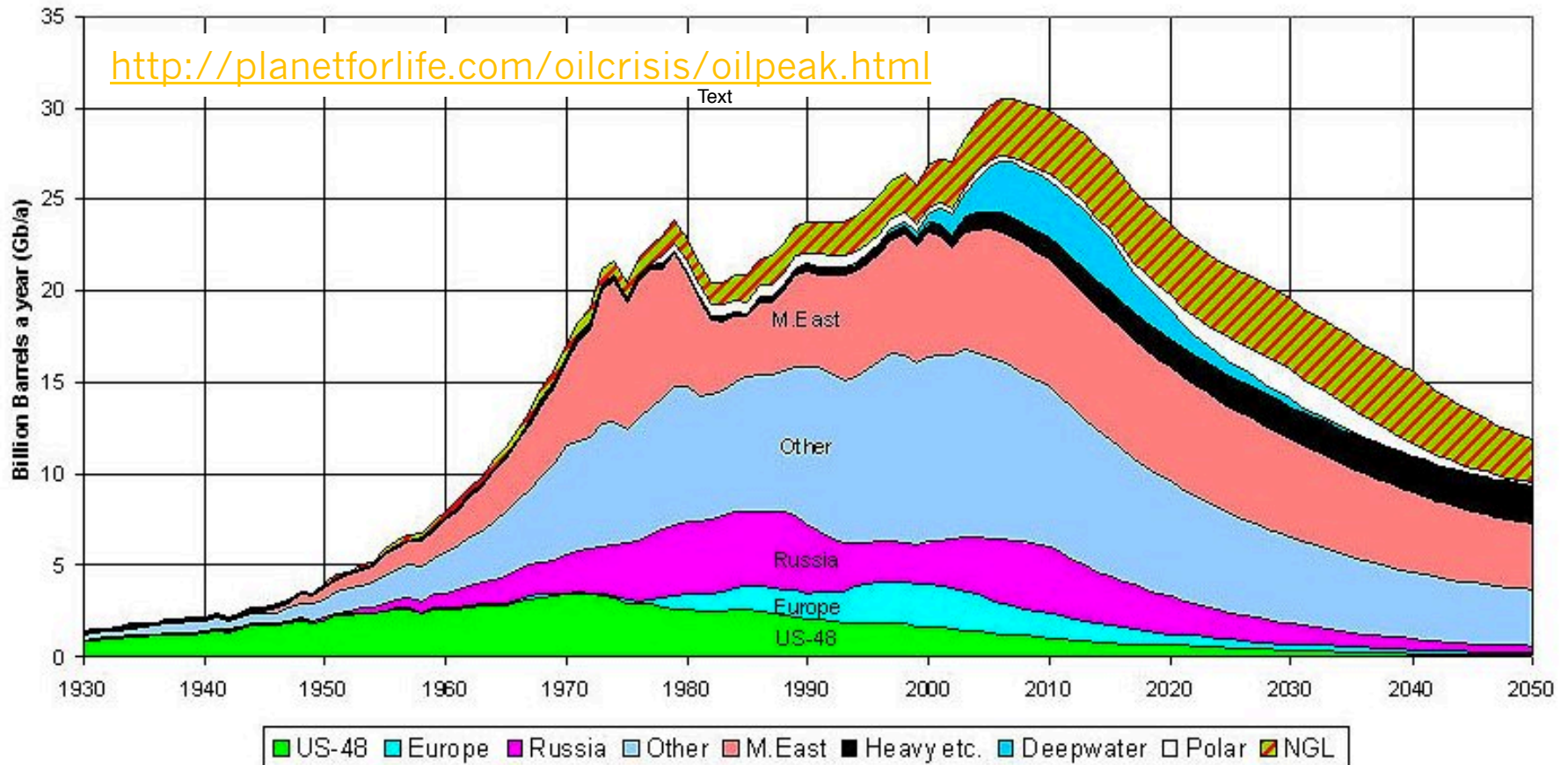
Commuting Mode Hierarchy

Where does an EV fit in?

