INFORMAL – NON-PEER-REVIEWED OVERVIEW ON ELECTRIC VEHICLES (MAINLY TESLA 3) by Corrie Kost

Discussion Topics for Electric Vehicles:

A. Price of EV's (Teslas)

B. Charging – home and/or away – times, costs, availability, rebates, etiquette, wireless

C. Range (vs speed and ambient temperatures)

D. Drivability & Habit adjustments

E. Driving in the Snow – Regenerative Braking Issues

F. Winter or All-Season tires for winters

G. **A**ll **W**heel (AWD) vs **4 W**heel (4WD) vs **R**ear or **F**ront **W**heel **D**rive (RWD/FWD)

H. Overall User Experience

I. Software Updates

J. Warranties

K. Maintenance Schedules Costs & Battery Life and Environmental/Disposal issues Costs / Tires

L. Primary & Supplementary Insurance

M. Autopilot Vs Full Self Driving

N. Carbon Costs /Global Legislation to Phase Out Internal Combustion Engines (ICE)

O. Other Issues

EUCCA-EXEC poll suggested removing F, G, L (to which I concur) from presentation on Sep 26th

A,C,J) Price/Warranties/Specs of TESLA 3

Tesla 3: Rear-Wheel Drive: **423km** 255km/h 0-100km/h 5.6s

Long Range all-wheel drive **568km** 233km/h 0-100km/h 4.4s (**3.7s** with $2.7k extra)

Performance Dual Motor all-wheel drive **507km** 261km/h 0-100km/h 3.3s

https://www.ccarprice.com/ca/tesla-model-3-long-range-2022-price-in-canada-6645 - updated daily

Long Range AWD: $65,610* 134/126/131MPGE City/Highway/Combined **449hp**

Standard RWD: $58,610* 138/126/132MPGE City/Highway/Combined 282hp

Performance: $75,610* 118/107/113MPGE City/Highway/Combined 480hp

Basic & Roadside assistance: 4 yrs 80,000km

Corrosion: 12yrs unlimited miles

Drivetrain: 8 yrs 192,000 km (LR &Performance) 160,000 (Standard)

Higher MPGE is better. Alternatively kWh/100km (combined 15.6 for Long Range) then smaller is better.

Battery: Min 70% of original range for all model 3's **at Drivetrain limit**. **But warranty replacement will only require that replacement meet 70% threshold when replaced!**

New Vehicle Limited Warranty will follow your vehicle and be transferred to the new owner. The **upgrade cost** from the Tesla 3 model RWD to the Long Range Dual Motor AWD (also having faster charging) may be worth the investment.

(*) 4th Quarter 2021 Total Price for my Tesla 3 Long Range, w. white premium interior **$76,245**

Jan 2023 MSRP prices: Model 3 $54,990-$72,990 +Taxes **Model Y $69,990 -$75,990 +Taxes**

References:

Car & Driver https://www.caranddriver.com/tesla/model-3
https://www.evspecifications.com/en/model-driving-range/1af7111
Comparison of Tesla Model 3 or Y with other EVs
https://insideevs.com/news/567158/model-y-comparison/

Tesla Y Best EV of 2022 while Hundai Ioniq 5 Best EV of 2023(* not by Motortrend)
https://www.cars.com/articles/best-electric-vehicle-of-2022-445835/
https://www.cars.com/articles/best-electric-vehicle-of-2023-461016/
(*) https://www.motortrend.com/reviews/2023-hyundai-ioniq-5-vs-tesla-model-y-comparison-test-review/

On EV Batteries
https://elements.visualcapitalist.com/ranked-top-10-ev-battery-makers/
https://elements.visualcapitalist.com/lithium-prices-surge-on-ev-demand-from-china/
https://elements.visualcapitalist.com/breaking-down-the-cost-of-an-ev-battery-cell/
https://elements.visualcapitalist.com/how-metals-prices-performed-in-2021/
https://elements.visualcapitalist.com/visualizing-the-natural-graphite-supply-problem/
http://www.northerngraphite.com/_resources/media/NGC%20Spotlight_Compressed%20Version.pdf

Best overall references
http://roperld.com/science/TeslaModel3.htm (dated)

Global EV Outlook 2022/23 (221/143 pages!)
https://iea.blob.core.windows.net/assets/e0d2081d-487d-4818-8c59-69b638969f9e/GlobalElectricVehicleOutlook2022.pdf
https://iea.blob.core.windows.net/assets/dacf14d2-eabc-498a-8263-9f97fd5dc327/GEVO2023.pdf

2022 Fuel Consumption Guide (EV's starts on page 41)
https://natural-resources.canada.ca/sites/nrcan/files/oee/pdf/transportation/fuel-efficient-technologies/2022%2520Fuel%2520Consumption%2520Guide.pdf

Comparison of 3-year ownership costs of EV, gas luxury SUVs
https://driving.ca/features/shopping-advice/comparison-3-year-ownership-costs-ev-gas-luxury-suvs

B1)Charging – Home&Away options – efficiency/times/costs/availability

Home: See slide "Wall Connector Technical details" below for charging rate.

In BC the cost is currently $0.0959 for ~ first 1376 kWh in two months and $0.1422/kWh over the ~1376kWh total.) Recent Tesla app shows "Charge Stats" for the past month. For some details/cost on home chargers see link below.

https://nahbnow.com/2021/04/pre-wiring-for-electric-vehicle-charging-prepping-your-homes-for-future-demand/

Efficiency: According to 2021 Tesla Model Y certification data mentioned in article https://www.caranddriver.com/features/a36062942/evs-explained-charging-losses/ it took 87.9 kWH to add 77.7 kWH to battery from 0 to 100% on the Long Range Model Y using level-2 chargers – **a loss of ~14%**. Efficiency of 400V DC from Superchargers is 98-99%. It appears ~ 21^{C} is optimal charging temperature. In non-sentry mode expect your Tesla to lose <1% in charge as it sits unused. Sentry mode can consume an extra 3%/day.

What You Need To Know About Fast Charging EVs Now & Over The Next Few Years

Many manufacturers that were formerly committed to CCS have planned to switch to the Tesla Superchargers or NACS as their primary charging standard.

https://cleantechnica.com/2023/08/14/what-you-need-to-know-about-fast-charging-evs-now-over-the-next-few-years-in-usa/

B2) Wall Connector Technical details (~$600)

Source: https://www.tesla.com/support/home-charging-installation/wall-connector

Refer to the following table for Tesla vehicle charging speeds for each power level option:

Wall Connector Technical Details			Charge Speed Max Miles of Range per Hour of Charge*			
Circuit breaker (amps)	Maximum output (amps)	Power at 240 volts (kilowatt)	Model S (mph)	Model 3† (mph)	Model X (mph)	Model Y† (mph)
60	48	11.5 kW	41	44	35	44
50	40	9.6 kW	34	37	29	37
40	32	7.7 kW	27	30	23	30
30	24	5.7 kW	21	22	17	22
20	16	3.8 kW	14	15	12	15
15	12	2.8 kW	10	11	9	11

Note that: For household outlet of 120 volts the 15 amp breaker (at 12 amps) will supply 1.4kW

*All charge speeds are approximate.

†Maximum charge rate for Model 3 Rear-Wheel Drive and Model Y Rear-Wheel Drive is 32A (7.7kW) - up to 30 miles of range per hour.

B3)

B4)Tesla SuperChargers (now using kWh pricing / Just opened 50,000th)

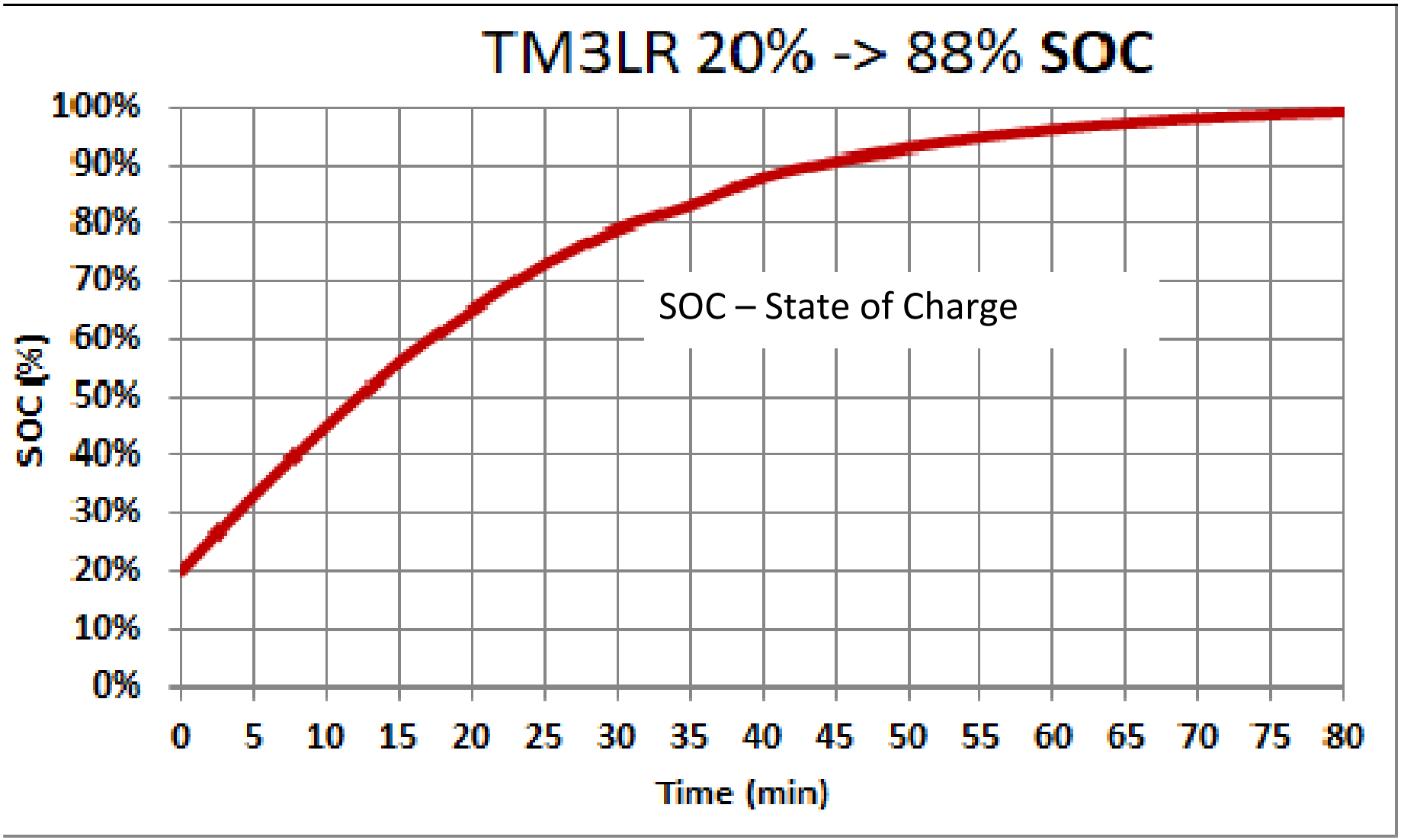
Costs more than twice as much per kWh than charging at home. Charging can take as little as 15min from 20% to 80% (about 50kWh) at a 250kW outlet.

Availability is currently limited in BC/AB to northern limit of Prince George, Jasper/Edson, Edmonton, Lloydminster [Hwy 16].

SuperChargers generally come in A/B pairs. Being the only one on a pair allows for almost twice the charging rate. Note that the charging rate slows rapidly when charging past 80% charge levels.

- Console **"Navigation" will optimize trip time for you**. Just enter your destination on console, or from your phone, or speak a voice command for address, business, etc. "Waypoints" can be added to customize your route.
- The vehicle will use its HVAC system to prepare the battery to a temperature that will ensure the best charging experience at successive charging stations.
- Process: Drive into stall backwards. Set the desired charging level on console or phone. Your phone app does automatic authorization. Unhook power cable. Plug it into car. Wait till you get what you need (or not). Unplug cable and return it to hanger. Leave.
- Plan **where** to charge and **how much** and where **next.** Typically "sweet" spot of how much to charge – charging to >80% takes more time/% - charging less means stopping more often but done right the overall trip takes less time.

B5) This data for SuperCharging a Tesla 3 Long Range is from
https://model3ownersclub.com/threads/request-to-an-owner-supercharging-rate.5427/#post-128114



B6) Charging Etiquette: https://www.evgo.com/ev-drivers/charging-etiquette/

https://www.bchydro.com/news/conservation/2019/ev-charging-etiquette.html

- Take only as much charge as you need to comfortably get to you next station
- Charging spaces are for charging only
- Monitor your charge when away from your vehicle, or at least leave a note
- Do not remove somebody else's charging cable (unless you **see** a note to allow)
- Keep music low & properly dispose of your trash

Note that while the majority of EV owners haven't been involved in an argument at a charging station, or witnessed one, almost a quarter have been in an argument.

Road Taxes – Benefit in Kind (in some places- 1 or 2% of cost of EV/yr) but, for example, London England waives Congestion/Emission charges.

https://pod-point.com/guides/vehicles/tesla/2021/model-3

BC Hydro **could** implement 2nd meter channel at homes to charge at a higher $rate/kWh. Technology is available to combat cheating.

Less than one in five federally funded car charging stations are operational

Government invested $768M between 2016 and 2027 to buy and install nearly 90,000 chargers. (Tesla Supercharging stations have a > 99% uptime)

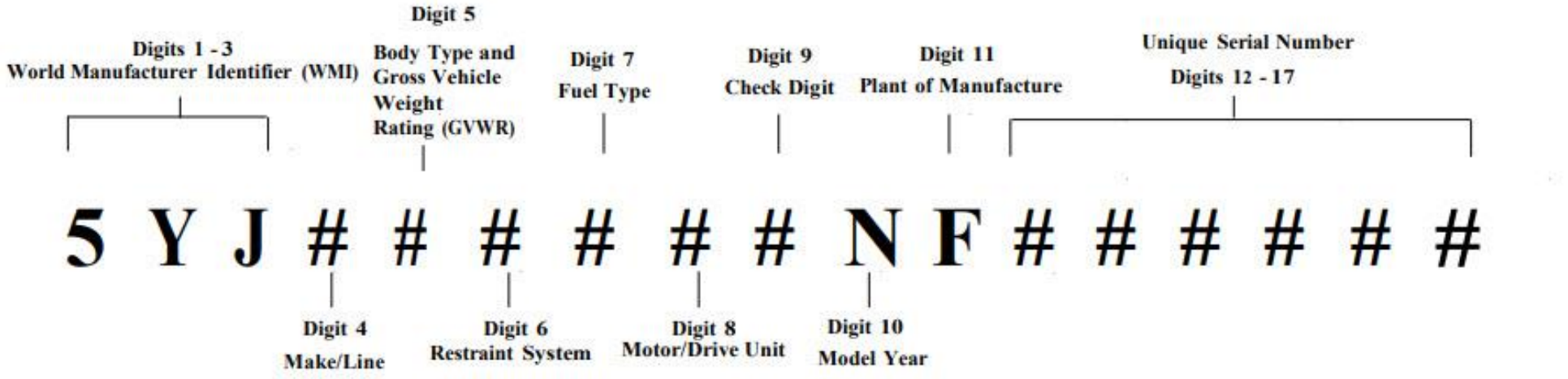
https://www.cbc.ca/news/politics/federally-funded-charging-stations-operational-1.6952269
https://www.statista.com/statistics/1402188/tesla-average-uptime-supercharger-site

B7) Future: Wireless charging on the go...Copper Coils fitted under the asphalt...

https://www.autoevolution.com/news/sweden-successfully-tests-wireless-charging-road-set-to-revolutionize-mobility-155137.html

"this is something that has not been implemented yet as a factory feature by any renowned carmaker but can be easy and cost-effective to add on existing and future EV models." **Short video s**hows concept at https://youtu.be/8BQUIRBMSWA (taken from https://www.intelligentliving.co/roads-that-charge-electric-cars-wirelessly-springing-up-everywhere/)

Vehicle Identification Number (VIN) Explained



B8) Review Home Charging Options

Mobile Connector	Wall Connector	Universal Wall Connector
		
Portable, convenient charging at any location	Optimal, fast charging with NACS connector	NACS + J1772 - All-in-one solution
$315 (no longer “free”)	$650	$785
$0-$2,000* (Install Cost)	$1,000-$2,000* (Install Cost)	$1,000-$2,000* (Install Cost)
Tesla (Vehicle Compatibility)	Tesla (Vehicle Compatibility)	All EVs (Vehicle Compatibility)
NACS (Plug Type)	NACS (Plug Type)	NACS & J1772 (Plug Type)
4.8-48.2 km/h† Charge Speed	Up to 71 km/h† Charge Speed	Up to 71 km/h† Charge Speed
6m Cable Length	7.3m Cable Length	7.3m Cable Length
Indoor Environment	Indoor/Outdoor Environment	Indoor/Outdoor Environment
✓ Using Tesla App and Touchscreen	✓ Using Tesla App	✓ Using Tesla App
✓ Portable	X Portable	X Portable

**If you have an existing outlet approved for charging by your installer, no installation is required. Installing a new 240 V outlet can cost $1,000 - $2,000. Charging speed is up to 4.8 km/h with a standard household outlet, or up to 48.2 km/h with a 240 V outlet.*

†Refer to Wall Connector and Mobile Connector charging speed tables for Tesla vehicles. Maximum charge rate for Model 3 Rear-Wheel Drive and Model Y Rear-Wheel Drive is 32A (7.7kw). Charging speeds for non-Tesla vehicles will vary.

