Dispelling Electric Vehicle Myths

There is an EV in your Future!

Part of the GREEN GROUP Webinars

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Questions?
Type them into the chat box or ask in person at the end.

30 Minutes:

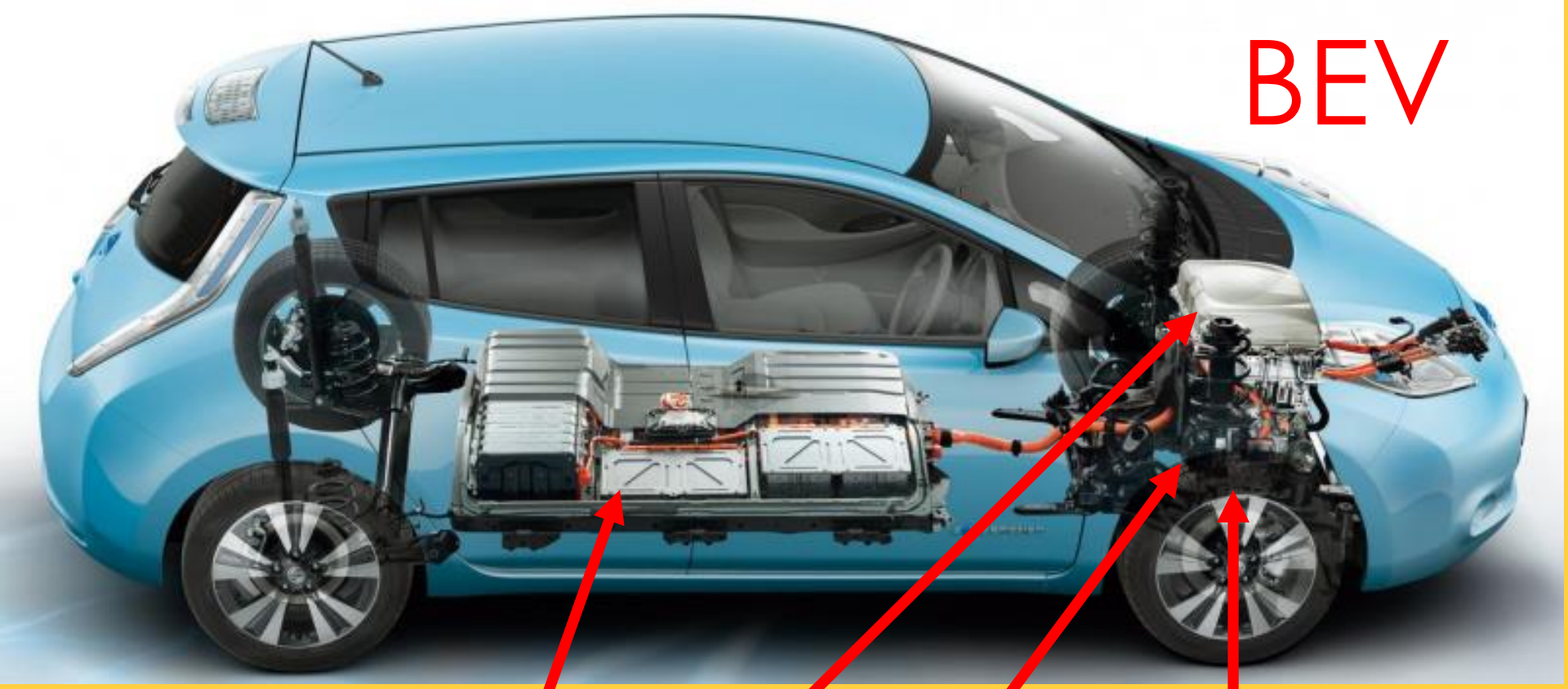
- GHG Emissions
- Economics
- Range and Charging
- Mining, Manufacturing
- Lifecycle GHG impact
- The Electricity Grid
- Hydrogen/Biofuels?
- Your questions!

Why we have a Worldwide EV Market

- Worldwide goal of zero GHG by 2050

Enabling Forces

- GHG regulations in many countries
- High performance batteries and electronics
- You and I want to have less impact



- Battery
- Inverter
- Electric Motor
- Reducing gears and differential

Why would you buy an EV?

- You want to reduce your contribution to Global Warming
- A “fill-up” is the price of a good latte!
- Very little maintenance
- Shhh….a very quiet car
- Good acceleration!
- Equal life cycle cost

Reasons we hesitate to buy an EV

- Range and charging concerns
- Initial cost
- Battery mineral mining
- Can the grid take it!
- Is it battery EVs or hydrogen/biofuels?

GHG Emissions

Using an EVs is likely the single biggest GHG emissions reduction you can make!

Ontario electricity has very low GHG/kWh

(0.013 to 0.044 kg GHG/kWh avg.*)

This means the electricity you use to charge your EV has a very, very low upstream GHG impact.