- Biking, e-biking, walking
- Taking the bus
- Car pooling in an EV/PHEV
- Single occupant in EV/PHEV
- Car pooling in hybrid/small car
- Single occupant hybrid/small car
- Typical cars

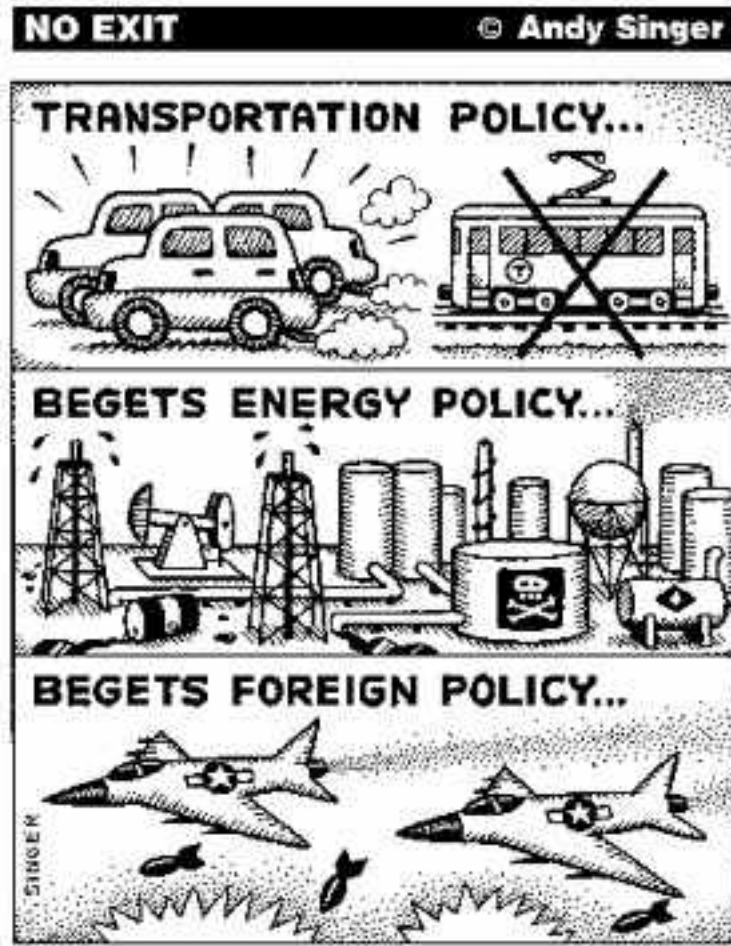


So, why get an EV/PHEV?