B9) EV REBATES

Income requirements

https://goelectricbc.gov.bc.ca/personal-rebate-offers/passenger-vehicle-rebates/

Individual income (gross annual income)	**Rebate for plug-in hybrids with range less than 85 km**	**Rebate for battery electric and long-range plug-in hybrids**
Less than $80,000	$2,000	$4,000
$80,001 – $90,000	$1,000	$2,000
$90,001 – $100,000	$500	$1,000
$100,001 and above	No rebate	No rebate

Eg. Details for Tesla Y are found at https://www.tesla.com/en_ca/modely

C1) Range

In Canada – uses enerGuide L_e/100km

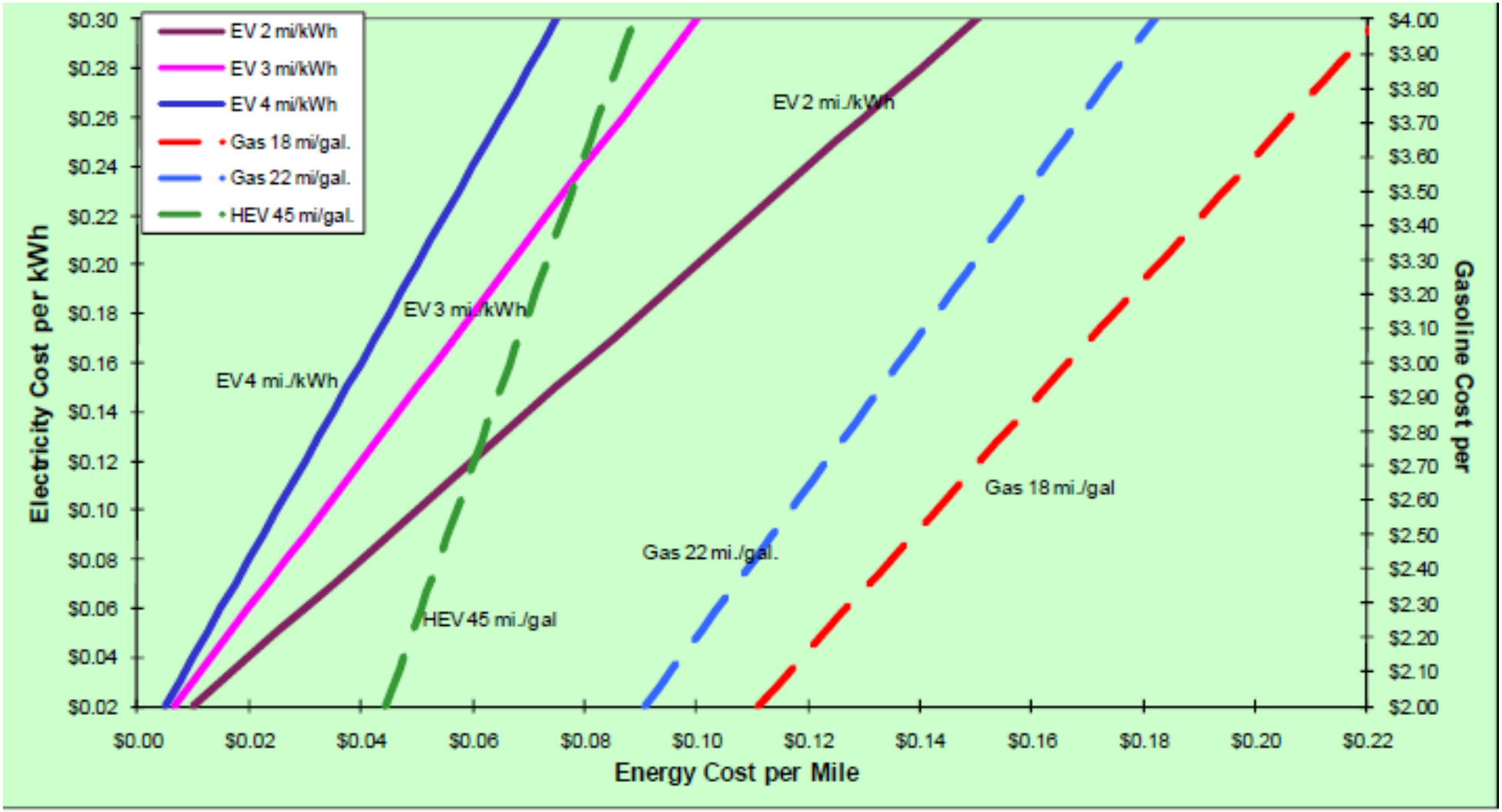
For Tesla 3 LR L_e/100km is 1.7/1.9/1.8 for city/highway/combined. Combined is also shown as 15.6kWh/100km (translates to 4.0miles/kWh)

An EV's efficiency rating, typically expressed in Le/100km accounts for all the energy expended by the vehicle. It's a metric created to compare the energy efficiency of EVs to that of gas-powered vehicles by **showing the energy consumed in terms of litres of gasoline (which is 8.9 kilowatt-hours per litre)[(1)]to travel 100km.**

Of course in BC that energy is supplied by hydro so the CO_2/km is ~ zero here for the Tesla which is given the highest rating[(1)] of 10 (best).

(1) https://www.nrcan.gc.ca/energy-efficiency/transportation-alternative-fuels/personal-vehicles/choosing-right-vehicle/buying-electric-vehicle/understanding-the-tables/21383

From https://avt.inl.gov/sites/default/files/pdf/fsev/costs.pdf

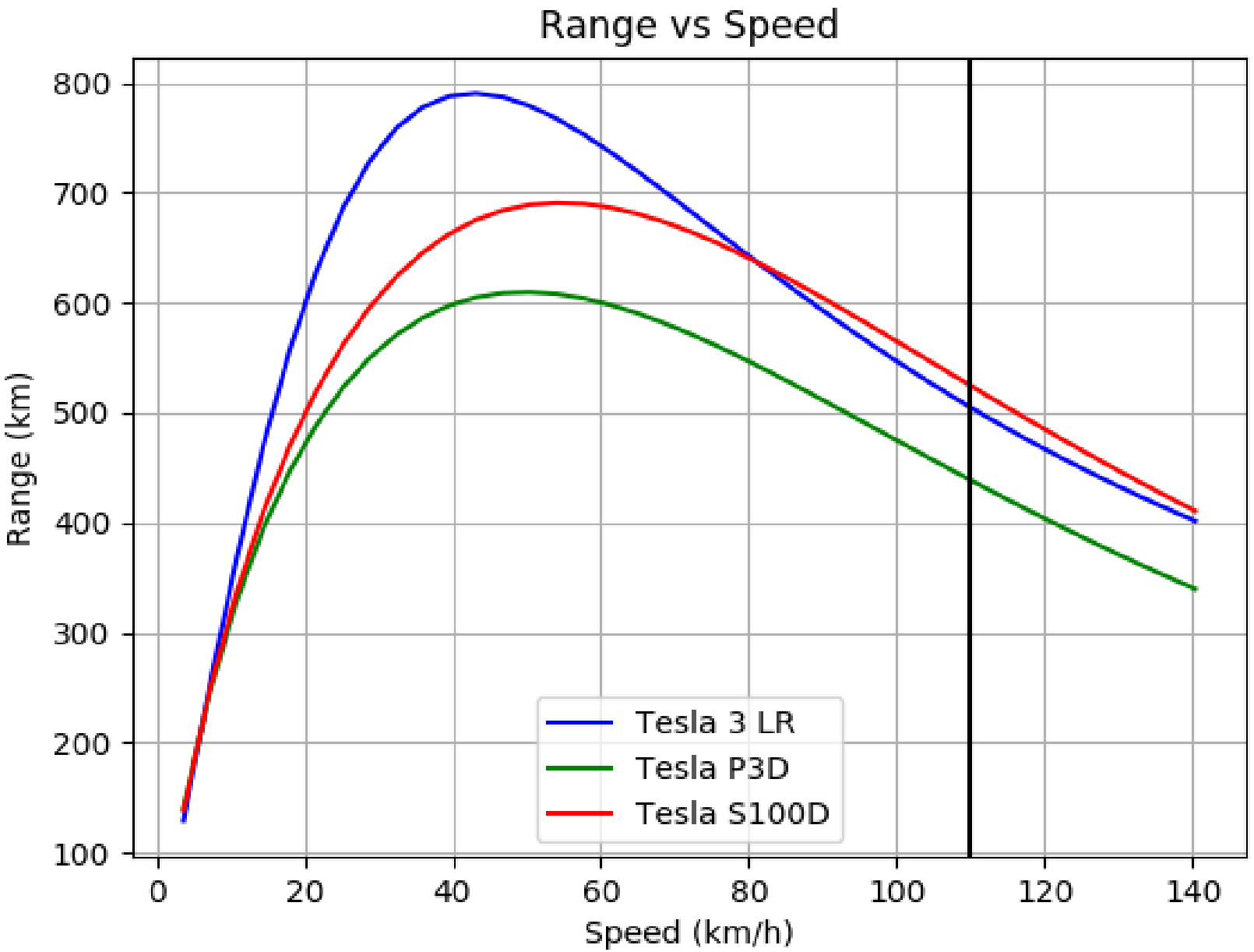


Energy Cost of 100km trip:

Tesla: combined 15.6kWh/100km at $0.14/kwh = **$2.18** ICE vehicle – say 8 ltr/100km →**$16.00** at $2.10/ltr
Using Tesla rating combined 1.8L_e/100km 1.8L_e x $2.10/ltr → **$3.78**

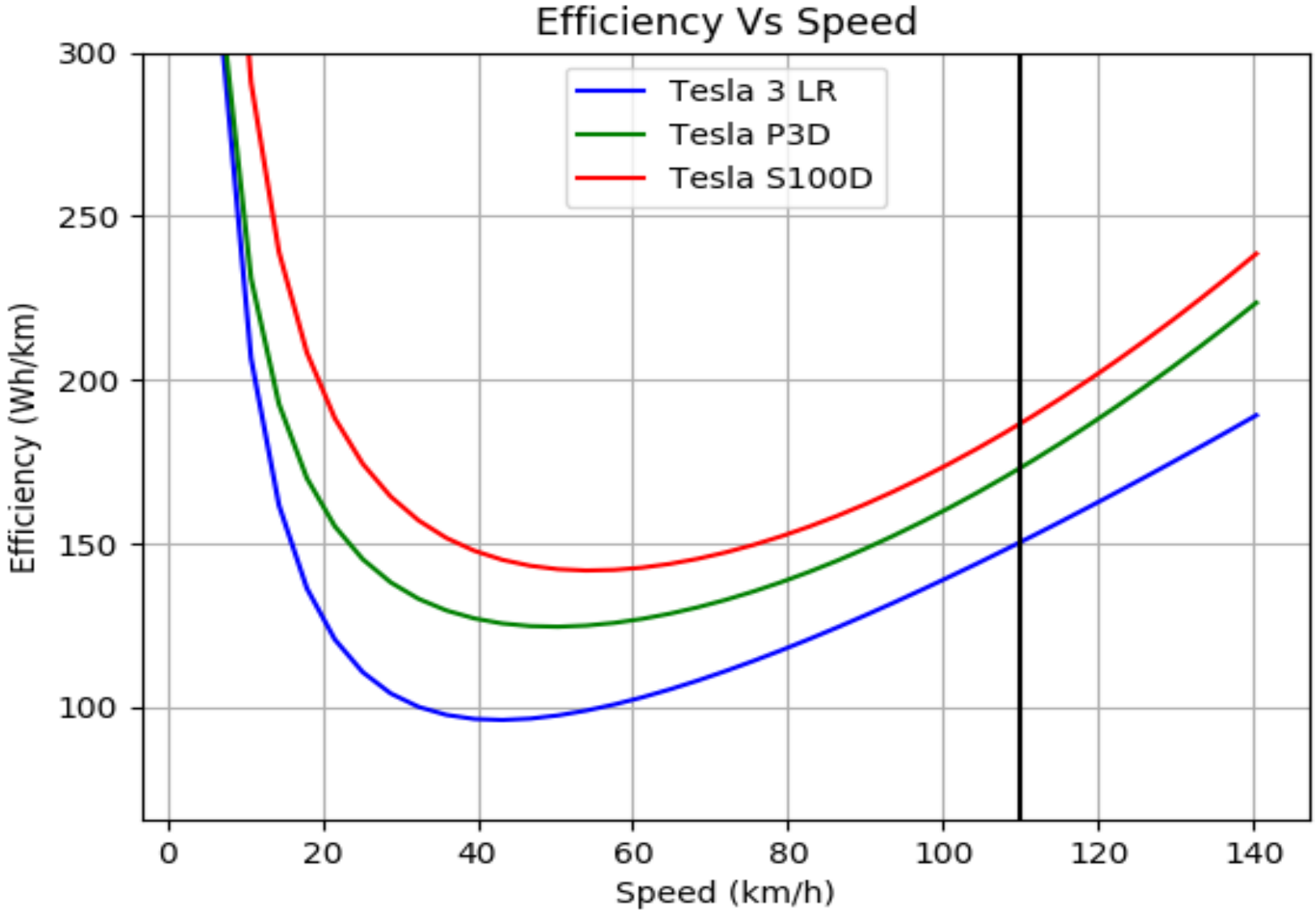
For annual 20,000km Tesla "fuel" costs **$406** For ICE at 8 ltr/100km and $2.10/ltr costs **$3,360.**
So for those who drive 20,000km/yr expect to save $2,954/yr **DATA AS OF Mar 6/2022**

C2) Range(km) vs Speed (km/h)



https://forum.abetterrouteplanner.com/blogs/entry/22-tesla-model-3-performance-vs-rwd-consumption-real-driving-data-from-233-cars/

C3) Efficiency[Energy Consumption] (Wh/km) vs Speed (km/h)



https://forum.abetterrouteplanner.com/blogs/entry/22-tesla-model-3-performance-vs-rwd-consumption-real-driving-data-from-233-cars/

C4) Real-life Range Experience in Winter

You may wish to view the ~ 14 min Youtube video which compares the Tesla's **Standard** range, **Long** range, and **Performance** models for a ~0°C simultaneous winter road trip in Britain. Lots of data, but in summary the 3 models gave about the same energy consumption, range, and charging rates. https://youtu.be/xEuLK9GrnyA

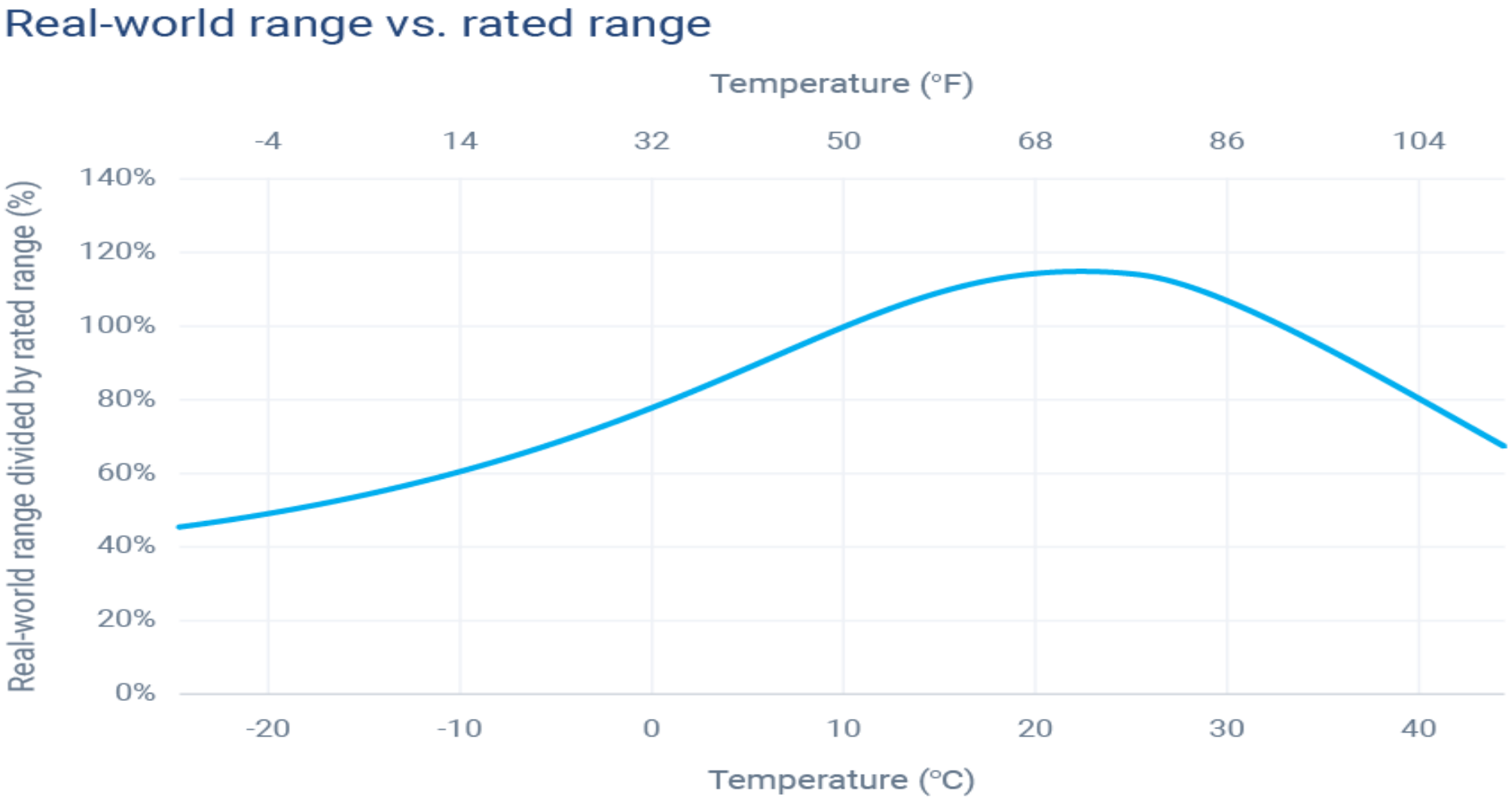
- Expect as little as 50% of published range when weather is ~ **-**20°C
- Use heated seats - since at low temperatures HVAC efficiency is low
- Dropping your speed will improve range (See C2) and C3) above).
  https://insideevs.com/news/490556/tesla-model-3-extreme-temperature-range-video/
  https://insideevs.com/features/464551/tesla-winter-cold-weather-driving-guide/

Winter & Cold Weather EV Range Loss in 7,000 Cars
https://www.recurrentauto.com/research/winter-ev-range-loss

Note that ICE vehicles also lose range in colder weather
https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/oee/pdf/transportation/fuel-efficient-technologies/autosmart_factsheet_3_e.pdf

C5) From https://www.geotab.com/blog/ev-range/

*"Most EVs follow the same **efficiency curve by temperature**, irrespective of their make, model or year... hot temperatures are worse for battery longevity than cold temperatures"*



D1) Driveability and Habit Adjustment

- After a couple of days you will find one-pedal driving very natural. Just don't forget that in an emergency you should use the BRAKE pedal!
- Using **Autopilot** (as distinguished from Full Self-Driving which I do not recommend you get at this time) enables you to set speed and keep in your lane and slow down and speed up automatically is useful when traffic is not congested. Oddly it **works well in stop-and-go traffic**. Must keep both hands on the steering wheel. Lane changes are done manually and require resetting Autopilot if desired.
- The cabin is quite and has a superb audio system. Car a joy to drive.