*Toronto Atmospheric Fund 2019

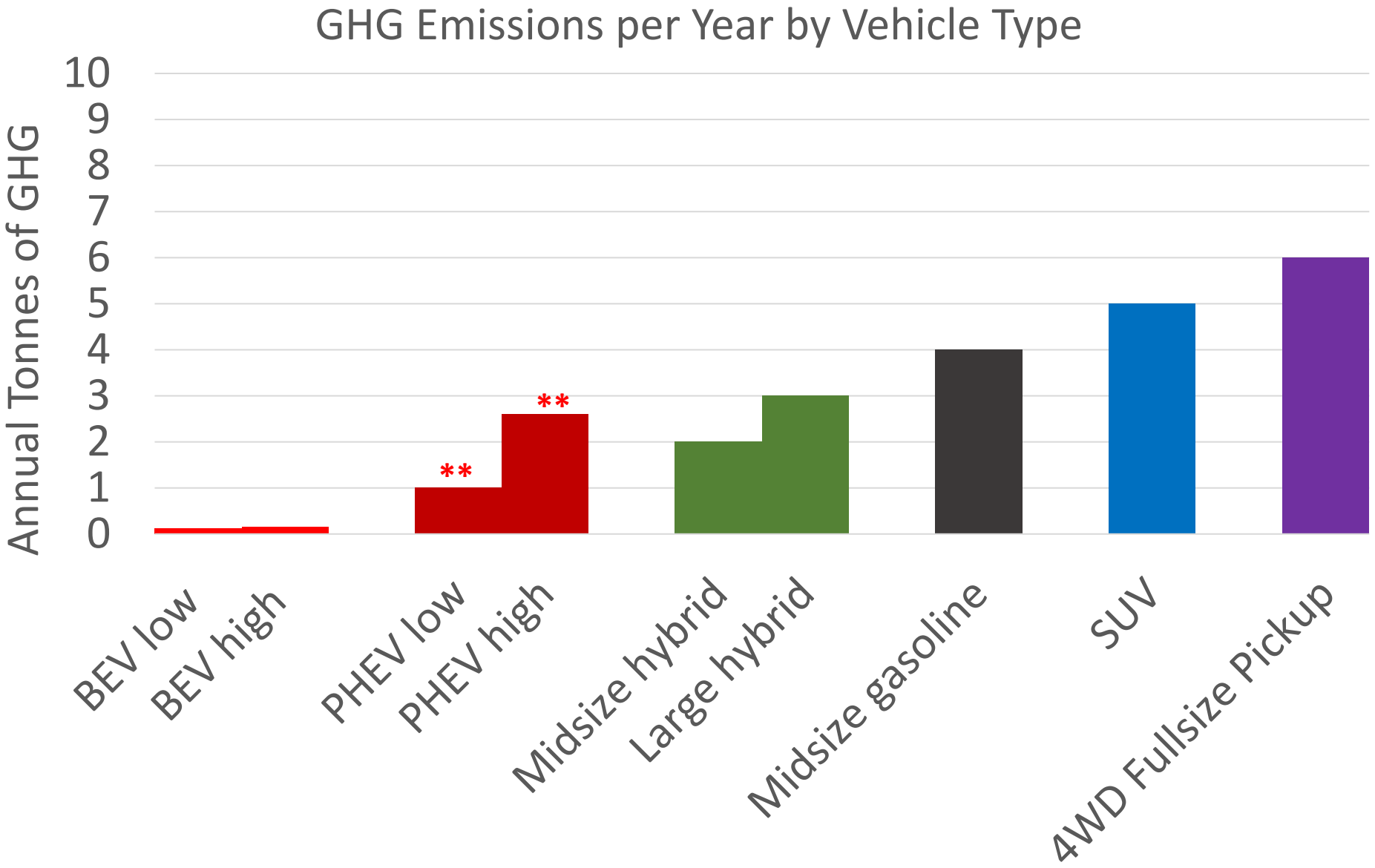
ICE Vehicle*:	2 - 6 t GHG/year
House: N.G.:	4 - 10 t GHG/year
Flying: YYZ/Paris:	2 t GHG/person
Total	8 - 18 t GHG/year