5

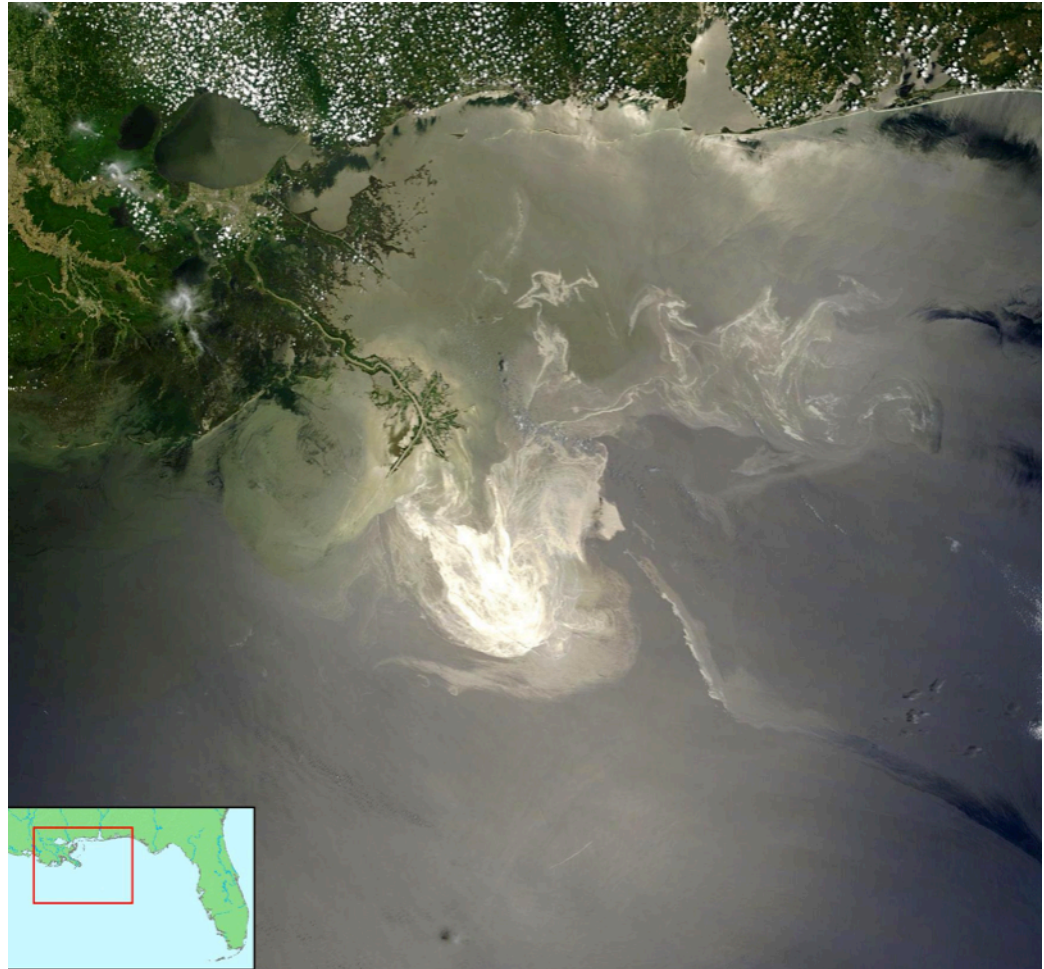


Foreign Wars to Secure Oil Supply

<http://www.lysistrataproject.org/oilandwar.htm>



6



Deepwater Horizon Oil Spill

http://en.wikipedia.org/wiki/Deepwater_Horizon_oil_spill



7



Canadian Oilsands

<http://www.ctvnews.ca/canada/oilsands-plant-spills-waste-water-into-river-1.1212729>

EVs because...

- Driving quality is better than hybrids or conventional cars
 - Quicker acceleration, very smooth, and quiet
- Convenient 'fueling' (plug in at home)
- Less maintenance
- Potentially democratic fuel source and decentralized
- EVs are inherently more energy efficient
- Electricity can get cleaner, oil is only going to get 'dirtier' and harder to extract