E1) Driving in the Snow & Regenerative Braking Issues

Associated with winter driving is the question of **"How Long Can an EV Keep the Cabin Warm When It's Cold Out?"** From https://www.caranddriver.com/news/a38807463/tesla-model-3-climate-control-cold-weather-test/ I noted the following:

A 2019 Tesla Model 3 can keep its interior at 18C for almost two days max, losing an average of 2.2 percent of its charge per hour. The ambient outdoor temperature averaged -9C.

From https://cleantechnica.com/2022/01/09/how-long-can-a-tesla-keep-you-warm-in-a-frozen-traffic-jam-dirty-tesla-finds-out/ I noted the following:

A 2021 Tesla Model Y (with the new heat pump) kept its interior at 21C for 12 hours, losing 26.5kWh (2.2kWh/hour). The ambient outdoor temperature averaged about -10C.

In both studies the Tesla was set in "camp" mode.

It is more costly to keep warm in ICE vehicles for which one needs to care about carbon-monoxide issues.

E2) Regenerative Braking (RB) Issues

This technology allows for one-pedal driving, improves vehicle range, and reduces wear on the brakes. In fact I rarely use the brake. So under those circumstances brakes may well last the life of the car. Note that when RB is triggered the stop lights go on to warn drivers behind you. There are circumstances where this technology can hamper safety. REMARKS...

See also section H2(2)

H1) Overall User Experience

- Everything is much simpler except the one-pedal driving which needs a warning – learn to make sure you always know to use the brake pedal in most emergencies. Confusion can result in an accident.
- Driver seat/steering-wheel/mirrors can be customized for multiple drivers.
- To power off the car simply park it and walk away with your paired phone. The car locks – windows go fully closed – screen goes dark. If on console one has set Controls>locks>lock confirmation sound>ON then a soft horn beep will sound in ~ 20sec after exit to confirm.
- Notification on phone allows for immediate software updates. New features keep the vehicle technology up-to-date and extend life of the vehicle.
- One can make good use of vehicle despite not knowing all its capabilities/features!

- Tailgate opens too high to reach the close button? Just pull it down to position you like & long push button. Now it will open to that height.
- For those who find the acceleration a bit too much I suggest using the “chill mode” setting on the console. It remembers this.
- Teslas can be opened with a key card, a phone's Bluetooth, a phone’s nfc chip, a phone's app, your partner’s app (if your phone is lost, broken or has a dead battery) and by calling Tesla and answering some questions. Tesla key cards cost C$35 for a set of two in a card holder.
- **Do you ever save money on “fuel”** since a 100kWh battery is comparable to about 40ltrs of gasoline for ICE vehicles. But remember that 100kwh costs (@14c/kWh) **$14.00** while 40ltrs of gasoline (@1.95/ltr) today costs **$78.00**

H2) My Two Trips from North Vancouver to Kelowna and back

1.September 24th 2021

Left N.VAN for Kelowna (**~400km**) at 6am. Arrived at Klassen Rd Hope ~ 7:30am. Charged for 40minutes at SuperCharger – where I was the sole user! Breakfast.

Next jump was to Kelowna via Coquihalla HWY-5. Note that to raise 2000kg by 1244m takes ~6.8kWh[(a)]. **Regeneration** should capture ~ 64% back[(c,d)]. Other sources put regeneration at only about 17-30%[(b)].

(a) https://www.omnicalculator.com/physics/potential-energy (b) http://bpba.ca/projects/climate-action/electric-vehicles

(c) https://www.tesla.com/en_CA/blog/magic-tesla-roadster-regenerative-braking (d) https://driven2drive.com/blog/the-ins-and-outs-of-tesla-regenerative-braking/#14-how-effective-is-regenerative-braking-on-tesla-

2. 2021 Christmas Holidays – Dec 21/2021 – First day HWY 3 open

Left N.VAN 6am for Kelowna. Distance **460km**. Arrived at Klassen Rd Hope ~ 7:30am. Charged for ~ 40minutes at Tesla SuperCharger – where I was the again the sole user! Had breakfast.

This time took **HWY #3 Hope-Princeton which had just opened to non-essential travel.** Traffic was light and road in good shape. In fact it was our best ever trip – better than summertime! No trucks! Recharged in Princeton and arrived in Kelowna with no delays via #3 to Keremeos and #3a and #97. Charged using 32A/240V outlet at a private home.

Return trip on December 28th was a different story!!!

Roads were icy and covered with snow. Traffic heavy. Hard to see lane lines and potholes. Picked up a valuable lesson about impact of **Regenerative Braking** (which can **no longer be disabled** since the October 2020 software update) so driving through icy corners, despite having high quality winter tires instead of the standard all season tires, **created uncertainty for the driver as to how much braking is going on**. Used SuperChargers in Princeton and then Hope. Consumed at least 40% more kWhs than normal. Lots of vehicles in ditches in section Hope to Vancouver. **Still, enjoyed driving Tesla!**

3. Tesla Phantom Braking Issue Key Points

- NHTSA initiated a new safety-defects investigation into Tesla after a barrage of drivers' complaints to the agency of phantom-braking incidents.
- **Phantom braking refers to instances when a driver's brakes activate unexpectedly, and cause rapid deceleration of a car even if traffic is flowing normally or there is no obstacle to avoid.**
- The investigation concerns braking-related systems that are part of an estimated 416,000 Tesla Model 3 and Model Y vehicles from the 2021 and 2022 model years in the U.S. https://www.cnbc.com/2022/02/17/tesla-phantom-braking-complaints-elicit-nhtsa-investigation.html
https://www.wardsauto.com/vehicles/countering-phantom-braking-phenomenon

Note that phantom braking (like automatic emergency braking – AEB) is happening on many EV and ICE vehicles. References on this and related issues are https://en.wikipedia.org/wiki/Tesla_Autopilot and https://www.automotive-fleet.com/10196711/safety-systems-may-cause-phantom-braking

Some personal experiences can be provided on this issue!

I) SOFTWARE UPDATES

THIS also is what separates TESLA from all the others!!

- Tesla is vertically integrated, meaning Tesla develops the software for everything in their cars
- Software over-the-air (SOTA) updates
- Firmware over-the-air (FOTA) updates (very few others have this ability)
  Cybersecurity, speedy connectivity, and massive computing power with a lot of memory, all must be present in an EV to receive FOTA updates.
  See https://electrek.co/2022/06/07/over-the-air-updates-how-does-each-ev-automaker-compare/
- Existing Tesla owners can benefit from free updates to features being regularly tested and improved at no extra cost.
-

K1) Environmental Issues

Study by Reuters (https://www.reuters.com/business/autos-transportation/lifetime-carbon-emissions-electric-vehicles-vs-gasoline-cars-2021-06-29/)

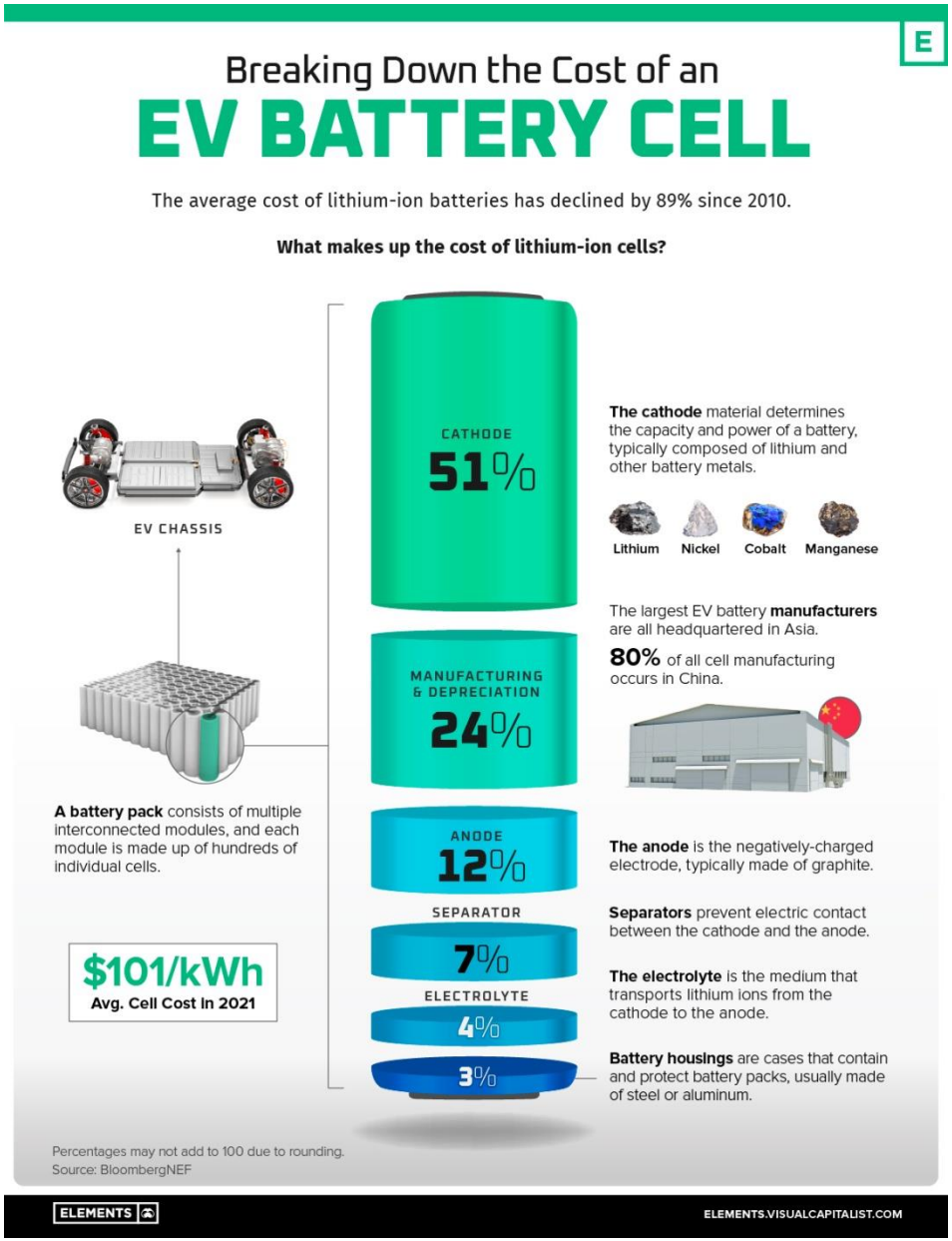
Tesla Model 3 (EV) vs Toyota Corolla (gasoline) the **"break-even" point** (where is does less harm to the environment), assuming Tesla 3 using electricity from BCHydro, **occurs at about 13,500 kilometres.**

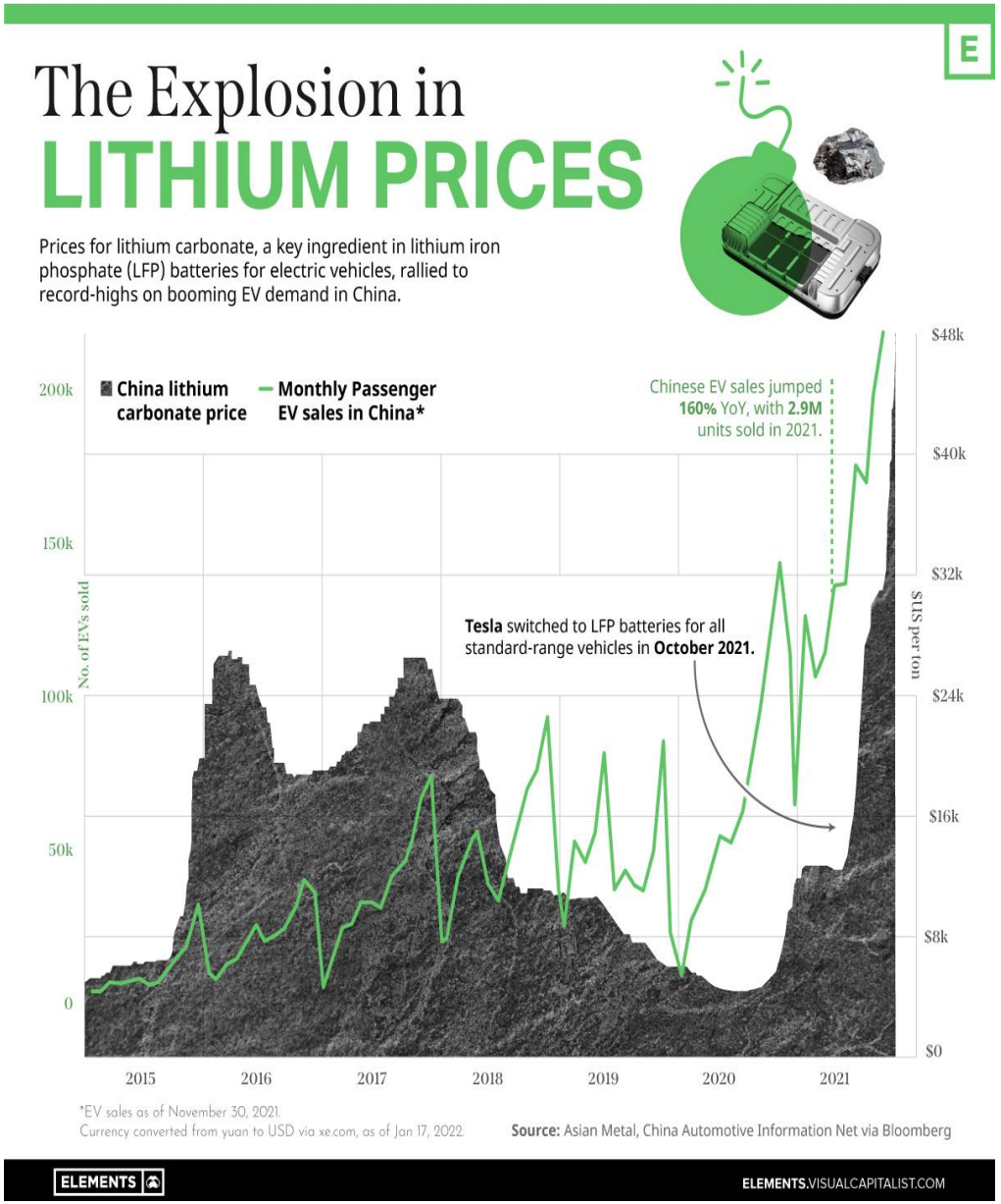
A somewhat dated (2017) report compared carbon emission of cyclists with EV's.

(https://www.greencarreports.com/news/1108357_electric-cars-vs-bicycles-which-has-a-higher-carbon-footprint)

"Exercise is good for virtually all humans for reasons that have nothing to do with lowering your personal carbon footprint. Ahem".

K2) Battery Component Costs and price of battery-grade lithium carbonate





This <u>may</u> explain the delay in EV deliveries!

K3) Battery Life

See also sections (A,J). After a lot of reading my conclusion – battery life is a non issue.