EV: 0.07 t GHG/year

(Ontario 11.3 t GHG/person/year)**

**Ontario data 2017

*20,000 km/year



20,000 km per year

* 0.04 kg CO_2e Ontario grid emissions

** depends on ratio of EV to gas operation

Range and Price

April 2014 – 3 models















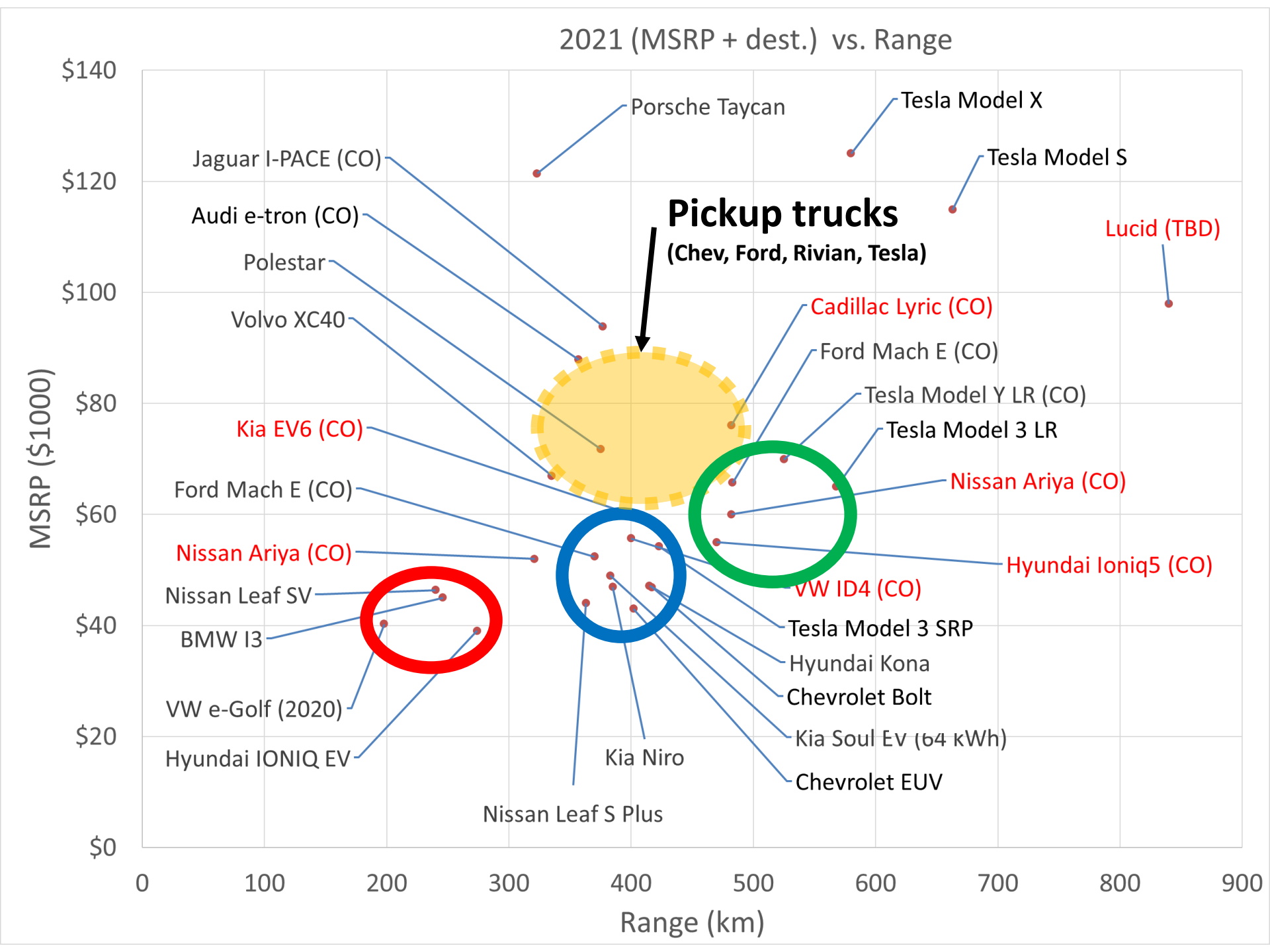


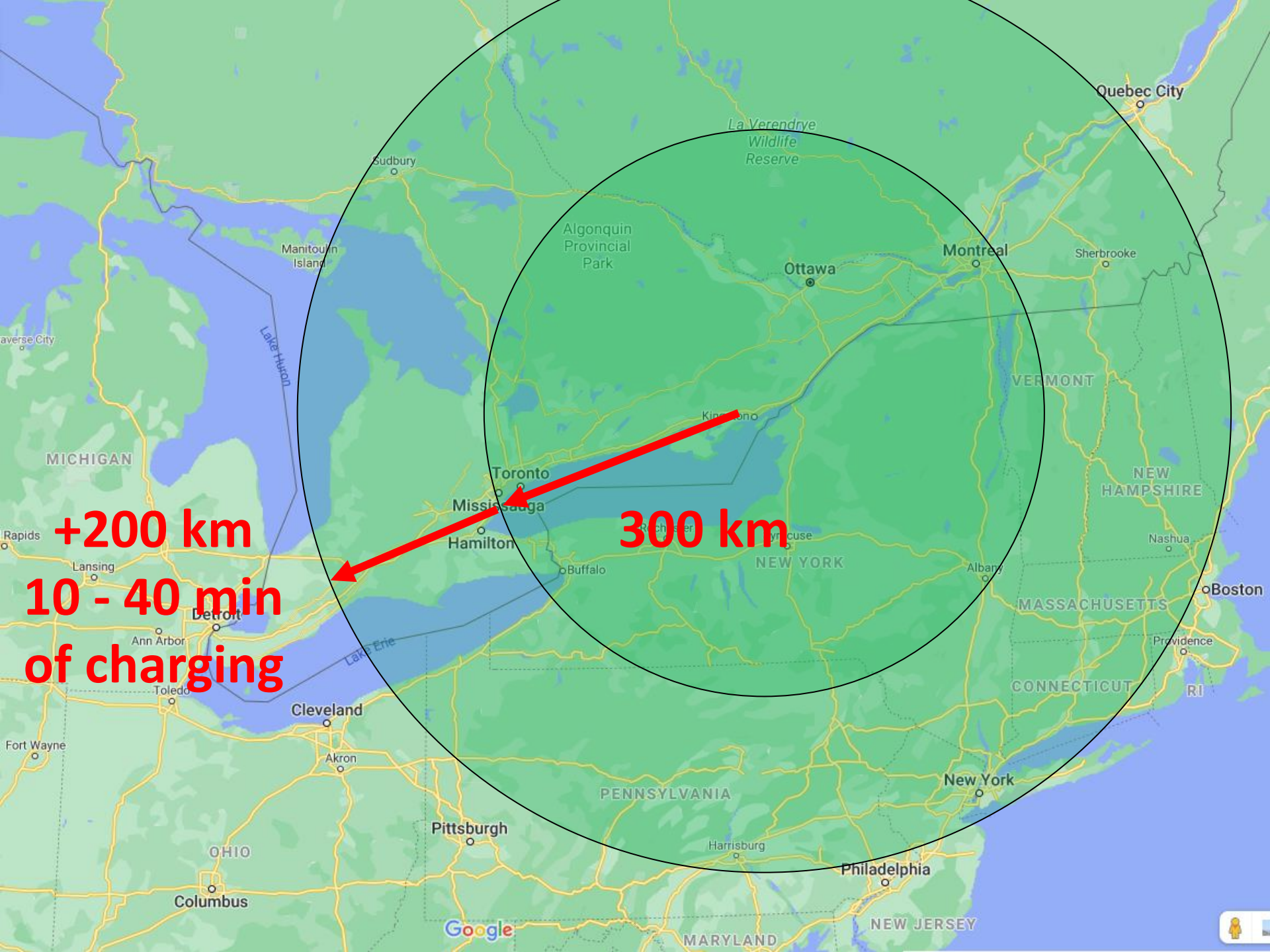
May 2020 BEV
17 models

2021 & 2022

30+ Models

100% Electric Cars (BEV)	Range (km)	Battery kWh Capacity	MSRP (plugndrive) 1000s
Lucid (TBD)	840	100	$98
Tesla Model S	663	100	$115
Tesla Model X	580	100	$125
Tesla Model 3 LR	568	75	$65
Tesla Model Y LR (CO)	525	75	$70
Ford Mach E (CO)	483	88	$66
Nissan Ariya (CO)	482	90	$60
Cadillac Lyric (CO)	482	100	$76
Hyundai Ioniq5 (CO)	470	72.6	$55
Tesla Model 3 SRP	423	75	$54
Chevrolet Bolt	417	66	$47
Hyundai Kona	415	64	$47
Chevrolet EUV	402	66	$43
VW ID4 (CO)	400	77	$56
Kia EV6 (CO)	400	77	$60
Kia Niro	385	64	$47
Kia Soul EV (64 kWh)	383	64	$49
Jaguar I-PACE (CO)	377	90	$94
Polestar	375	78	$72
Ford Mach E (CO)	370	68	$52
Nissan Leaf S Plus	363	62	$44
Audi e-tron (CO)	357	95	$88
Volvo XC40	335	78	$67
Porsche Taycan	323	93.4	$121
Nissan Ariya (CO)	321	65	$52
Hyundai IONIQ EV	274	38.3	$39
BMW I3	246	42.2	$45
Nissan Leaf SV	240	40	$46
VW e-Golf (2020)	198	35.8	$40
Mini Cooper S E	177	32.6	$40