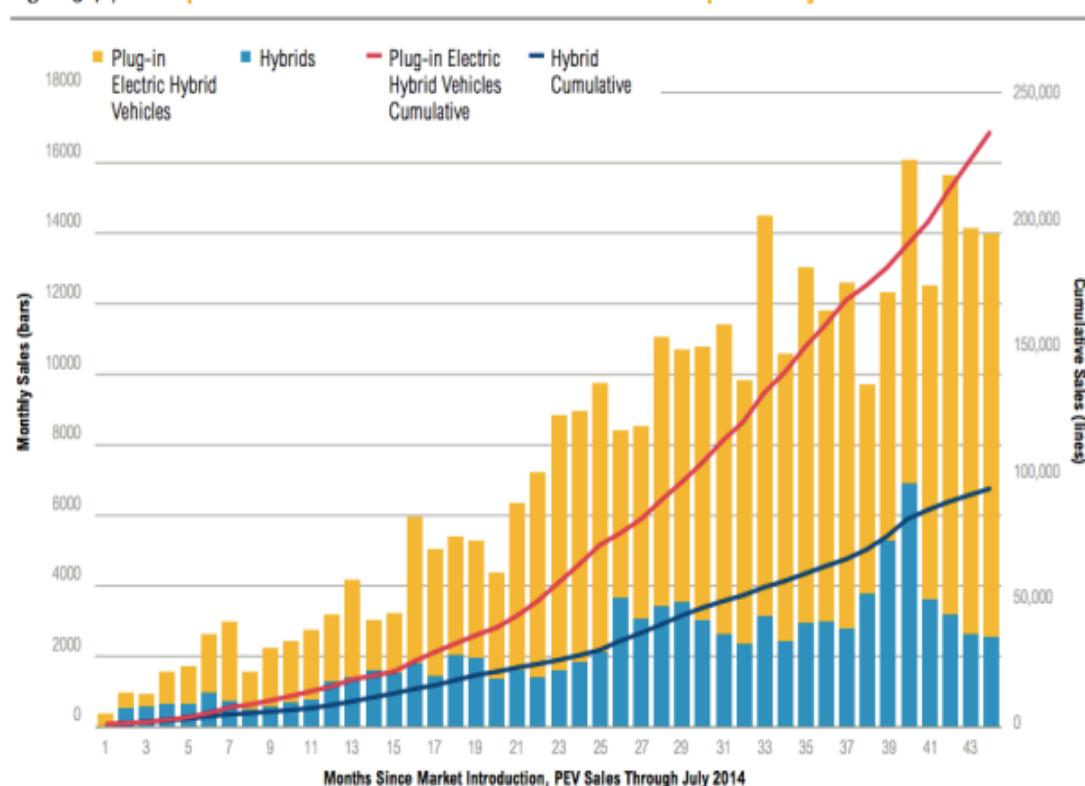
8



How well are EVs selling?

- EV/PHEV vs Hybrids
- As of Sep 2014, approx. 600,000 worldwide (<http://cleantechnica.com/2014/10/23/sales-of-plug-in-cars-exceed-600000-worldwide/>)
- Existing worldwide fleet estimated at ~750 million, with ~80 million produced every year

Figure 3.4 | The Uptake of Electric Vehicles Has Been Faster than the Uptake of Hybrid Vehicles



<http://evobsession.com/electric-car-sales-growing-much-faster-hybrid-sales-chart/>



EVs and PHEVs Available

EVs

- BMW i3
- Ford Fusion
- Kia Soul
- Mitsubishi i-MiEV
- Nissan Leaf
- Tesla Model S and Model X (2015)
- Volkswagen E-Golf (US only right now, late 2014)

PHEVs

- BMW i3 Rx
- Chevrolet Volt
- Ford C-Max Energi and Fusion Energi
- Mitsubishi Outlander (late 2015)
- Via Motors Silverado Truck and Express Van (fleet only)
- Volvo XC90 (2015)

Other vehicles that are being electrified



■ Electric bus (city and school)



■ Small utility vehicles

might-E-truck



might-E-tug





How far can EVs go?

- Numerous factors that impact range:
 - Battery size!
 - Elevation changes
 - Speed
 - Outside temperature (i.e. HVAC use)

Elevation effects on efficiency

	Distance (km)	Efficiency (km/kWh)	Energy Used (kWh)
Trail to Rossland	10	2.6	3.85
Rossland to Trail	10	-	-1
Trail to Rossland (round)	20	7.0	2.85
Similar distance on flat ground	20	8	2.5

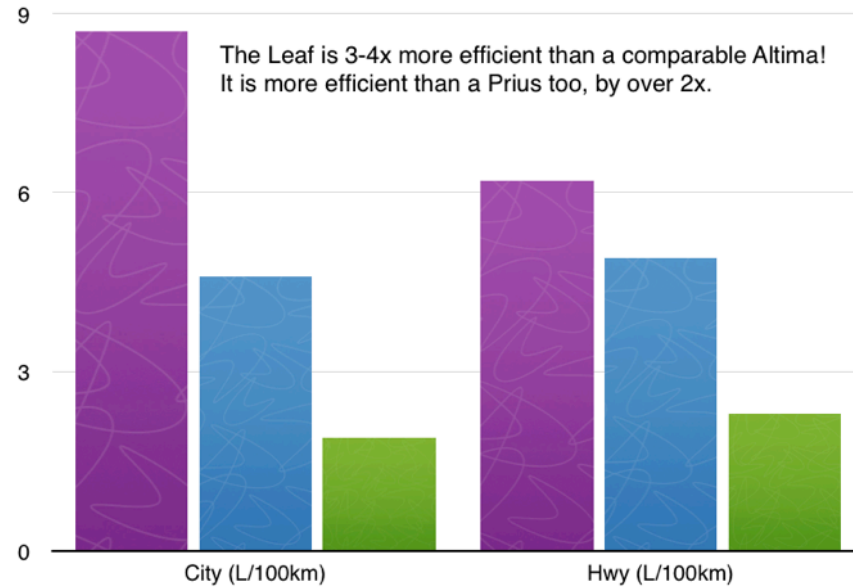
Range (km)	Typ. PHEV	Typ. EV	Model S
Minor hills, -10C	25 - 50	90 - 120	350
Minor hills, +20C	30 - 60	120 - 150	425
Flat, max range	40 - 80	140 - 180	500