From https://www.findmyelectric.com/blog/how-long-does-a-tesla-battery-last/

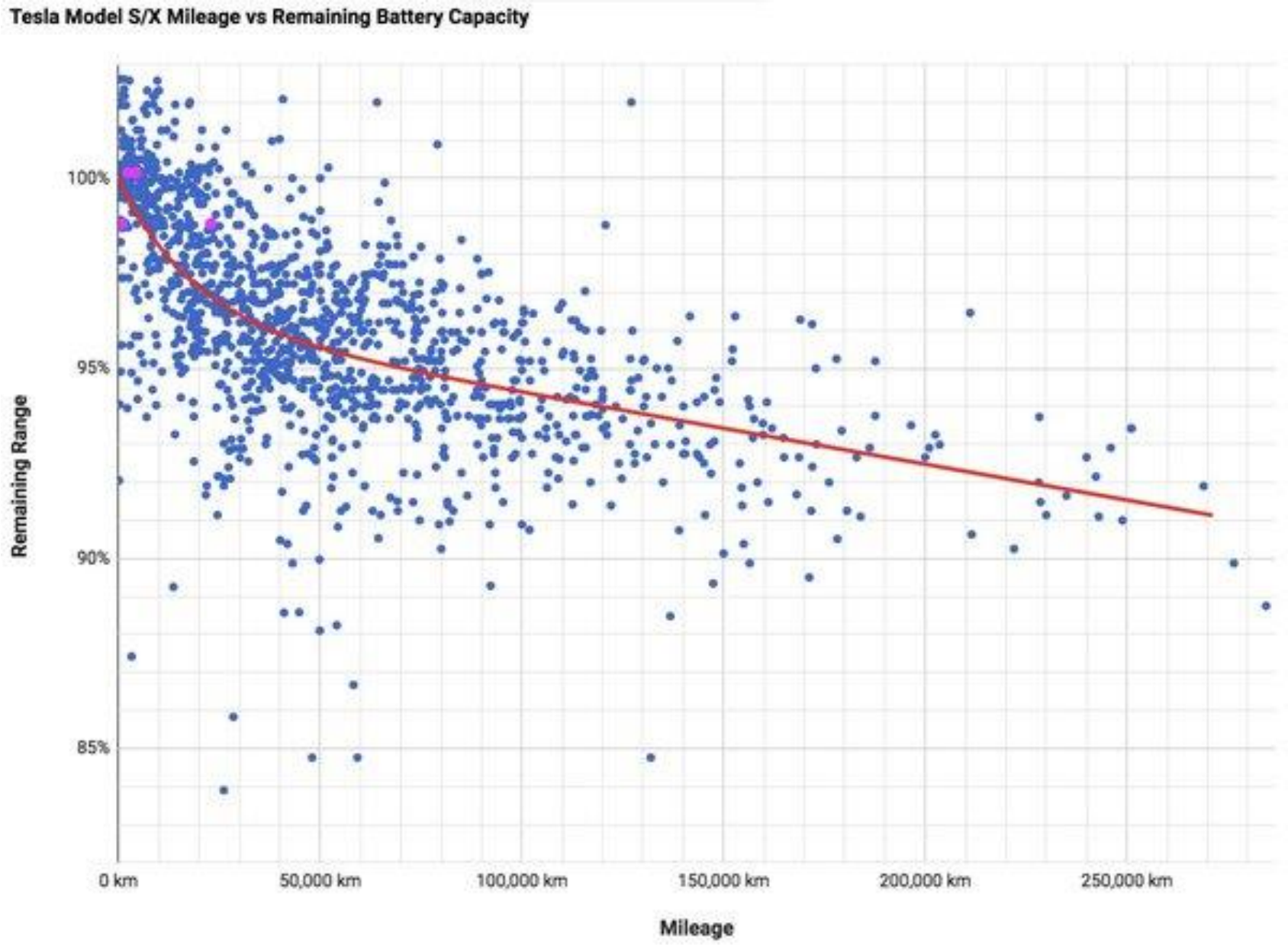
Tesla's warranty includes a clause for retaining 70% battery capacity over the 8yr warranty period (typically between 160,000-190,000 km)

However from collected data (from Tesla models that have existed for many more years) one concludes that the Tesla 3 batteries should last 500,000 to 800,000km.

Tips for extending battery life: Avoid hot climates; Don't regularly charge past 85%; For longest battery life it is suggested to keep the charge between 20-80% (60-80% even better). Whenever possible, don't let the battery go above 90% or below 20%. Charge mainly at home since Superchargers put much more stress on the battery. Newer Tesla models using LFP batteries: Always charge to 100%

https://www.autocraftbodywerks.com/blog/maintaining-your-teslas-battery.html

https://www.quora.com/Will-electric-cars-become-almost-impossible-to-sell-once-the-batteries-become-exhausted-and-the-cost-of-its-replacement-deeming-buying-used-uneconomical-I-just-dont-see-there-being-viable-aftermarket



K4) Maintenance Schedule

- Generally on an as-needed basis (wiper blades, tires)
- Schedule a service via “Schedule Service” on the mobile app
- Rotate tires every 10,000 km
- Change brake fluid every 2 years if needed.
- Change battery coolant every 4 years or 80,000 km.
- A/C desiccant bag replaced every 6 years
- Cabin air filter replaced every 2 years
- Perform daily and monthly checks according to manual.

K5) Near Future Battery Technology:

The video at https://www.youtube.com/watch?v=IIkA-mq5htw is worth a view. https://youtu.be/IIkA-mq5htw?t=727

Lithium Iron Phosphate (LFP) batteries.

Tesla has started shipping some models with LFP batteries in the 4680 format. The norm is to always charge these to 100%. LFP can readily be recharged ~ 1000 cycles with ~10% capacity loss. Note that driving range drops significantly below 10°C and would require thermal management. Note also that lower value of material makes recycling of LFP batteries less profitable (more of an environmental problem?).

https://www.greencarreports.com/news/1134547_2022-tesla-model-3-charging-to-100-can-be-the-norm-for-272-mile-lfp-version

BYD Blade Cells -with Lithium Iron Phosphate (LFP) cells -LiFePO4 **)**

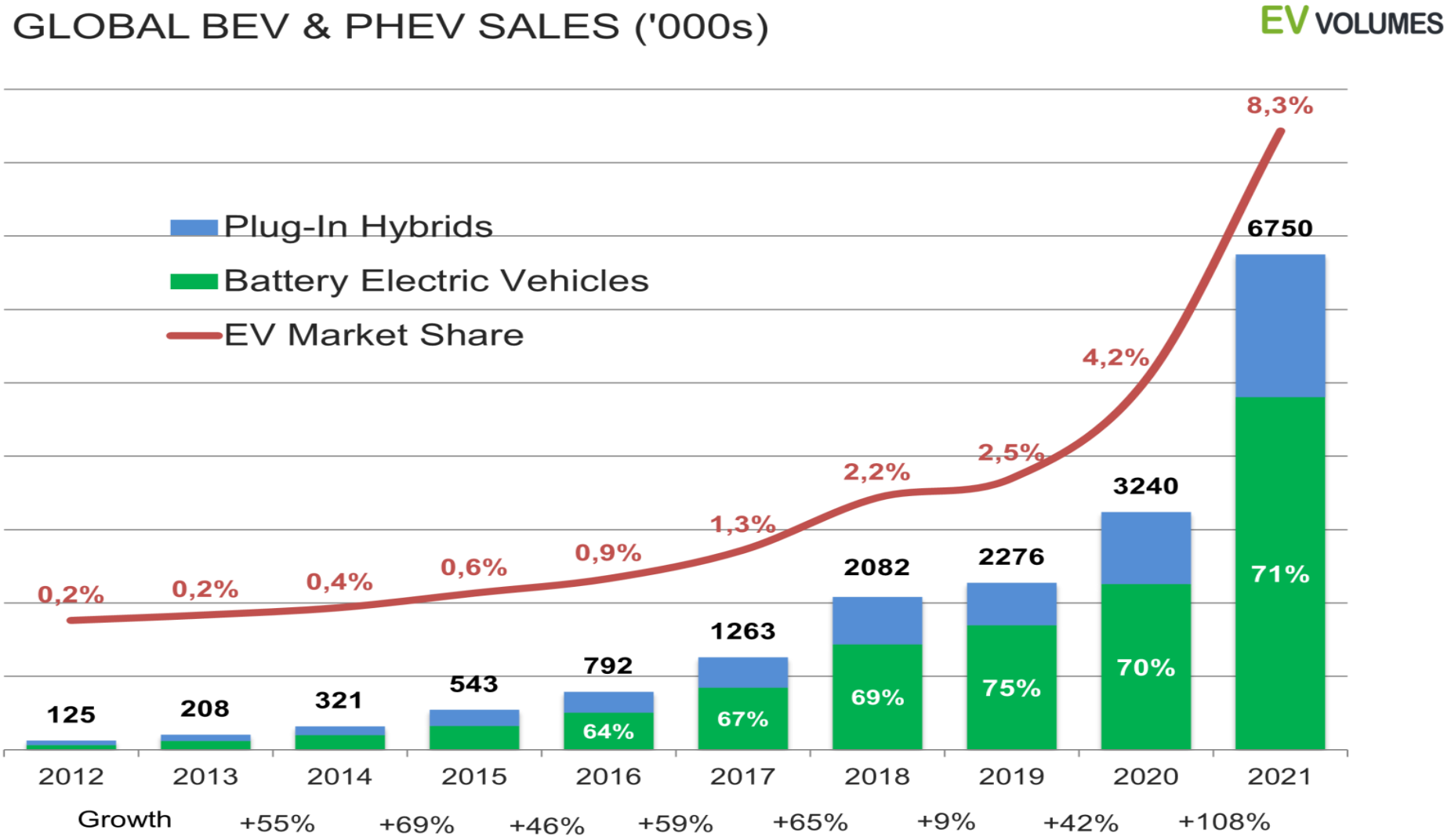
Due to their geometric configuration they are much safer. Energy densities of 176Wh/kg have been reported.

https://www.youtube.com/watch?v=uEvR3kyx_KM https://pushevs.com/2021/09/30/new-energy-density-record-for-a-lfp-battery/
https://www.allaboutcircuits.com/news/a-closer-look-at-lithium-iron-phosphate-batteries-teslas-new-choice-of-battery/
https://en.wikipedia.org/wiki/Lithium_iron_phosphate_battery

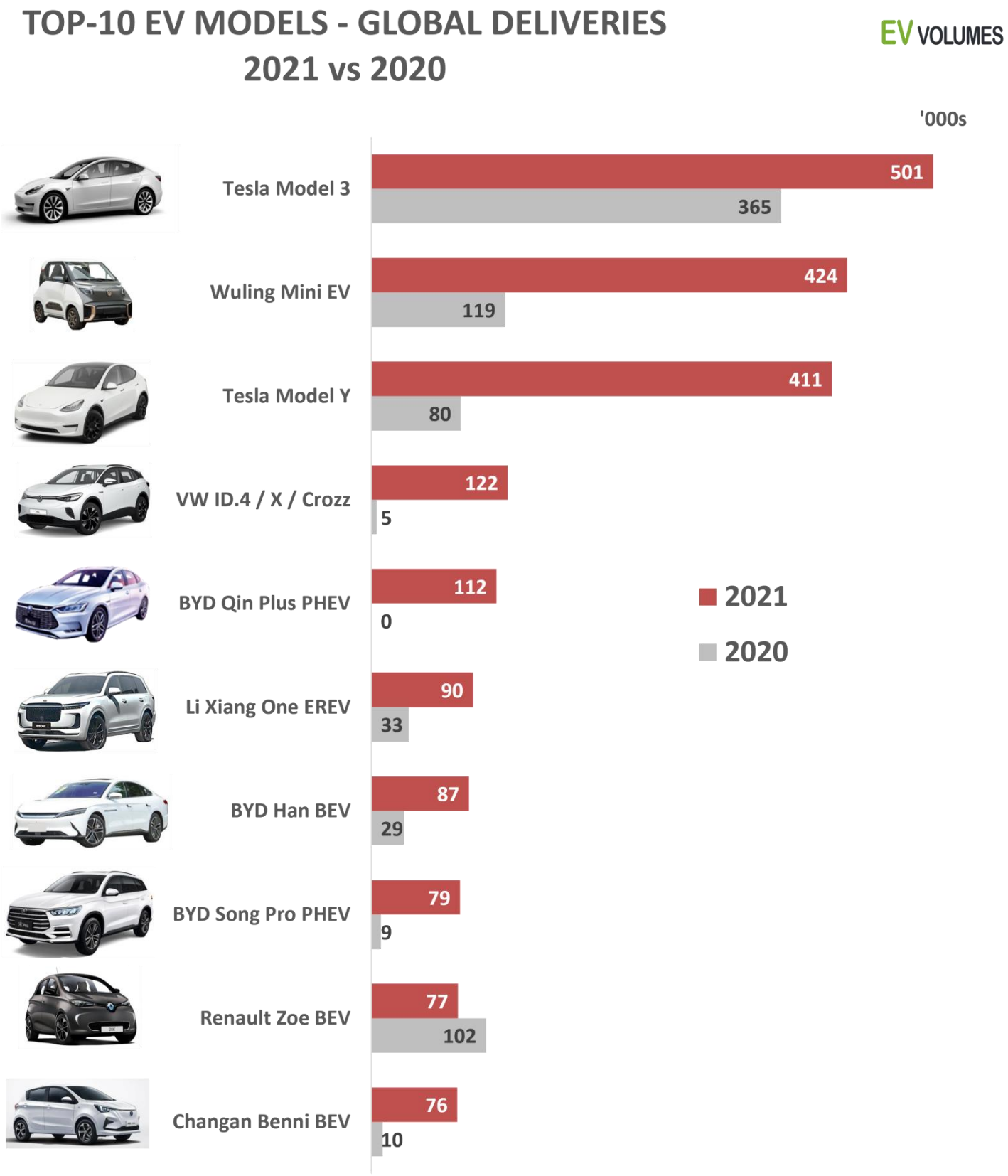
Global EV Volumes

https://www.ev-volumes.com/

For detailed definitions of various terms relating to electric vehicles, such as BEV, EREV, PHEV, HEV, FCEV, ZEV, ICE etc. see http://curenev.com



2021 and 2020 Sales of Top-10 EV models



FACTOIDS ABOUT EV's

- US has about 130,000 fuel STATIONS and about 110,000 electric chargers[(fs)]
- US has 2-million EV's on roads (16,000 10 years ago)[(fs)]
- Projecting 30-million EV's in US by 2030 with 500,000 chargers[(fs)]
- Currently - Globally EV's are only 1 in 250 and 1 in 50 market share of cars
- Ideal to have 40 Level 2 and 3.4 DC fast chargers (DCFC) per 1000 EV's[(fs)]
- Currently there are 41 Level 2 and 5.7 DCFC chargers per 1000 EV's[(fs)]
- Average range of EV-259 miles (416km) , for ICE-360 miles (579km)[(fs)]
- My 2021 Tesla 3 LR is rated for 568km & annual cost $406 (20,000km) [(fe)]
- **EV's transfer ~80% of energy to wheels, while ICE about 25%**
- Drag coefficient -resistance to the air of front surface of a Tesla Model 3 is 0.23
- Majority of car drivers travel less than 40km per day.
- By Aug 2021 there were 5.6 million EV's in the world
- Batteries now make up ~ 40% of the cost of an EV and ~ 20% by 2030[(fb)]
- EV sales make up 58% of new cars in Norway.[(fn)]
- Compound Annual Growth Rate (CAGR) for EV's is predicted as 38% by 2024[(fg)]

(fb) https://www.statista.com/statistics/797638/battery-share-of-large-electric-vehicle-cost/

(fe) http://vehicles.rncan.gc.ca

(fg) https://www.globenewswire.com/news-release/2020/11/11/2124610/0/en/The-global-electric-vehicle-market-is-expected-to-reach-an-estimated-335-3-billion-by-2023-with-a-CAGR-of-38-from-2018-to-2023.html

(fn) https://www.reuters.com/business/autos-transportation/electric-cars-take-two-thirds-norway-car-market-led-by-tesla-2022-01-03/

(fs) https://insideevs.com/news/567694/chargers-outnumber-gas-stations-soon/

Tips on Tesla Delivery Dates

1. Complete all steps in your Tesla account and order to move things along. If you have unfinished paperwork or incomplete steps in your order, then Tesla won't move forward to confirming a VIN and then a delivery date. So, make sure you check your account regularly and are sure you've completed all necessary paperwork and other steps when you need to.

2. Keep in regular contact with your customer service representative. It's the representative who will be contacting you to arrange a delivery date and time. It's imperative that you are always reachable by that person and that you remain in regular contact in order to keep things moving smoothly, and to ensure that your delivery date can be confirmed. If they can't reach you about a particular time or date, they might postpone your delivery further.

3. Don't get frustrated when deadlines come and go. Any dates that you get from Tesla are invariably just estimates and should always be taken with a pinch of salt. The waiting game requires patience and a level head. Just know that it's not just you, and never feel like everyone is getting their Tesla but you. Numerous factors go into the precise delivery time and everyone just has to play the waiting game.

M) Autopilot vs Full Self-Driving Capability

Autopilot includes the following functionality and features:

- **Traffic-Aware Cruise Control:** Matches the speed of your car to that of the surrounding traffic
- **Autosteer:** Assists in steering within a clearly marked lane, and uses traffic-aware cruise control

Enhanced Autopilot – adds the following

- **Navigate on Autopilot:** Actively guides your car from a highway's on-ramp to off-ramp, including suggesting lane changes, navigating interchanges, automatically engaging the turn signal and taking the correct exit.
- **Auto Lane Change:** Assists in moving to an adjacent lane on the highway when Autosteer is engaged.
- **Autopark:** Helps automatically parallel or perpendicular park your car, with a single touch.
- **Summon:** Moves your car in and out of a tight space using the mobile app or key.
- **Smart Summon:** Your car will navigate more complex environments and parking spaces, maneuvering around objects as necessary to come find you in a parking lot.