2021 (MSRP + dest.) vs. Range
MSRP ($1000)
Range (km)
$0
$20
$40
$60
$80
$100
$120
$140
0
100
200
300
400
500
600
700
800
900
Porsche Taycan
Tesla Model X
Tesla Model S
Lucid (TBD)
Jaguar I-PACE (CO)
Audi e-tron (CO)
Polestar
Volvo XC40
Pickup trucks
(Chev, Ford, Rivian, Tesla)
Cadillac Lyric (CO)
Ford Mach E (CO)
Tesla Model Y LR (CO)
Tesla Model 3 LR
Kia EV6 (CO)
Nissan Ariya (CO)
Ford Mach E (CO)
Nissan Ariya (CO)
Hyundai Ioniq5 (CO)
VW ID4 (CO)
Nissan Leaf SV
BMW I3
Tesla Model 3 SRP
Hyundai Kona
Chevrolet Bolt
VW e-Golf (2020)
Kia Soul EV (64 kWh)
Hyundai IONIQ EV
Kia Niro
Chevrolet EUV
Nissan Leaf S Plus


+200 km
10 - 40 min
of charging
300 km
Quebec City
La Verendrye
Wildlife
Reserve
Sudbury
Algonquin
Provincial
Park
Manitoulin
Island
Ottawa
Montreal
Sherbrooke
Lake Huron
VERMONT
MICHIGAN
Toronto
Mississauga
Hamilton
NEW
HAMPSHIRE
Rapids
Lansing
Buffalo
NEW YORK
Albany
Nashua
Boston
MASSACHUSETTS
Detroit
Ann Arbor
Lake Erie
Providence
Toledo
CONNECTICUT
RI
Cleveland
Fort Wayne
Akron
New York
PENNSYLVANIA
Pittsburgh
OHIO
Harrisburg
Philadelphia
Columbus
Google
NEW JERSEY
MARYLAND

Seasonal Range Change

- Spring, summer and fall days range will be better than stated, “400” km could become 450 km
- kWh consumption increases with speed^2
- Worst day (-25°C, snow) range at 100 kph could be 40 - 50% reduced.
- It’s not the energy to run the heater, it is the cold bearings, stiff rubber, dense air and lowered battery temperature that impacts the range (heat 6% on a 1600 km winter trip)

Charging

Level 1

120 VAC

(High Power)
Wall Connector

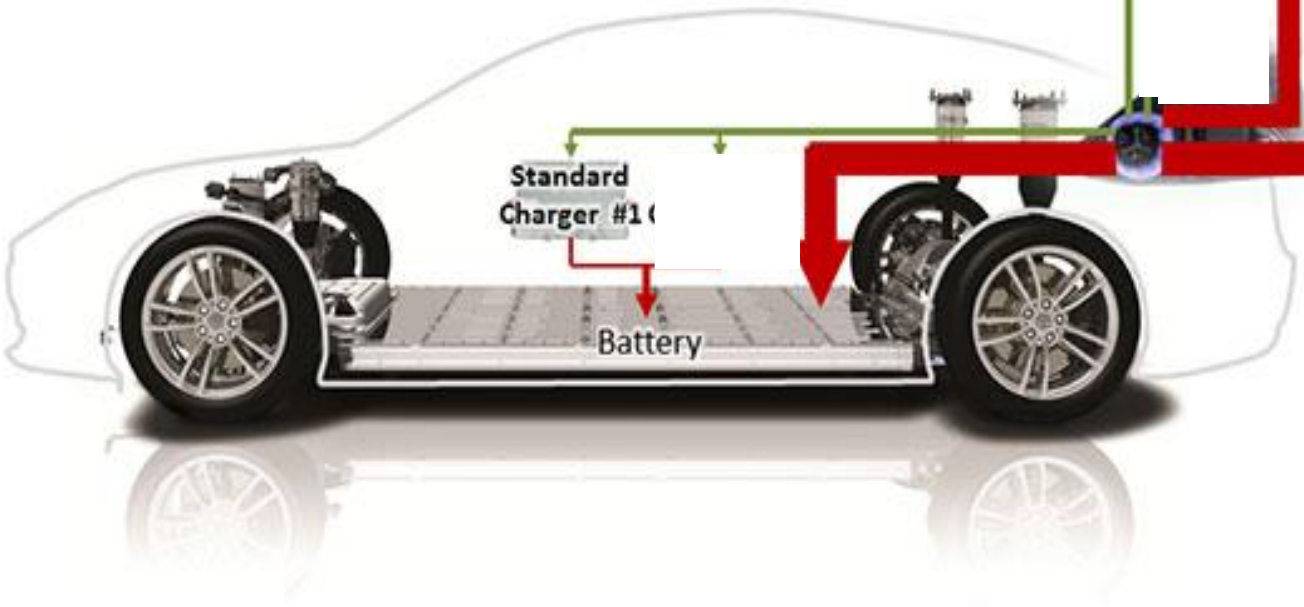
Level 2

240 VAC

Level 3

400-800 VDC

Tesla
Supercharger



Level 1 and 2 at home or away

200 km = $4 to $6

(gasoline 200 km @ 8 l/100km = $16 to $20)