Efficiency

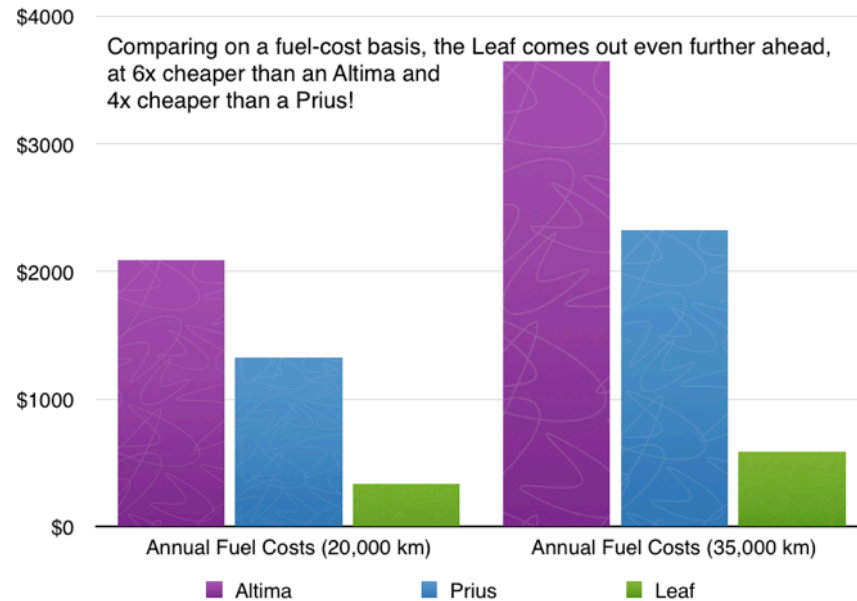


13

Comparing Energy Efficiency



Comparing 'Fuel' Costs



Lifecycle Analysis

14

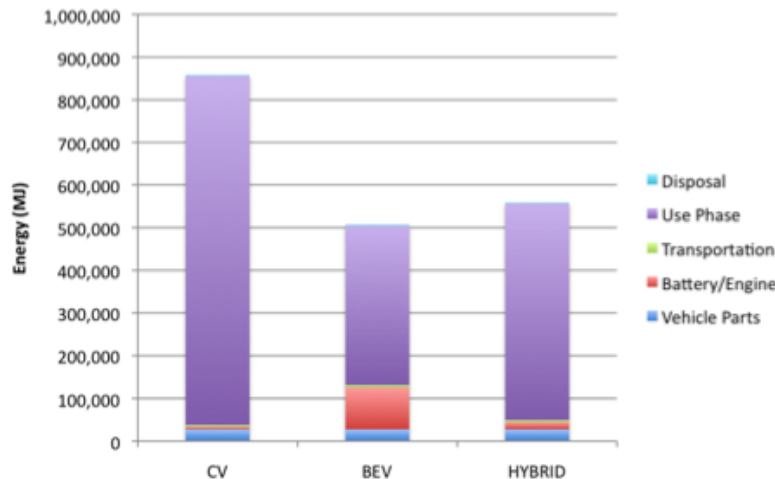
- Manufacturing battery currently consumes the most energy and emits most emissions