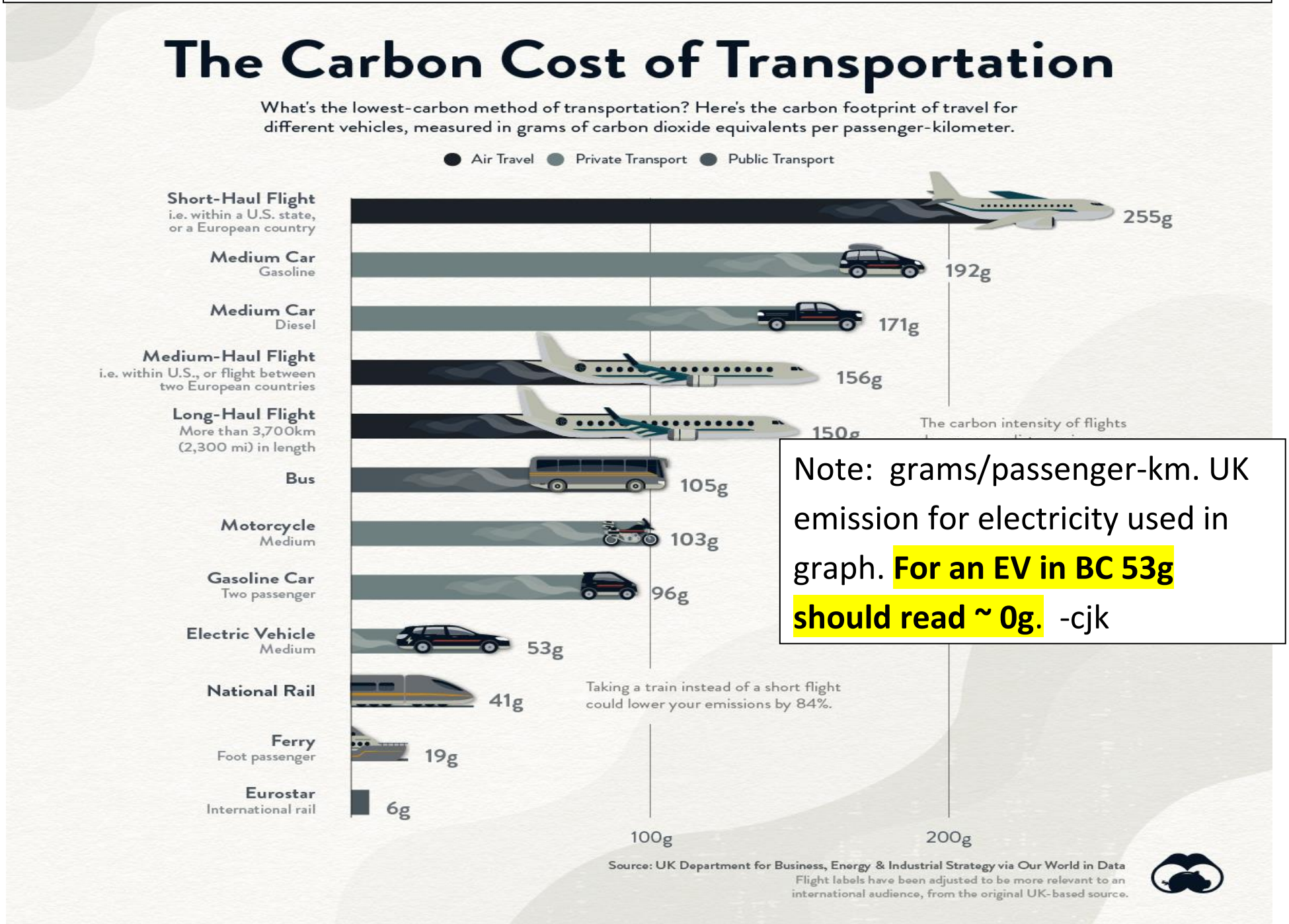
Full Self-Driving Capability

Your vehicle will be able to drive itself almost anywhere with minimal driver intervention and will continuously improve. In addition to the functionality and features of Autopilot and Enhanced Autopilot, Full Self-Driving Capability also includes:

- **Autosteer on City Streets**
- **Traffic and Stop Sign Control:** Identifies stop signs and traffic lights and automatically slows your car to a stop on approach, with your active supervision

The currently enabled Autopilot, Enhanced Autopilot and Full Self-Driving features require active driver supervision and do not make the vehicle autonomous. Full autonomy will be dependent on achieving reliability far in excess of human drivers as demonstrated by billions of miles of experience, as well as regulatory approval, which may take longer in some jurisdictions. As Tesla's Autopilot, Enhanced Autopilot and Full Self-Driving capabilities evolve, your car will be continuously upgraded through over-the-air software updates.

N1)https://www.visualcapitalist.com/comparing-the-carbon-footprint-of-transportation-options/



Note: grams/passenger-km. UK emission for electricity used in graph. **For an EV in BC 53g should read ~ 0g**. -cjk

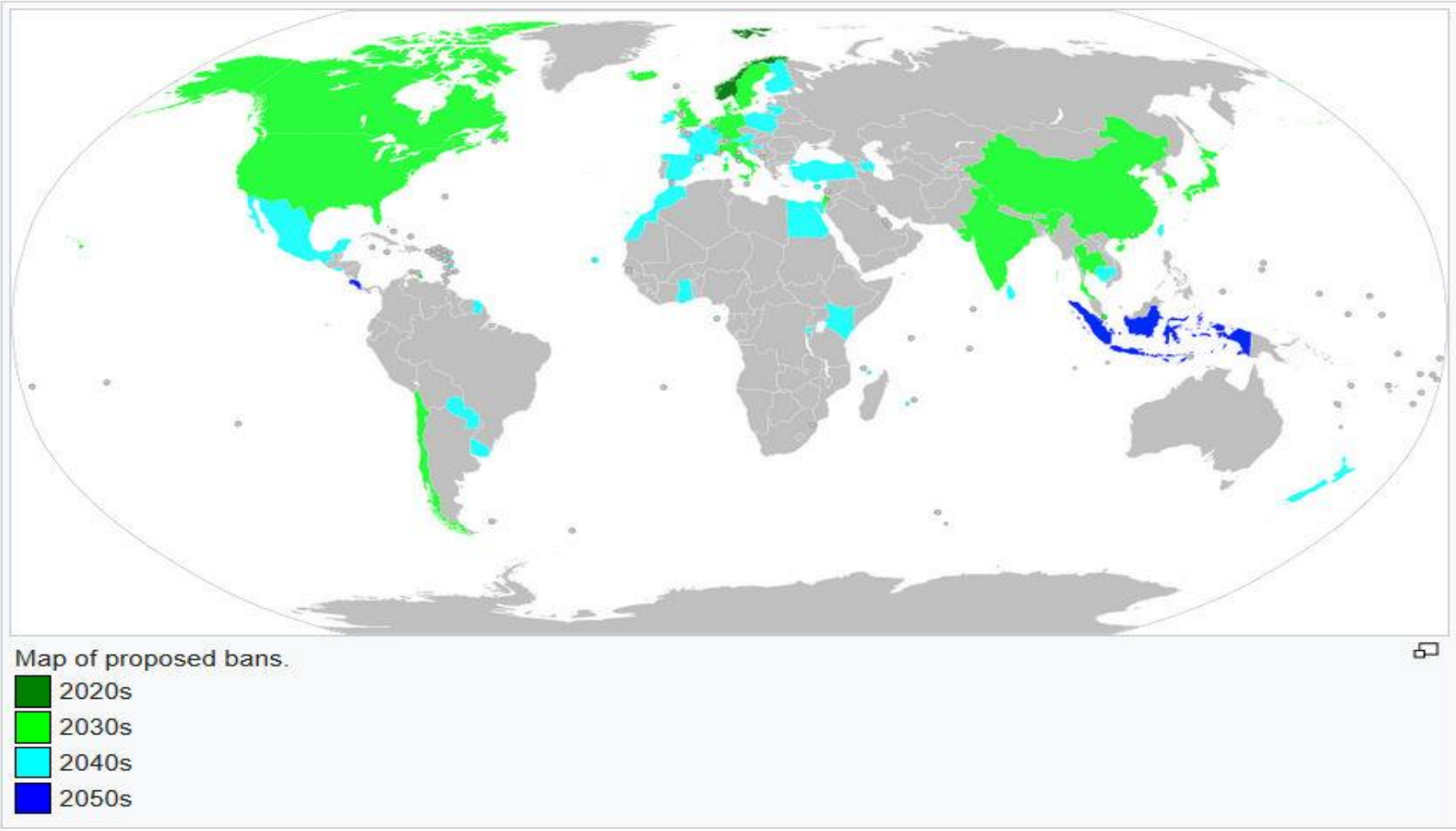
N2) Global Legislation to Phase out ICE vehicles

New phase-out dates for ICE passenger cars and vans, moving from the initial 2040 target to specified goals for 2035 and 2030[(a)].

Countries with proposed bans or implementing 100% sales of zero-emissions vehicles include China (including Hong Kong and Macau), Japan, Singapore, the UK, South Korea, Iceland, Denmark, Sweden, Norway, Slovenia, Germany, Italy, France, Belgium, the Netherlands, Portugal, Canada, the 12 U.S. states that adhered to California's Zero-Emission Vehicle (ZEV) Program, Sri Lanka, Cabo Verde, and Costa Rica[(b)]

EVs to Surpass ⅔ of Global Car Sales by 2030, Putting at Risk Nearly Half of Oil Demand
https://cleantechnica.com/2023/09/16/evs-to-surpass-%E2%85%94-of-global-car-sales-by-2030-putting-at-risk-nearly-half-of-oil-demand/

N3) Map of ICE phaseout program



(a)https://theicct.org/sites/default/files/publications/update-govt-targets-ice-phaseouts-jun2021_0.pdf