Level 3 - Long Distance

$0.22 - $0.44/minute

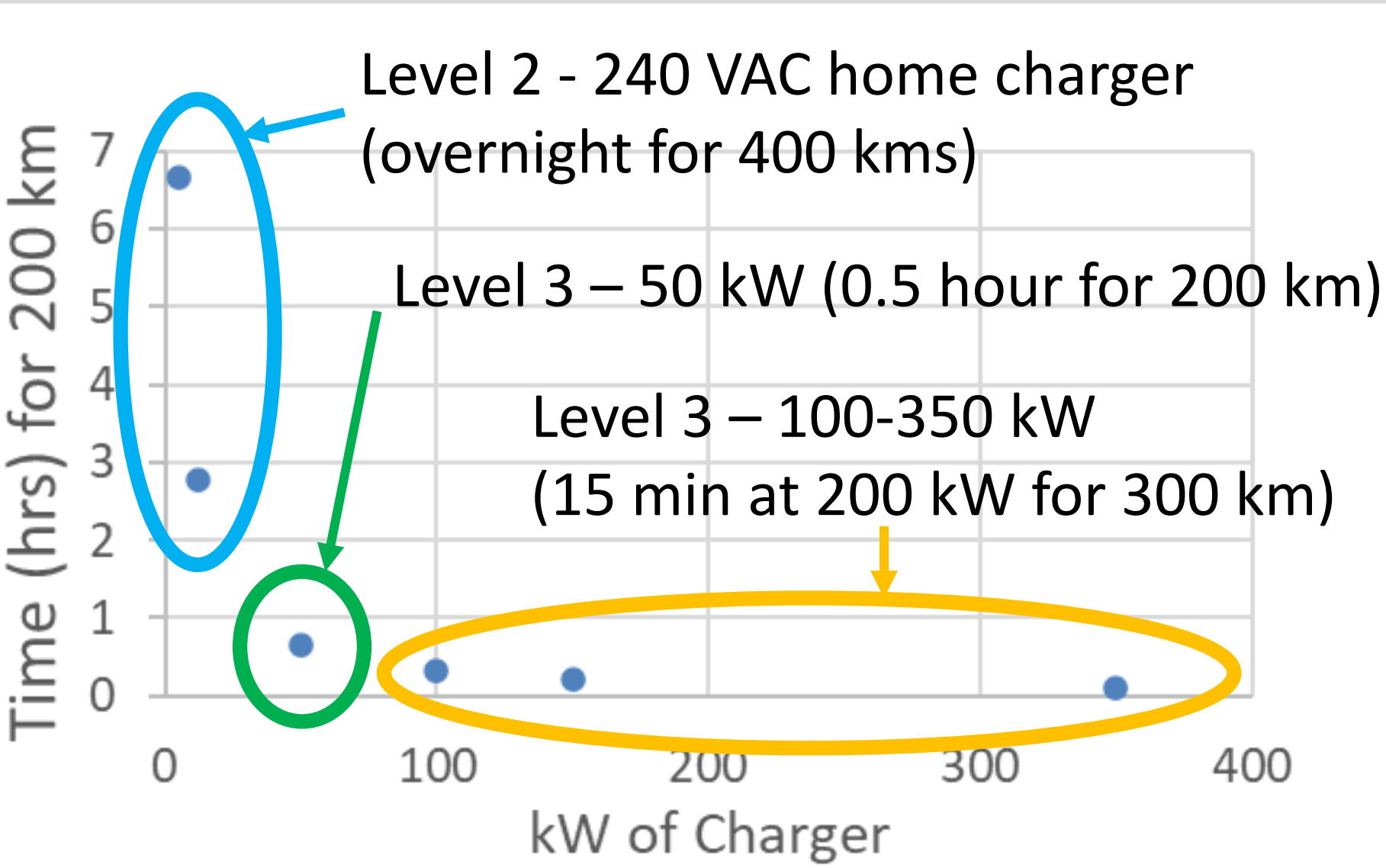
200 km = $9 to $17

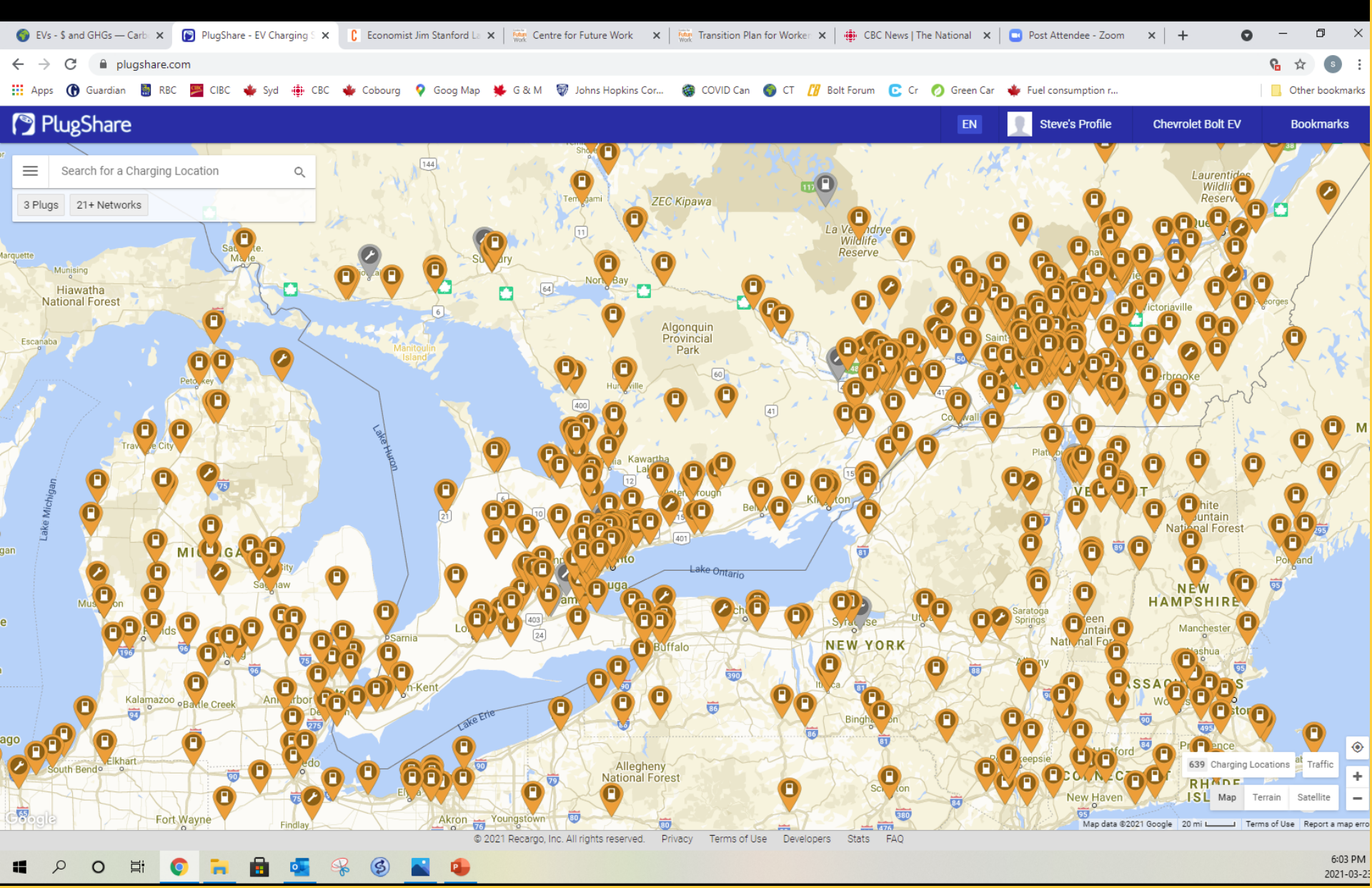
Same $/km as 5 to 8 l/100km gas car

Power: 20 - 350 kW

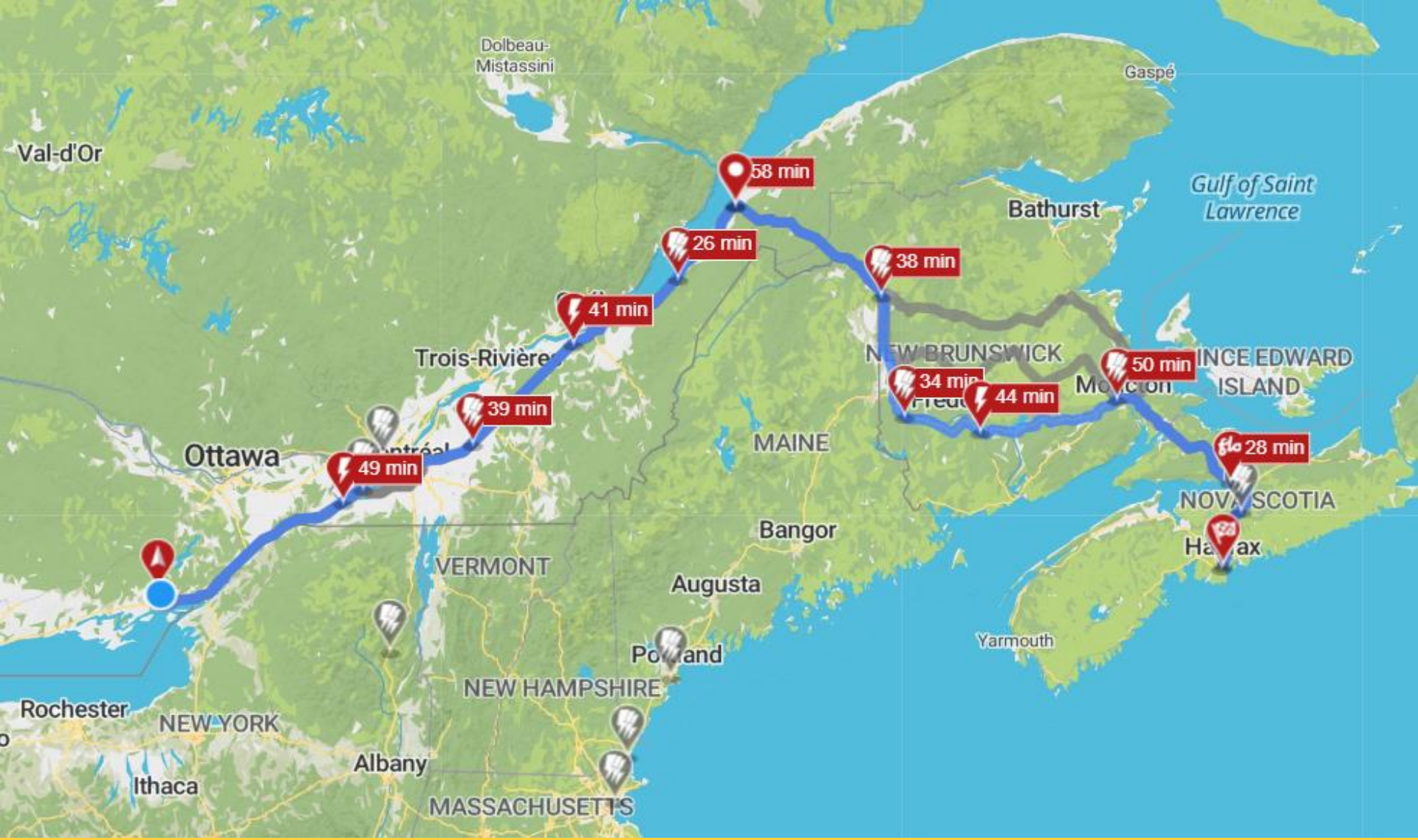
10+ vendors

Charging times





Level 3 “Plugshare.com” screen grab



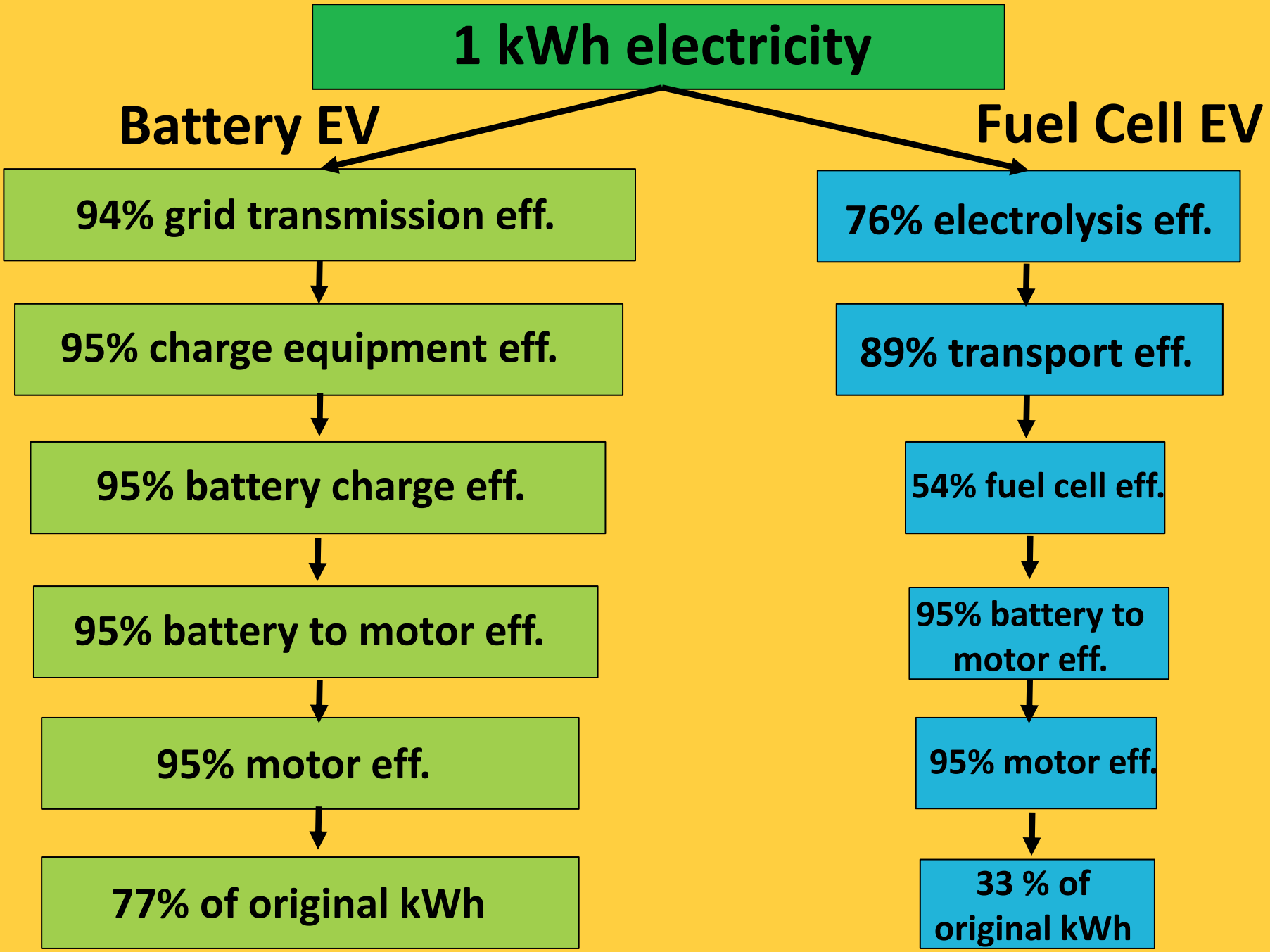
Trip Planning Software
(A Better Routeplanner)

Key points on Charging

- Vast majority of your charging will be done at home at night (condos/apmts?)
- On trips more than 300 - 400 km you'll use Level 3 for fee chargers
- Level 2 and 3 charge power (kW) varies by model of car – higher kW of charge power is better
- If on long trips with tight timelines, advance booking of chargers is emerging

The Big Picture

Hydrogen?
Biofuels?
Minerals?
The Grid?


1 kWh electricity
Battery EV
Fuel Cell EV
94% grid transmission eff.
95% charge equipment eff.
95% battery charge eff.
95% battery to motor eff.
95% motor eff.
77% of original kWh
76% electrolysis eff.
89% transport eff.
54% fuel cell eff.
95% battery to motor eff.
95% motor eff.
33 % of original kWh

Biofuels

- Cost will be higher than electricity
- All the corn and soybean grown in USA could only replace maybe a quarter to a third of the gasoline and diesel used for transport in USA
- Food versus fuel a challenge
- Biofuel combustion - pollutants
- Energy Return On Investment an issue
- Airplanes will be priority

Climate Change Mining & Manufacturing

Consumption and Impact

- We humans have no choice but to aggressively reduce GHG emissions.
- EVs very effectively address the existential crisis presented by global warming and the immense negative environmental impacts of fossil fuel extraction, processing and transport.
- Virtually everything we buy has upstream environment impacts.
- Buy less or buy things that have less impact – EVs address the climate crisis.