- Expected to improve dramatically

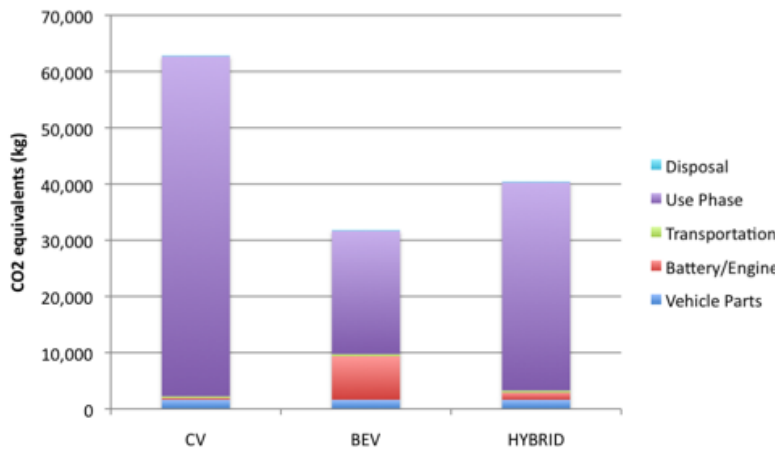
- The CO₂ noted for energy use is based on a mix:

- Left graph, California mix, 7% coal, 14% nuclear, 42% natural gas, 25% renewable
 - Right graph, UK mix (not noted in study; however, www.carbonbrief.org notes UK mix as 66% fossil fuel, 21% nuclear, 12% renewables for 2013)

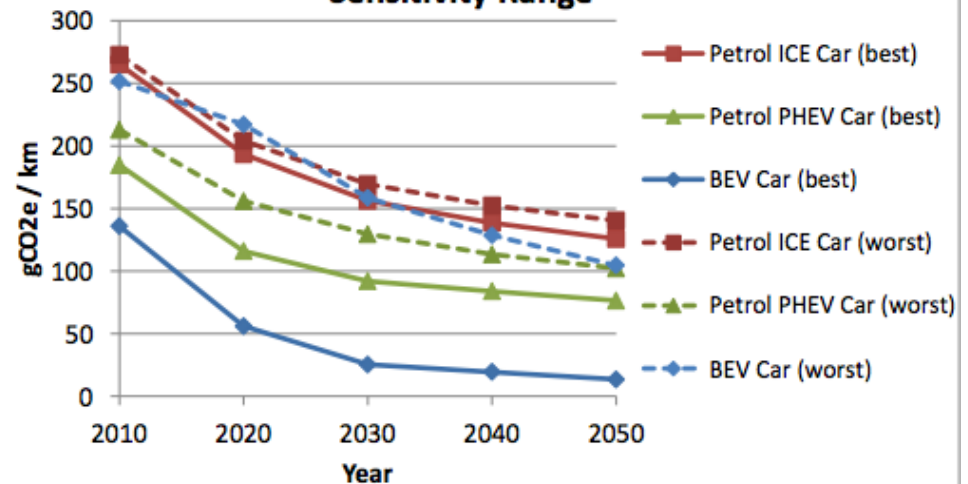
Energy Inputs Lifecycle Comparison



CO₂ Equivalents Lifecycle Comparison



Sensitivity Range



"Lifecycle Analysis Comparison of a Battery Electric Vehicle and a Conventional Gasoline Vehicle", Aguirre et al for CARB, June 2012

"Life-Cycle Assessment for Hybrid and Electric Vehicles", Hill for LowCVP Annual Conference, July 2013

<http://www.ricardo-aea.com/cms/assets/Documents-for-Insight-pages/Transport/08.-LowCVP-conference.pdf>