(b) https://en.wikipedia.org/wiki/Phase-out_of_fossil_fuel_vehicles

O) OTHER

https://cdn.motor1.com/images/custom/bev-car-comparisons-us-2022-02-07-img.png

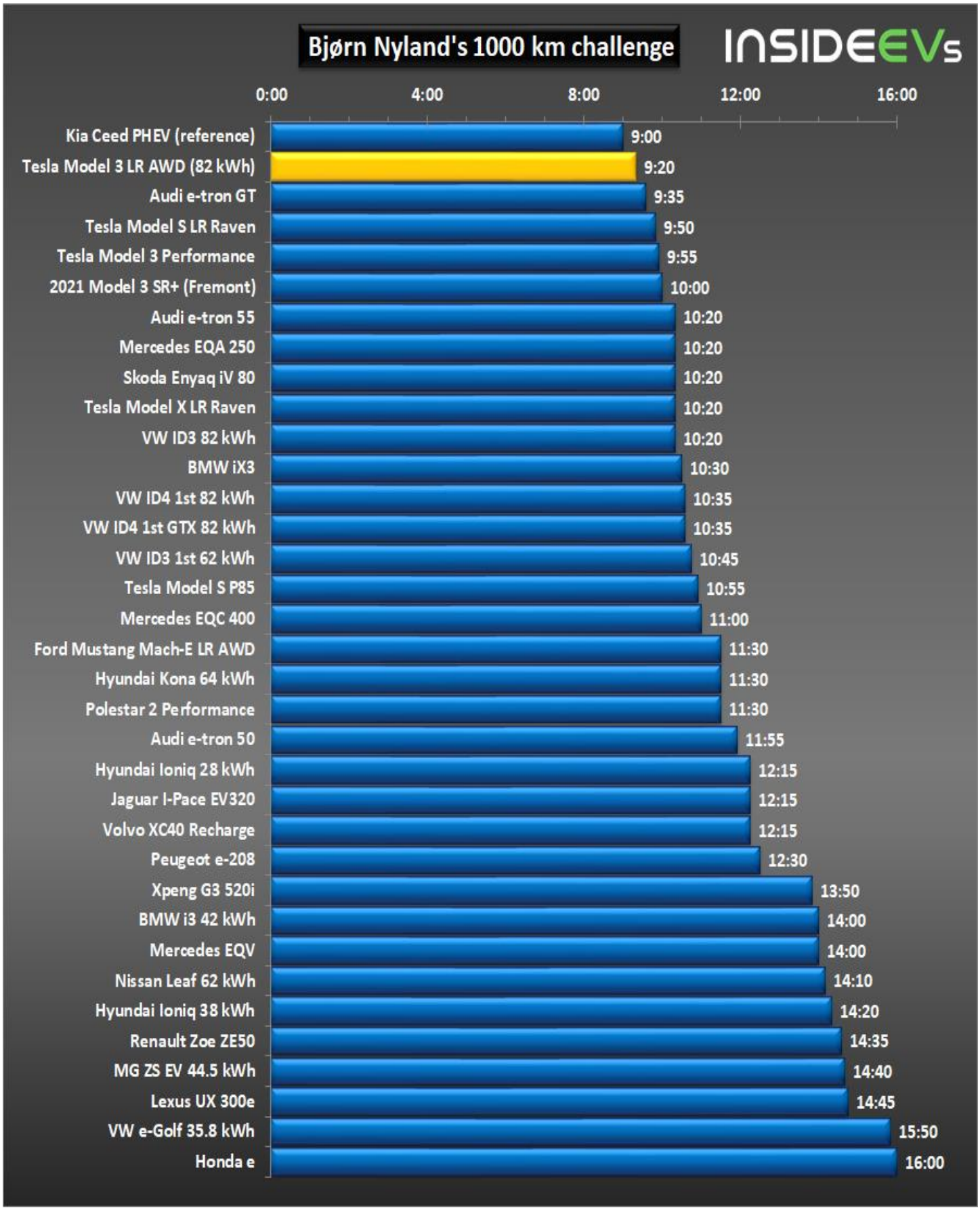
INSIDEEVs

All-Electric Car Comparisons - US

Updated 2022-02-07

Estimated/Unofficial

Brand	Model		Base Price (MSRP)	Dest. Charge	Tax Credit	Price After Tax Credit	Battery Size (kWh)	EPA Range (mi)	0-60 mph (sec)	Top Speed (mph)	Peak Power (kW)	EPA Energy Consumption combined / city / highway (Wh/mi)		
Audi	e-tron GT quattro 20" (2022)	AWD	$102 400	$1 045	$7 500	$ 95 945	93.4	238	3.9	152	390	411	416	406
Audi	RS e-tron GT quattro 20" (2022)	AWD	$142 400	$1 045	$7 500	$ 135 945	93.4	232	3.1	155	475	416	427	411
Audi	e-tron quattro 20" (2022)	AWD	$ 65 900	$1 095	$7 500	$ 59 495	95	222	5.5	124	300	432	432	438
Audi	e-tron Sportback quattro 20" (2022)	AWD	$ 69 100	$1 095	$7 500	$ 62 695	95	218	5.5	124	300	438	443	432
Audi	e-tron S 20" (2022)	AWD	$ 84 800	$1 095	$7 500	$ 78 395	95	208	4.3	130	370	462	468	449
Audi	e-tron S 21" (2022)	AWD	$ 87 450	$1 095	$7 500	$ 81 045	95	181	4.3	130	370	535	544	527
Audi	e-tron S Sportback 20" (2022)	AWD	$ 87 400	$1 095	$7 500	$ 80 995	95	212	4.3	130	370	449	462	432
Audi	e-tron S Sportback 21" (2022)	AWD	$ 90 050	$1 095	$7 500	$ 83 645	95	185	4.3	130	370	518	527	511
Audi	Q4 40 e-tron 19" (2022)	RWD	$ 43 900	$1 095	$7 500	$ 37 495	82	250	7.9	99	150			
Audi	Q4 50 e-tron quattro 19" (2022)	AWD	$ 49 900	$1 095	$7 500	$ 43 495	82	241	5.8	112	220	355	337	379
Audi	Q4 Sportback 50 e-tron quattro 20" (2022)	AWD	$ 52 700	$1 095	$7 500	$ 46 295	82	241	5.8	112	220	355	337	379
BMW	i4 eDrive40 18" (2022)	RWD	$ 55 400	$ 995	$7 500	$ 48 895	83.9	301	5.5	118	250			
BMW	i4 M50 19" (2022)	AWD	$ 65 900	$ 995	$7 500	$ 59 395	83.9	270	3.7	130	400			
BMW	iX xDrive50 20" (2022)	AWD	$ 83 200	$ 995	$7 500	$ 76 695	111.5	324	4.4	124	385			
Cadillac	Lyriq Debut Edition (2023)	RWD	$ 58 795	$1 195	N/A	$ 59 990	100.4	300			255			
Chevrolet	Bolt EV (2022)	FWD	$ 31 000	$ 995	N/A	$ 31 995	65	259	6.5		150	281	257	309
Chevrolet	Bolt EUV (2022)	FWD	$ 33 000	$ 995	N/A	$ 33 995	65	247	7.0		150	293	270	324
Ford	F-150 Pro SR 18" (2022)	AWD	$ 39 974	$1 695	$7 500	$ 34 169	110	230			318			
Ford	F-150 Pro ER (fleets) 18" (2022)	AWD	$ 49 974	$1 695	$7 500	$ 44 169	145	300			420			
Ford	F-150 Lightning XLT SR 18" (2022)	AWD	$ 52 974	$1 695	$7 500	$ 47 169	110	230			318			
Ford	F-150 Lightning XLT ER 20" (2022)	AWD	$ 72 474	$1 695	$7 500	$ 66 669	145	300			420			
Ford	F-150 Lightning Lariat SR 20" (2022)	AWD	$ 67 474	$1 695	$7 500	$ 61 669	110	230			318			
Ford	F-150 Lightning Lariat ER 20" (2022)	AWD	$ 77 474	$1 695	$7 500	$ 71 669	145	300			420			
Ford	F-150 Lightning Platinum ER 22" (2022)	AWD	$ 90 874	$1 695	$7 500	$ 85 069	145	280			420			
Ford	Mustang Mach-E Select SR RWD 18" (2022)	RWD	$ 43 895	$1 100	$7 500	$ 37 495	75.7	247	5.8		198			
Ford	Mustang Mach-E Select SR AWD 18" (2022)	AWD	$ 46 595	$1 100	$7 500	$ 40 195	75.7	224	5.2		198			
Ford	Mustang Mach-E Premium SR RWD 19" (2022)	RWD	$ 49 100	$1 100	$7 500	$ 42 700	75.7	247	5.8		198			
Ford	Mustang Mach-E Premium SR AWD 19" (2022)	AWD	$ 51 800	$1 100	$7 500	$ 45 400	75.7	224	5.2		198			
Ford	Mustang Mach-E Premium ER RWD 19" (2022)	RWD	$ 55 100	$1 100	$7 500	$ 48 700	98.8	303	6.1		216			
Ford	Mustang Mach-E Premium ER AWD 19" (2022)	AWD	$ 57 800	$1 100	$7 500	$ 51 400	98.8	277	4.8		258			
Ford	Mustang Mach-E Route 1 ER RWD 18" (2022)	RWD	$ 52 775	$1 100	$7 500	$ 46 375	98.8	314	6.1		216			
Ford	Mustang Mach-E Route 1 ER AWD 18" (2022)	AWD	$ 55 475	$1 100	$7 500	$ 49 075	98.8	312	4.8		258			
Ford	Mustang Mach-E GT ER AWD 20" (2022)	AWD	$ 61 995	$1 100	$7 500	$ 55 595	98.8	270	3.8		358	401	374	438
Ford	Mustang Mach-E GT Perf. ER AWD 20" (2022)	AWD	$ 67 995	$1 100	$7 500	$ 61 595	98.8	260	3.5		358	411	383	449
GMC	Hummer EV Pickup (Edition 1) (2022)	AWD	$110 295		N/A	$ 110 295	200	329	3.0		745			
Hyundai	Ioniq 5 SE SR RWD 19" (2022)	RWD	$ 39 700	$1 225	$7 500	$ 33 425	58.2	220			125	306	265	359
Hyundai	Ioniq 5 SE RWD 19" (2022)	RWD	$ 43 650	$1 225	$7 500	$ 37 375	77.4	303		115	168	296	255	344
Hyundai	Ioniq 5 SE AWD 19" (2022)	AWD	$ 47 150	$1 225	$7 500	$ 40 875	77.4	256	5.0	115	239	344	306	387
Hyundai	Ioniq 5 SEL RWD 19" (2022)	RWD	$ 45 900	$1 225	$7 500	$ 39 625	77.4	303		115	168	296	255	344
Hyundai	Ioniq 5 SEL AWD 19" (2022)	AWD	$ 49 400	$1 225	$7 500	$ 43 125	77.4	256	5.0	115	239	344	306	387
Hyundai	Ioniq 5 Limited RWD 19" (2022)	RWD	$ 50 600	$1 225	$7 500	$ 44 325	77.4	303		115	168	296	255	344
Hyundai	Ioniq 5 Limited AWD 20" (2022)	AWD	$ 54 500	$1 225	$7 500	$ 48 225	77.4	256	5.0	115	239	344	306	387
Hyundai	IONIQ Electric (2021)	FWD	$ 33 245	$1 005	$7 500	$ 26 750	38.3	170	10.0	102	100	253	232	279
Hyundai	Kona Electric (2022)	FWD	$ 34 000	$1 185	$7 500	$ 27 685	64	258	7.9	104	150	281	255	312
Jaguar	I-PACE EV400 (2022)	AWD	$ 69 900	$1 150	$7 500	$ 63 550	90	234	4.5	124	294	443	421	468
Kia	EV6 Light RWD SR 19" (2022)	RWD	$ 40 900	$1 215	$7 500	$ 34 615	58	232	8.0	115	125	288	248	337
Kia	EV6 Wind RWD LR 19" (2022)	RWD	$ 47 000	$1 215	$7 500	$ 40 715	77.4	310	7.2	115	168	288	251	334
Kia	EV6 Wind AWD LR 19" (2022)	AWD	$ 50 900	$1 215	$7 500	$ 44 615	77.4	274	5.1	117	239	321	291	359
Kia	EV6 GT-Line RWD LR 19" (2022)	RWD	$ 51 200	$1 215	$7 500	$ 44 915	77.4	310	7.2	115	168	288	251	334
Kia	EV6 GT-Line AWD LR 19" (2022)	AWD	$ 55 900	$1 215	$7 500	$ 49 615	77.4	274	5.1	117	239	321	291	359
Kia	EV6 First Edition AWD LR 20" (2022)	AWD	$ 58 500	$1 215	$7 500	$ 52 215	77.4	265	5.1	117	239			
Kia	Niro EV (2022)	FWD	$ 39 990	$1 175	$7 500	$ 33 665	64	239	7.5	104	150	301	274	330
Lucid	Air Dream Edition Performance 19" (2022)	AWD	$169 000	$1 500	$7 500	$ 163 000	118	471	2.5	168	828	291	288	296
Lucid	Air Dream Edition Performance 21" (2022)	AWD	$169 000	$1 500	$7 500	$ 163 000	118	451	2.4	168	828	304	306	304
Lucid	Air Dream Edition Range 19" (2022)	AWD	$169 000	$1 500	$7 500	$ 163 000	118	520	2.7	168	695	270	267	270
Lucid	Air Dream Edition Range 21" (2022)	AWD	$169 000	$1 500	$7 500	$ 163 000	118	481	2.7	168	695	291	293	288
Lucid	Air Grand Touring 19" (2022)	AWD	$139 000	$1 500	$7 500	$ 133 000	112	516	3.0	168	596	257	259	255
Lucid	Air Grand Touring 21" (2022)	AWD	$139 000	$1 500	$7 500	$ 133 000	112	469	3.0	168	596	279	279	276
Mazda	MX-30 (2022)	FWD	$ 33 470	$1 175	$7 500	$ 27 145	35.5	100		87	107	366	344	396
Mercedes	EQS 450+ (RWD; 20") (2022)	RWD	$102 310	$1 050	$7 500	$ 95 860	115	350	5.9	130	245	347	347	347
Mercedes	EQS 580 4MATIC (AWD; 21") (2022)	AWD	$119 110	$1 050	$7 500	$ 112 660	115	340	4.1	130	385	355	366	340
MINI	Cooper SE (2022)	FWD	$ 29 900	$ 850	$7 500	$ 23 250	32.6	114	6.9	93	135	306	283	337
Nissan	Ariya Venture+ FWD 19" (2023)	FWD	$ 45 950	$1 175	$7 500	$ 39 625	91	300	7.2		178			
Nissan	Ariya Evolve+ FWD 19" (2023)	FWD	$ 48 950	$1 175	$7 500	$ 42 625	91	285	7.2		178			
Nissan	Ariya Premiere FWD 19" (limited) (2023)	FWD	$ 53 450	$1 175	$7 500	$ 47 125	91	285	7.2		178			
Nissan	Ariya Platinum+ e-4ORCE AWD 19" (2023)	AWD	$ 58 950	$1 175	$7 500	$ 52 625	91	265	4.8		290			
Nissan	LEAF S (40 kWh) (2022)	FWD	$ 27 400	$ 975	$7 500	$ 20 875	40	149	7.4	90	110	304	274	340
Nissan	LEAF e+ S (62 kWh) (2022)	FWD	$ 32 400	$ 975	$7 500	$ 25 875	62	226	6.5		160	312	286	347
Nissan	LEAF e+ SV (62 kWh) (2022)	FWD	$ 37 400	$ 975	$7 500	$ 30 875	62	215	6.5		160	324	296	359
Polestar	2 Single Motor 19" (2022)	FWD	$ 45 900	$1 300	$7 500	$ 39 700	78	270	7.0	100	170	315	298	337
Polestar	2 Dual Motor 19" (2022)	AWD	$ 49 900	$1 300	$7 500	$ 43 700	78	249	4.5	127	300	379	359	401
Porsche	Taycan (79 kWh) 19" (2022)	RWD	$ 82 700	$1 350	$7 500	$ 76 550	79.2	200	5.1	143	300	427	443	401
Porsche	Taycan (93 kWh) 19" (2022)	RWD	$ 88 480	$1 350	$7 500	$ 82 330	93.4	225	5.1	143	350	449	475	421
Porsche	Taycan 4S (79 kWh) 19" (2022)	AWD	$103 800	$1 350	$7 500	$ 97 650	79.2	199	3.8	155	390	427	427	421
Porsche	Taycan 4S (93 kWh) 19" (2022)	AWD	$109 370	$1 350	$7 500	$ 103 220	93.4	227	3.8	155	420	438	449	416
Porsche	Taycan GTS (93 kWh) 20" (2022)	AWD	$131 400	$1 350	$7 500	$ 125 250	93.4		3.5	155	440			
Porsche	Taycan Turbo (93 kWh) 20" (2022)	AWD	$150 900	$1 350	$7 500	$ 144 750	93.4	212	3.0	161	500	462	475	449
Porsche	Taycan Turbo S (93 kWh) 21" (2022)	AWD	$185 000	$1 350	$7 500	$ 178 850	93.4	201	2.6	161	560	481	488	475
Porsche	Taycan 4 Cross Turismo 19" (2022)	AWD	$ 93 700	$1 350	$7 500	$ 87 550	93.4	215	4.8	137	350	443	443	438
Porsche	Taycan 4S Cross Turismo 19" (2022)	AWD	$110 300	$1 350	$7 500	$ 104 150	93.4	215	3.9	149	420	449	449	449
Porsche	Taycan GTS Sport Turismo 20" (2022)	AWD	$133 300	$1 350	$7 500	$ 127 150	93.4		3.5	155	440			
Porsche	Taycan Turbo Cross Turismo 20" (2022)	AWD	$153 500	$1 350	$7 500	$ 147 350	93.4	204	3.1	155	500	468	468	468
Porsche	Taycan Turbo S Cross Turismo 20" (2022)	AWD	$187 600	$1 350	$7 500	$ 181 450	93.4	202	2.7	155	560	462	455	462
Rivian	R1S (Large pack, 21") (2022)	AWD	$ 70 000	$1 075	$7 500	$ 63 575	135	316	3.0	125	562	488	462	518
Rivian	R1T (Large pack, 21") (2022)	AWD	$ 67 500	$1 075	$7 500	$ 61 075	135	314	3.0	125	562	481	455	511
Tesla	Model 3 RWD 18" (2022)	RWD	$ 44 990	$1 200	N/A	$ 46 190	60	272	5.8	140		255	244	267
Tesla	Model 3 RWD 19" (2022)	RWD	$ 46 490	$1 200	N/A	$ 47 690	60	267	5.8	140				
Tesla	Model 3 Long Range AWD 18" (2022)	AWD	$ 50 990	$1 200	N/A	$ 52 190	80	358	4.2	145		257	251	267
Tesla	Model 3 Long Range AWD 19" (2022)	AWD	$ 52 490	$1 200	N/A	$ 53 690	80	334	4.2	145				
Tesla	Model 3 Perf. LR AWD 20" (2022)	AWD	$ 58 990	$1 200	N/A	$ 60 190	80	315	3.1	162		298	286	315
Tesla	Model S LR AWD 19" (2022)	AWD	$ 94 990	$1 200	N/A	$ 96 190	100	405	3.1	155	499	281	272	293
Tesla	Model S LR AWD 21" (2022)	AWD	$ 99 490	$1 200	N/A	$ 100 690	100	375	3.1	155	499			
Tesla	Model S Plaid 19" (2022)	AWD	$129 990	$1 200	N/A	$ 131 190	100	396	2.0	200	760	291	283	301
Tesla	Model S Plaid 21" (2022)	AWD	$134 490	$1 200	N/A	$ 135 690	100	348	2.0	200	760	334	330	340
Tesla	Model X LR AWD 20" (2022)	AWD	$104 990	$1 200	N/A	$ 106 190	100	348	3.8	155	499	330	315	347
Tesla	Model X LR AWD 22" (2022)	AWD	$110 490	$1 200	N/A	$ 111 690	100	332	3.8	155	499			
Tesla	Model X Plaid 20" (2022)	AWD	$126 490	$1 200	N/A	$ 127 690	100	333	2.5	163	760	344	327	362
Tesla	Model X Plaid 22" (2022)	AWD	$131 990	$1 200	N/A	$ 133 190	100	311	2.5	163	760	370	359	383
Tesla	Model Y Long Range AWD 19" (2022)	AWD	$ 58 990	$1 200	N/A	$ 60 190	80	330	4.8	135		276	265	288
Tesla	Model Y Long Range AWD 20" (2022)	AWD	$ 60 990	$1 200	N/A	$ 62 190	80	318	4.8	135				
Tesla	Model Y Perf. LR AWD 21" (2022)	AWD	$ 63 990	$1 200	N/A	$ 65 190	80	303	3.5	155		304	293	318
Volvo	C40 Recharge (2022)	AWD	$ 58 750	$1 095	$7 500	$ 52 345	78	226	4.7	112	300	387	359	421
Volvo	XC40 Recharge (2022)	AWD	$ 55 300	$1 095	$7 500	$ 48 895	78	223	4.7	112	300	396	366	427
Volkswagen	ID.4 Pro 19" (2022)	RWD	$ 40 760	$1 195	$7 500	$ 34 455	82	260	7.7	99	150			
Volkswagen	ID.4 Pro S 19" (2022)	RWD	$ 45 260	$1 195	$7 500	$ 38 955	82	250	7.8	99	150			
Volkswagen	ID.4 AWD Pro 19" (2022)	AWD	$ 44 440	$1 195	$7 500	$ 38 135	82	249	5.7	111	220			
Volkswagen	ID.4 AWD Pro S 19" (2022)	AWD	$ 48 940	$1 195	$7 500	$ 42 635	82	240	5.8	111	220			



From : https://insideevs.com/news/521066/tesla-model3-lr-record-1000km/amp/

Date: July 11, 2021, Sunday (but traffic was surprisingly high)

- **Temperatures:** 17-22°C (20°C on average)
- **Start:** 100% State of Charge (SOC)
- **Number of stops for charging:** 4 (usually until charging power will fall to 120 kW or less)
- **Total time:** 9 hours and 20 minutes
- **Average speed (total):** 111 km/h (69 mph)
- **Average efficiency:** 186 Wh/km (299 Wh/mile)

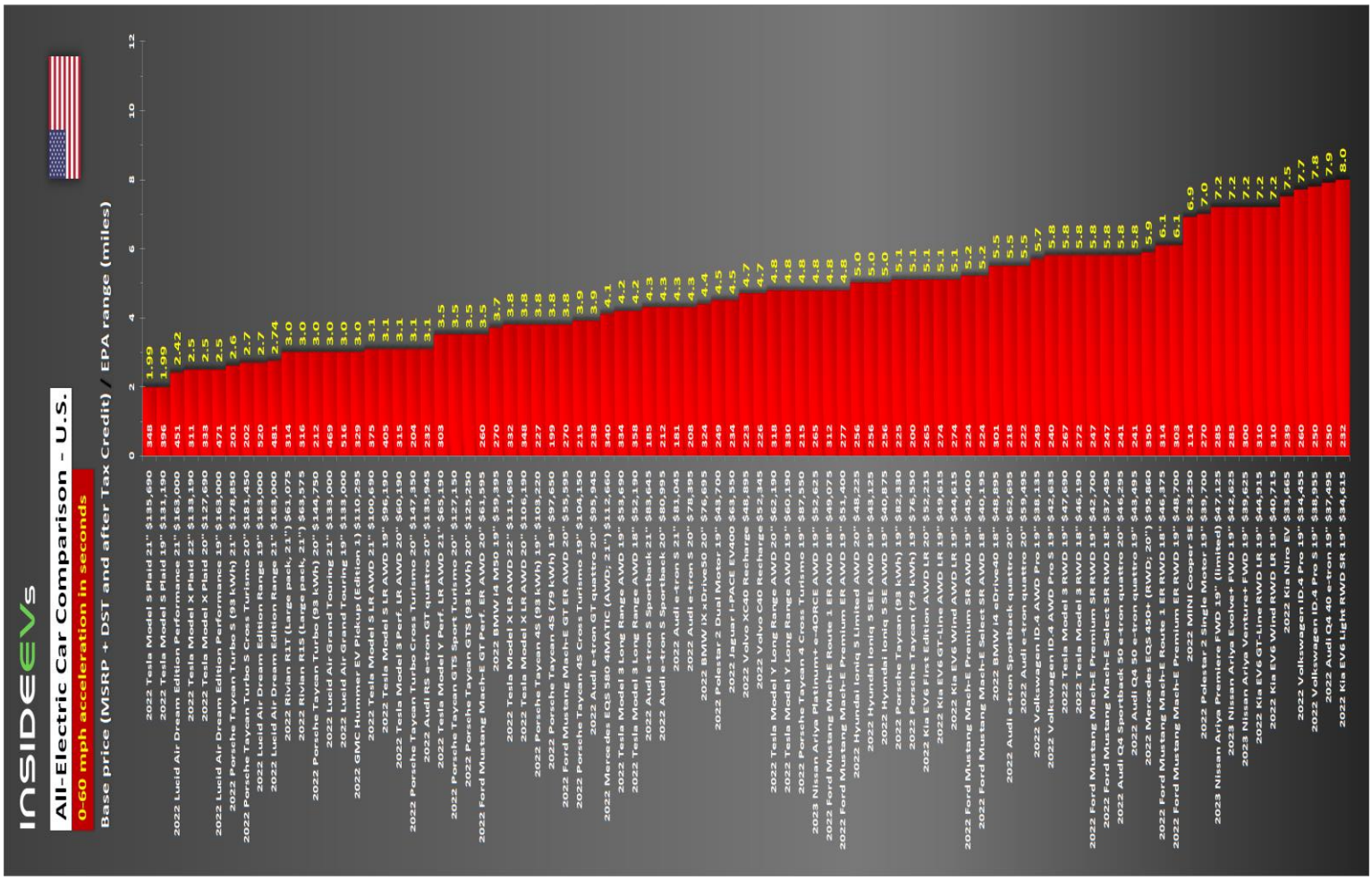
Charging stops:

1. Charging: after 400 km (249 miles) at a Tesla Supercharger (V3)
2. Charging: after 569 km (354 miles) at a non-Tesla charger (IONITY)
3. Charging: after 735 km (457 miles) at a non-Tesla charger
4. Charging: after 868 km (539 miles) at a non-Tesla charger (IONITY)