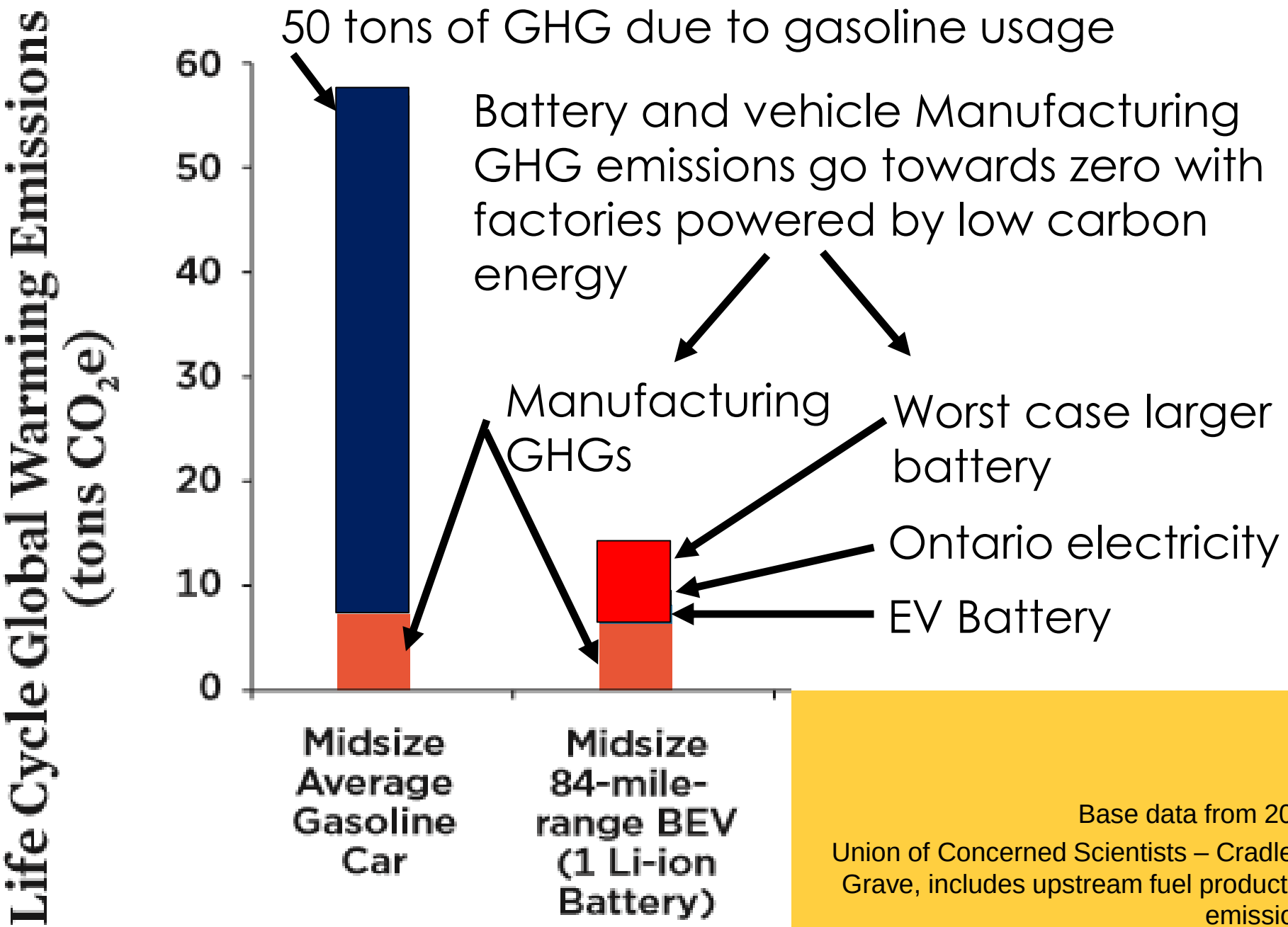
Battery Materials

- 10 kg Lithium per EV = 5.3 billion batteries (1.3 B pass. vehicles world)*
- Other battery chemistries will very likely enter the market to year 2050, some will require no conflict minerals

Not to be ignored

- Mining has negative impacts and they can be addressed with policy, laws and through activist pressure – all happening
- We must reduce GHGs

*U.S. Geological Survey, Mineral Commodity Summaries, January 2018



Base data from 2015

Union of Concerned Scientists – Cradle to Grave, includes upstream fuel production emissions

220,000 km vehicle life

Impact of EVs on the Ontario Electricity Grid

1,000,000 EVs each going 20,000 km/year would create a

2.5%

increase in Ontario's total 137 TWh of electricity generation

Economics

Comparing Costs?

Factor in that EVs are:

- Quieter
- Faster accelerating
- EVs require about $500/year electricity versus $1,500 to $4,000 of gasoline
- Have remote heating and cooling
- Heated seats and steering wheels
- Minimal to no scheduled maintenance (data shows 50% maintenance cost compared to ICE)

Variables

March 2021 Data		
Gasoline Cost	1.25	$/litre
Electricity Cost	0.1356	$/kWh
Fuel/Elec inflation cost	3.0	%
General inflation	2.0	%
Annual driving	20,000	km/year
ICE annual maintenance	1000	per year
BEV annual maintenance	500	per year
Resale at 5 years	0.52	% of MSRP
Ontario elec emissions factor	0.04	kg CO2/kWh

	Gasoline only						200 km BEV		400 km BEV		
	Hyundai Elantra	Volks Jetta	Hyundai Kona	Ioniq hybrid	Volks Golf	Prius	Ioniq EV	Volks Golf EV	Bolt	Kona EV	Tesla 3 St Range Plus
5 year energy*	$9	$9	$10	$5	$10	$6	$2.5	$2.5	$2.5	$2.5	$2.5
5 year total*	$29	$31	$32	$28	$33	$32	$30	$31	$31	$34	$37
5 year GHG t	15	16	18	9	17	10	0.7	0.7	0.7	0.7	0.7

*In $1000's

5 Year $ Costs* and GHG Emissions

(includes $5k federal incentive)

Wrap-up

Finally

- EVs in Ontario: Lower your vehicle annual and lifetime GHG emissions massively
- EVs have the same five and ten year ownership cost as similarly equipped fossil fuel cars
- Long distance travel entirely feasible

Thank you for your attention.

Questions?

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The End