Charging

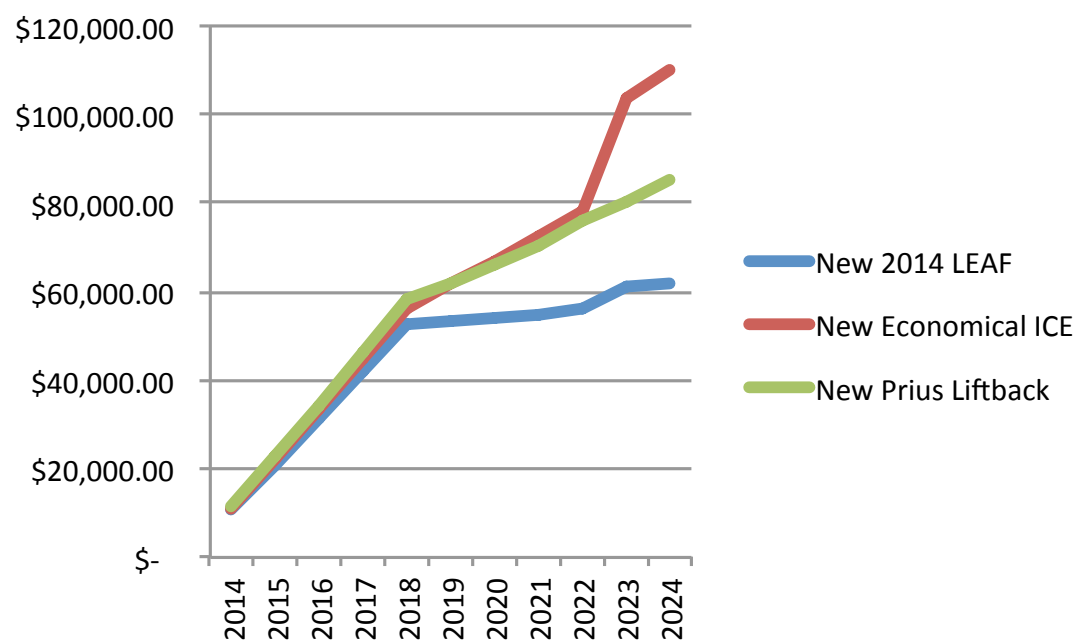


15

Type of Charging	Level 1	Level 2	Level 3 (Quick Charge)
Range gained per hr	5 – 8 km	20 – 40 km (20 – 90 km)	90 – 120 km (200 – 270 km)
Electrical	120V, 15 – 20A	240V, 15 – 80A	>400V, >100A
Where	Almost anywhere!	Home, commercial, public spaces	Public (in BC)
Useful for...	Overnight charge for commute, opportunity charge	Long commutes, errands into adjacent town, intra-regional travel (with patience)	Intraregional travel for today's cars; inter-regional (e.g. to Vancouver) for future



Personal Costs and Savings



My projections based on my yearly driving of 35,000 km

Actual Costs for first 6 months:

- One time, \$1800 for Level 2 charger in my carport (not needed if commute < 60km)
- \$195 for electricity (\$32.5/month)
- Fuel savings, \$1920 (\$320/month)
- Regular maintenance avoidance savings, \$200 (two oil changes)
- Car payment, \$660/month for 'S', \$820/month for 'SL'

Deciding between EV or PHEV



17

Consider an EV if...

- You commute between 10 – 40km and have no plug at work (up to 80km if you do)
- Your living situation already requires two vehicles
- Or, if you want only one vehicle, the idea of renting for road-trips is fine (or join the car co-op!)

Consider a PHEV if...

- You would prefer to remain a single-car family and occasionally take road trips
- Your commute fits entirely (or close to it) within the electric-only range
 - This maximizes the financial return



Road trips with an EV

- I drove from Vancouver to Nelson



- Short road trips possible now, Nelson to New Denver, to Kaslo, to Nelson



- Future regional trips with a few key chargers in other towns
 - Nelson to Kelowna currently, about 24 hours
 - Nelson to Kelowna with upgraded infrastructure, about 7.5 hours
 - Compared with gas car now, about 5.5 hours

Questions?

kootenayEVfamily.ca

Electric vehicle tidbits
and adventures in the
Kootenays

Andrew Chewter
achewter@gmail.com
**Electric Vehicle
Enthusiast**