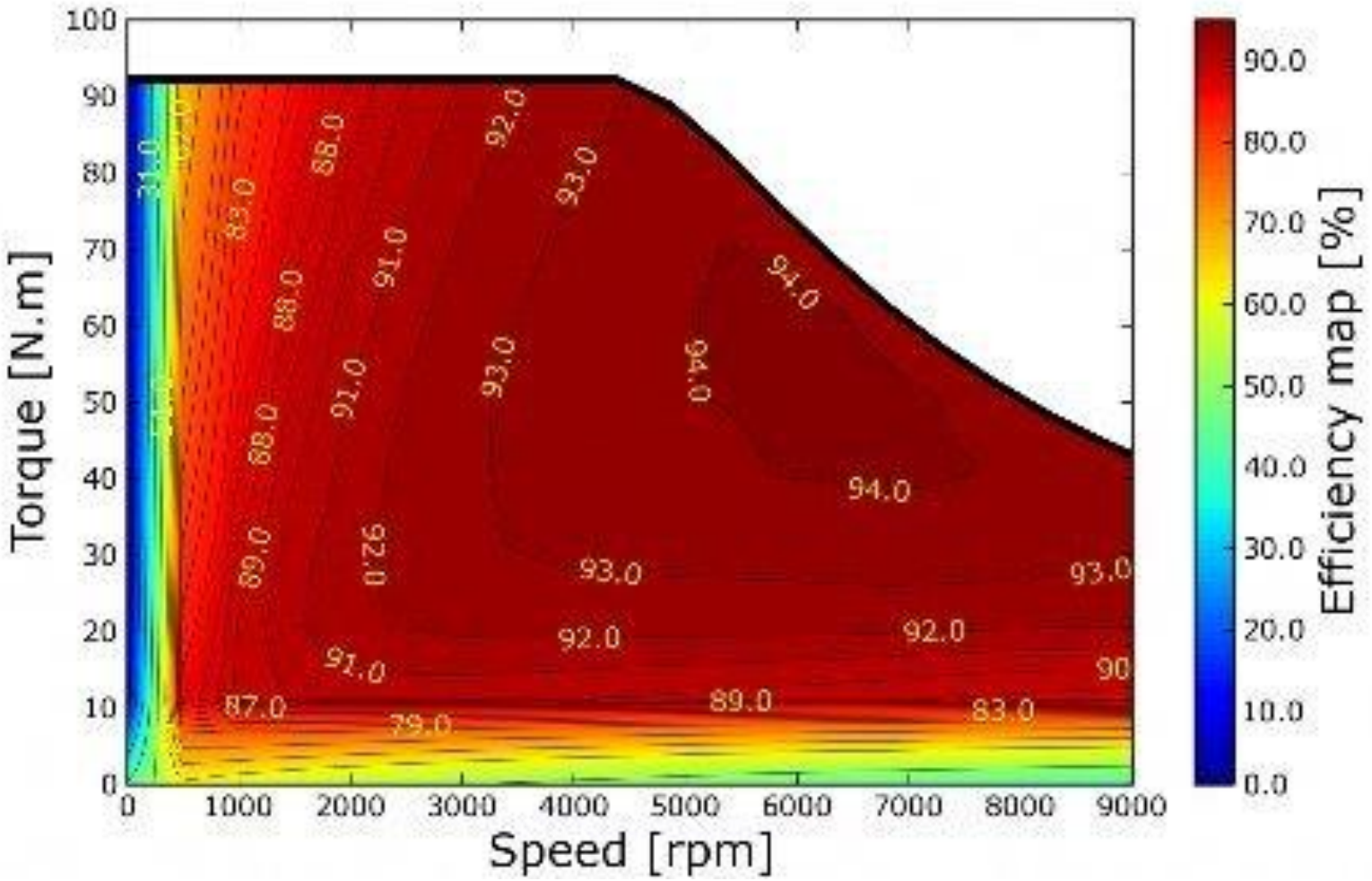
For July 11,2022 results see:

https://insideevs.com/news/597394/tesla-model3-performance-1000km-challenge/

All-Electric Car Acceleration Compared – February 14, 2022



Electric Motor Efficiency – Gears?



https://www.quora.com/Why-dont-electric-cars-have-transmissions-Even-though-the-motors-can-handle-a-high-RPM-wouldnt-several-lower-gear-ratios-help-keep-the-motors-at-a-low-RPM-and-use-less-battery-power-while-going-just-as-fast

“The efficiency that you could save by keeping the electric motor in optimum operating rpm (a few percent) is easily lost in a transmission itself.”

Questions and Answers scrubbed from Internet:

How often do electric cars need new batteries compared to gas cars?

They need a new battery about every four or five years. My Tesla X is saying it needs a new battery right now. I think it's going to be expensive. I'd like to replace it myself, but I don't enjoy crawling over cars anymore. Besides, Tesla doesn't like it when you do your own work. It can void the warranty.

Oh, you mean the main battery, the one that is used to power the motor??!!! Sorry, I'm talking about the lead-acid battery that is used to power the electronics. The main battery should last the life of the car. It's warrantied for 120,000 miles or 8 years. I'm not too worried about it.

Why can't some electric car enthusiasts accept that the inability for electric cars to fully recharge in 5 minutes is a deal breaker for some people since every gasoline car ever made can do that?

I think you are mistaken, I think people are saying that electric cars are different to gas cars and that for MOST people just rethinking how they do something will give benefits.

For example, my car has a 300ish mile range, I do not drive 300 miles a day. Therefore all I need to do is plug it in when I get home and hay presto it is fully recharged by the time I leave in the morning. If you drive more than 300 miles, sure it may not be the right solution for you.

I have had my car about a month, I have not visited a fuel station (OK, I cheated, I have supercharged once because Tesla gave me 6,000 supercharger miles free, not because I could not charge at home, but free vs paying and free won the argument, a 15 minutes stop added 140 miles of range). In that same month I have travelled 2,000 miles (new car syndrome), how many 5 minutes stops would you have needed to make to travel 2,000 miles?

What is the main reason why electric cars don't exist yet in a large scale?

Cars last for 15–20 years. It takes a long time to replace older technologies with newer ones.

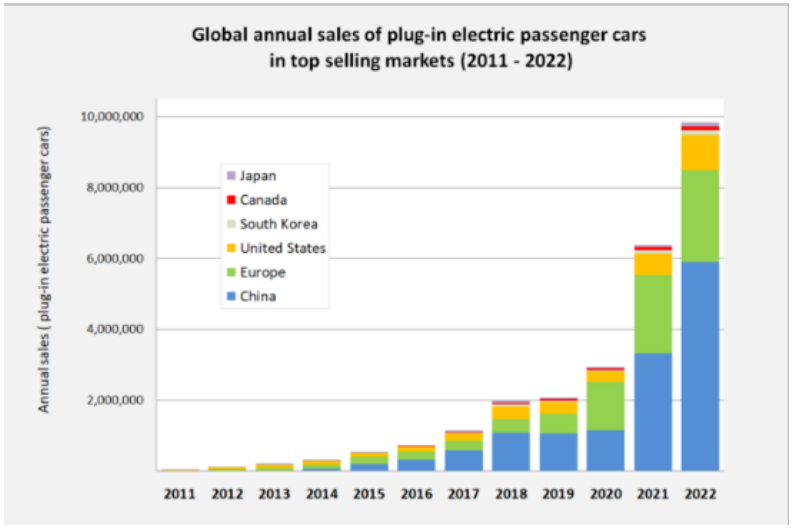
There are well over 30 million plug-in electric cars on the roads of the world, currently selling at a rate approaching 1.4 million a month.

That is only 2–3% of all the cars on the road, but makes up 20% of new car sales. And the percentage of new sales is only going up.

Is there a battery overheat warning on Tesla and other EVs so the driver has a chance pull over in case of a possible fire?

There is no need. EVs hardly ever catch fire. ICE cars catch fire 200 times more often than EVs.

Is there a warning system to tell the driver of a gas car that it is about to catch fire?



People who own Teslas and charge their cars in their garage, is your electric bill huge? Do those cars require a lot of energy?
Very easy rule of thumb: you need approx 2.5 kWh to replace 1 litre of gasoline, or 9.5 kWh to replace 1 gallon.

It can vary a lot, for example highway driving and using heating favours gasoline cars, city driving is much more efficient with electric cars.

Now you have to plug in (no pun intended) your own gasoline and electricity prices as they are different everywhere. Often electricity is cheaper in the off peak hours (night), which is convenient for car charging. Of course your own solar panels will change the math.

Off the top of my head, an example for Ontario, 1 kWh is about 15c including all the transmission charges and taxes. I need 2.5 * 15c = 37.5c to replace 1 litre of gasoline, which is around $1.60 atm. I spend $160 per month on gasoline, with an EV my electricity bill would go up by $37.50 instead, so I would save about $120 per month. Now I can decide if paying extra for an EV makes sense for me. There should also be some additional savings on car maintenance (like oil changes).

I'd also save some time by not having to go to a gas station every 10 days but let's say that would just compensate for some extra planning and longer breaks for charging at public chargers, during my occasional long trips.

Please comment if I made a mistake or didn't factor in something significant; and provide examples of what the calculation looks like in your neck of the woods.

How does the Biden Administration hope to immediately address the excessive weight of electric vehicles on our highway infrastructure that is not designed for these extremely heavy vehicles?
I'm getting really good at fighting off EV haters…I've discovered the cunning trick of looking up the FACTS…

Considering three roughly comparable cars:

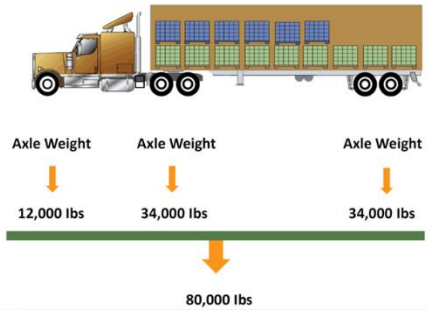
- Weight of Tesla Model 3 - 4,048 lbs. (Electric)
- Weight of BMW 3 Series - 3,766 to 4,321 lbs. (Gasoline)
- Weight of Audi A6 - 4,101 to 4,266 lbs. (Gasoline)
- Weight of Mercedes E-Class - 3,781 to 4,566 lbs. (Gasoline)

DOES WEIGHT MATTER FOR ROAD DAMAGE?

Yes - very definitely. The damage a vehicle does is proportional to the FOURTH POWER of the axle load on the road. So if you double the weight of a vehicle, the damage is SIXTEEN times greater.

Fourth power law - Wikipedia

From Wikipedia, the free encyclopedia Rule in road engineering The fourth power law (also known as the fourth power rule) states that the greater the axle load of a vehicle, the stress on the road caused by the motor vehicle increases in proportion to the fourth power of the axle load. This law was discovered in the course of a series of scientific experiments in the United States in the late 1950s and was decisive for the development of standard construction methods in road construction. [1] Background [edit] At the beginning of the 1950s, the American Association of State Highway Officials (AASHO) dealt with the question of how the size of the axle load affects the service life of a road pavement. For this purpose, a test track was built in Ottawa, Illinois , which consisted of six loops, each with two lanes. The lanes were paved with both asphalt and concrete of varying thicknesses. In the two-year test, trucks with different axle loads then drove the roads almost continuously. The test was called the AASHO Road Test . When evaluating the series of tests, it was found that there is a connection between the thickness of the pavement, the number of load transfers and the axle load, and that these have a direct effect on the service life and condition of a road. The service life of the road is thereby reduced with approximately the fourth power of the axle load. [1] The accuracy of the law of the fourth power is disputed among experts, since the test results depend on many other factors, such as climatic conditions, in addition to the factors mentioned above. [2] Calculation examples [edit] This example illustrates how a car, a truck and a bicycle affect the surface of a road differently according to the fourth power law. Car (total weight 2 tonnes , 2 axles): load per axle: 1 tonnes Truck (total weight 30 tonnes, 3 axles): load per axle: 10 tonnes 10 4 = 10 · 10 · 10 · 10 = 10 , 000 {\displaystyle 10^{4}=10\cdot 10\cdot 10\cdot 10=10,000} times as large The load on the road from one axle (2 wheels) is 10 times greater for a truck than for a car. However, the fourth power law says that the stress on (damage to) the road is this ratio raised to the fourth power. The road stress ratio of truck to car is 10,000 to 1. The same can be done for the bicycle: Bicycle (total weight 0.1 tonnes, 2 axles): load per axle: 0.05 tonnes, or the car has 20 times the load per axle as the bicycle 20 4 = 20 · 20 · 20 · 20 = 160 , 000 {\displaystyle 20^{4}=20\cdot 20\cdot 20\cdot 20=160,000} times as large The road stress ratio of the car to bicycle is 160,000 to 1. This means that after 160,000 crossings, the bicycle causes as much damage as the car does when driving on the road only once. From this it can be deduced that a large part of the damage in the streets is caused by heavy motor vehicles compared to the damage caused by lighter vehicles. [3] See also [edit]
Reference **https://en.wikipedia.org/wiki/Fourth_power_law**



So a Tesla Model 3 has two axles and a 50/50 weight distribution on the wheels - so it has an axel load of around 2,000 lbs. A Semi-truck looks like this:

This initially looks OK - 80,000 lbs spread over 5 axles is 16,000 lbs per axle. But because of the 4th power thing - the front axle is relatively unimportant. Each of the four main axles supports 17,000 lbs. That would be 8.5 times more than my Tesla - and 8.5 raised to the 4th power is 5,220 times more damage per axle than my EV…and with four load-bearing axles - that's 10,440 times more damage to the road.

With 4 million semi-trucks on the roads covering an average of 45,000 miles per year each and 290 million cars - driving 15,000 miles per year each - that works out to be 430 times more damage done to US roads by semi trucks than by cars.

Even if EV's WERE a lot heavier than regular cars - it would still be a TINY drop in the bucket.

CONCLUSION: Well, I'm sorry - you seem to have lost this round rather comprehensively. Thanks for playing.

How did Tesla Model Y became the best selling car in Q1 of 2023?

How is rather surprising because no one expected the Y to outsell the 3, but it has. Maybe it can be put down to cargo capacity making the Y a better choice for families for about the same price as the 3. Note: Prices in US dollars

Are You Too Old For An Electric Vehicle?
https://cleantechnica.com/2023/08/31/are-you-too-old-for-an-electric-vehicle/

Tesla Model 3's motor - The Brilliant Engineering behind it
https://www.youtube.com/watch?v=esUb7Zy5Oio

If the U.S. goes to all electric cars, what are people living in rural areas supposed to do? Some drive over 100 miles or more per day just to get to work and back. (Assume moving to a city is not an option.)
https://www.quora.com/If-the-U-S-goes-to-all-electric-cars-what-are-people-living-in-rural-areas-supposed-to-do-Some-drive-over-100-miles-or-more-per-day-just-to-get-to-work-and-back-Assume-moving-to-a-city-is-not-an-option

How does Tesla make money from its charging stations? Will it be a loss for Tesla since the charging stations will require maintenance?
https://www.quora.com/How-does-Tesla-make-money-from-its-charging-stations-Will-it-be-a-loss-for-Tesla-since-the-charging-stations-will-require-maintenance

Why can't some electric car enthusiasts accept that the inability for electric cars to fully recharge in 5 minutes is a deal breaker for some people since every gasoline car ever made can do that?
https://www.quora.com/Why-cant-some-electric-car-enthusiasts-accept-that-the-inability-for-electric-cars-to-fully-recharge-in-5-minutes-is-a-deal-breaker-for-some-people-since-every-gasoline-car-ever-made-can-do-that

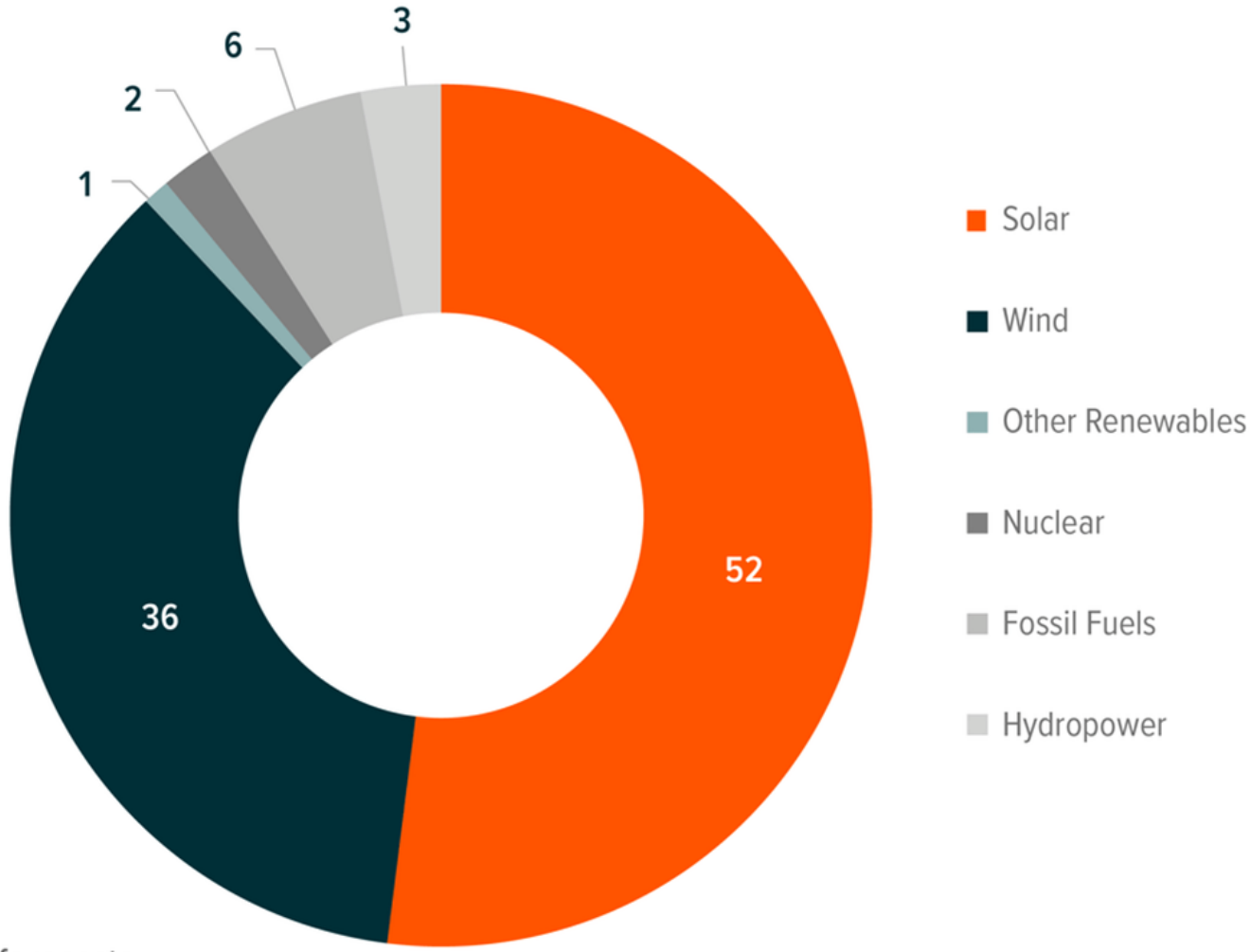
Can someone justify electric vehicles to me?

Local emissions kill people. Getting the particles and gases out of residential areas is one huge plus for the EVs.
https://www.quora.com/Can-someone-justify-electric-vehicles-to-me

Are the materials in failed EV batteries currently reusable? Will they be in the future?
https://www.quora.com/Are-the-materials-in-failed-EV-batteries-currently-reusable-Will-they-be-in-the-future

FORECASTED SHARE OF NET ELECTRICITY CAPACITY ADDITIONS FROM 2022-2032, BY TECHNOLOGY (%)

Sources: Global X ETFs with information derived from references specified in the footnotes section titled "Forecast Analysis Derived from the Following Sources".



Note: All numbers are forecasts.

Reference: https://seekingalpha.com/article/4569695-tech-advancing-unlocking-solar-power-growth-potential

Battery EVs vs Hydrogen FCEV's

FCEV's are Fuel Cell Electric Vehicles.

BEV sales are about 200 times that of FCEV's

Very few hydrogen refueling stations in BC

Hydrogen Will Not Save Us. Here's Why.

https://www.youtube.com/watch?v=Zklo4Z1SqkE

Electric Vehicles: Will they save or destroy us?

https://www.youtube.com/watch?v=UNBLhGsjHQI

Enjoyable and highly recommended.

In BC (where say 95% of electricity is produced by hydro power) one needs to drive a new EV only about 10,000km to start saving on carbon emissions compared to a new gas-powered vehicle due to mining of minerals like lithium etc. In China, which uses largely coal to make electricity, the break-even point is 126,000km!

The statistics on automobile fires per 100k sold.

Of 100K ICE vehicles sold 1529 of them will catch fire.

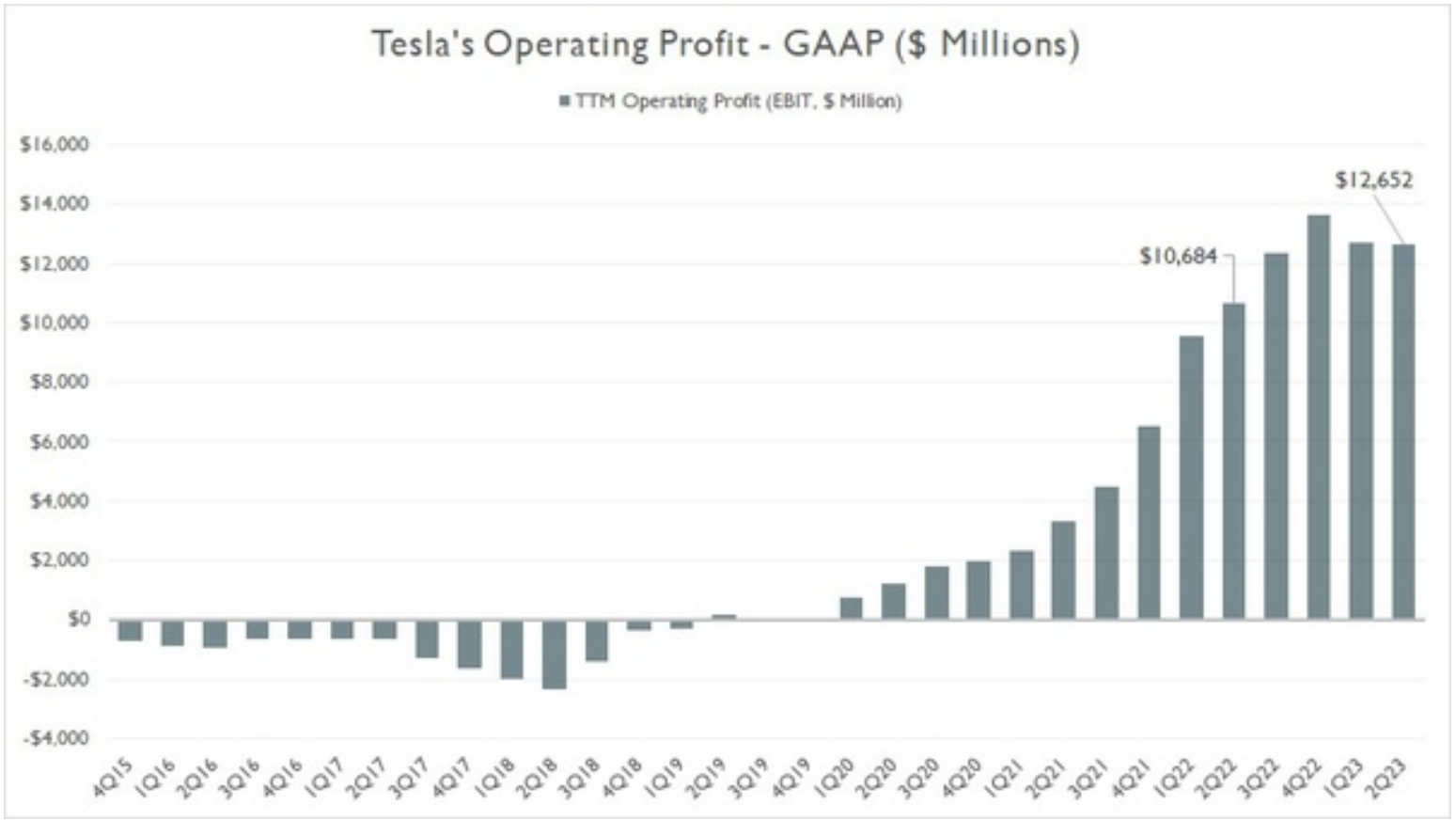
Of 100K EVs sold 25 of them will catch fire.

Of 100K Hybrids sold 3474 will catch fire.

Ref: https://www.familyhandyman.com/article/are-electric-vehicles-more-likely-to-catch-on-fire

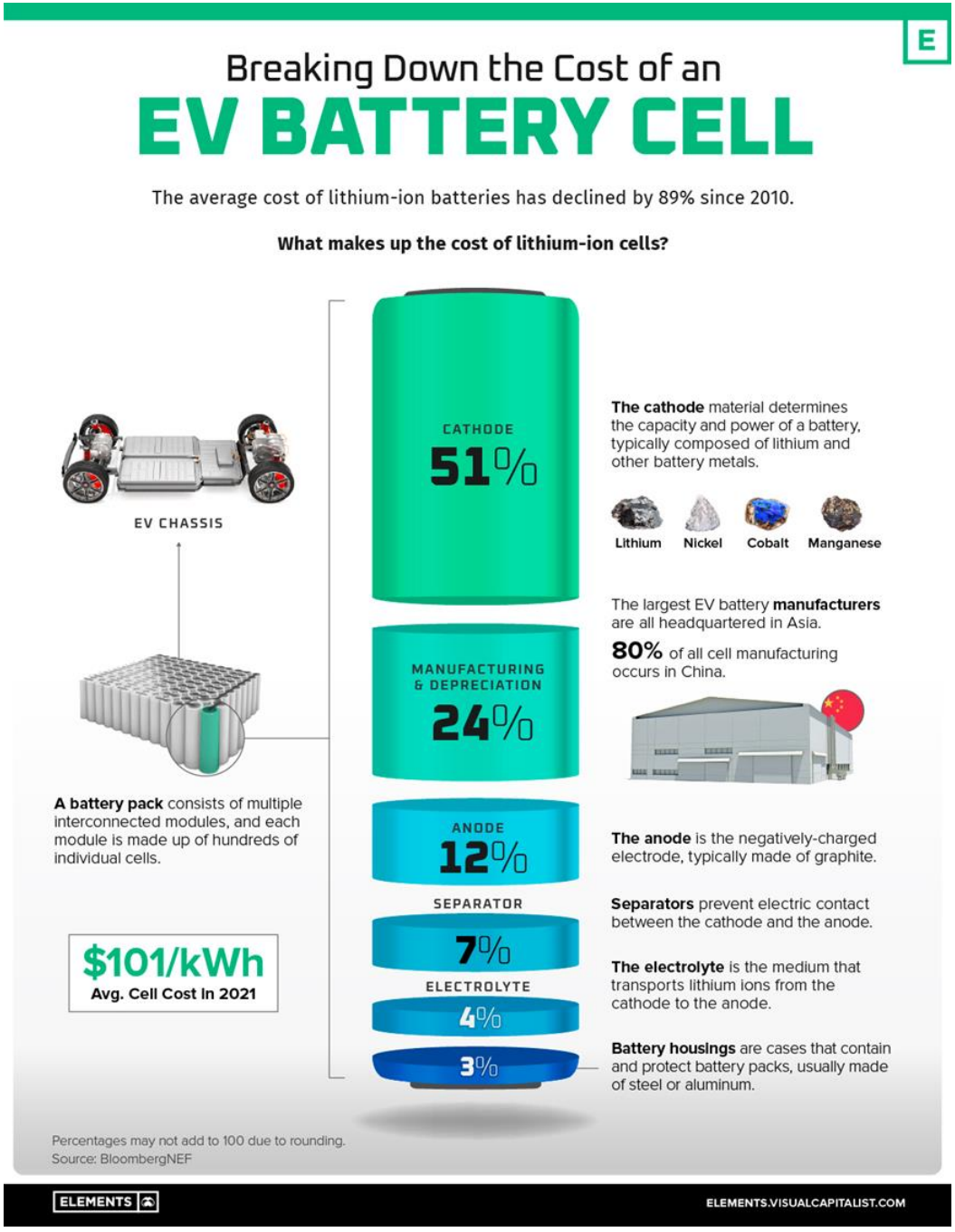
See also https://www.tesla-fire.com/index-amp

History of Tesla Operating Profit



Extract from: https://www.quora.com/How-will-electric-vehicles-affect-Michigans-place-in-the-automotive-industry

Why are electric vehicle batteries so expensive?



LET'S DO A SUPER-NAIVE CALCULATION:

Let's suppose you wanted to build your own EV…to get a very approximate feel for this…let's look at how much ONE battery costs on Amazon:

https://www.batteryjunction.com/lg-hg6-inr-20650-li-ion-battery.html

So $10 for 3Ah at 3.6 volts - (**amps x volts = watts**) - so 10 Watt-hours for $10.

So $1 per Watt-hour - which is $1,000 per kWh - if you tried to make one yourself.

A Tesla Model Y has a 70kWh battery pack - so you'd need 7,000 of those batteries - which would be $70,000 - but there's more to a battery pack than just batteries - it includes coolant channels, battery connections, temperature sensors and all of the structural stuff that goes around that.

So $10,000 for a battery pack is a very ***reasonable*** price!

IN REALITY:

In truth, Tesla use larger batteries than the 20650 - so they have fewer, larger, batteries.

The ACTUAL cost of the cells really was $1,000/kWh back in 2010 - but has dropped to $100 per kWh today. But we still have to add the packaging, monitoring, shipping, profit margins, etc.

SO WHY ARE THEY SO EXPENSIVE?

This means that the batteries that you buy online for $10 each are being sold by Tesla and other EV makers for just $1 each - which is actually a hell of a good deal!

The bigger question is why the individual cells cost even $1 each?

https://www.visualcapitalist.com/breaking-down-the-cost-of-an-ev-battery-cell/

So half the cost is the cathode materials - lithium, nickel, cobalt and manganese. None of those are cheap. Manganese is very cheap - Nickel, Cobalt and Lithium Carbonate are all pretty pricey..

A quarter of the cost is the manufacturing processes - and the rest is kinda irrelevant by comparison.

COST OF MATERIALS - AND THE ROLE OF RECYCLING:

We're in a slightly odd situation right now where all of these materials come from mining. But that's a temporary thing - in maybe 20 to 40 years, lots of old electric cars will be heading to the scrapyards - and recycling those batteries will be a massively profitable business - and almost all materials will come from recycling.

Many people (especially the Elon-haters, the Tesla-haters and the EV's-in-general haters) doubt that this is true.

But consider that Lead is so valuable that today, 90% of all lead-acid car batteries are currently recycled.

- Lead is worth about $2,000 per tonne.
- Lithium, nickel and cobalt are each worth about $28,000 per tonne.

So the incentive (or at least the profit-motive) to recycle an EV battery is somewhere around ten to fifteen times greater than the incentive that currently results in 90% of lead-acid batteries being successfully recycled.

Of the $10,000 cost of a typical EV battery - $5,000 of that could be reclaimed from the materials inside the battery!

That's why Tesla built a battery recycling plant in the same building as their battery manufacturing plant - literally 10 feet away in GigaNevada…materials from used batteries go straight into the new battery manufacturing plant.

Who is stupid enough to toss $5,000 worth of stuff into landfill?

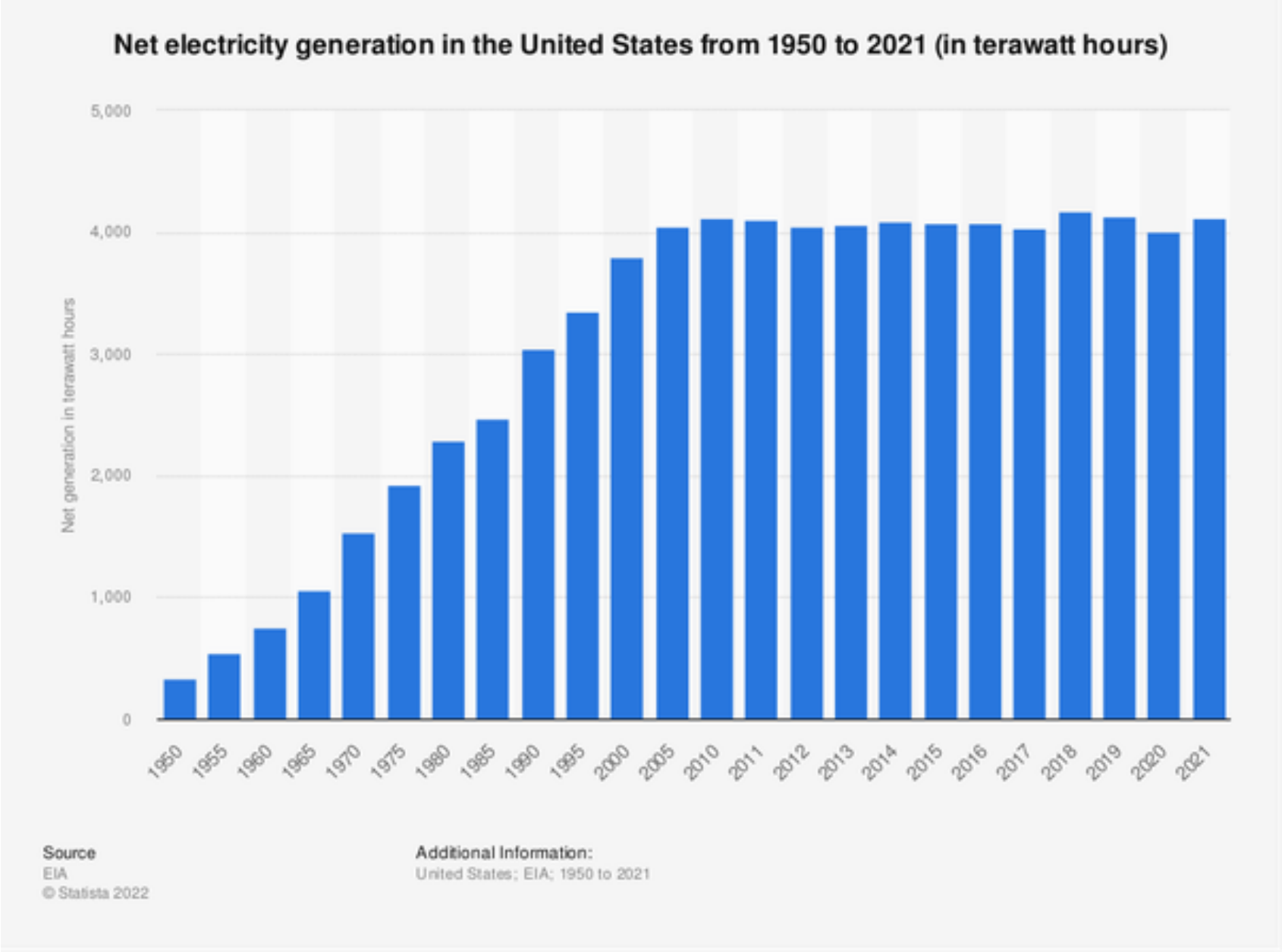
Why is Tesla still pursuing its own 4680 battery when they are inferior to BYD's blade batteries that already hit 55$/kwh cost to make?

Well let's start with the fact that the BYD Blade Battery at $61/kWh is only hitting 168Wh/kg, while the Texas made 4680 has an energy density of 244Wh/kg. Note, that's not even the target energy density which is > 300Wh/kg. While cost is definitely a factor to consider, energy density is also a major factor and with the other factors I'll discuss below, I would put the 4680 as superior not inferior.

Next, the 4680's can be used as part of the structure in the battery pack, reducing overall weight further. The BYD blade batteries cannot.

Third, Tesla's working towards a 100% dry electrode process, right now they've got the anode working with a dry process, but the cathode is still a wet process. Once they get that cathode to a dry process they will have significantly reduced their energy footprint, and have a much lower cost battery, but more importantly without the dependency of a third party to produce, and even if it was only at the same cost to manufacture as BYD's, do you think BYD would be selling their battery to others w/o a markup?

Some [unverified] Stats about Electric Vehicles and US Electrical Grid

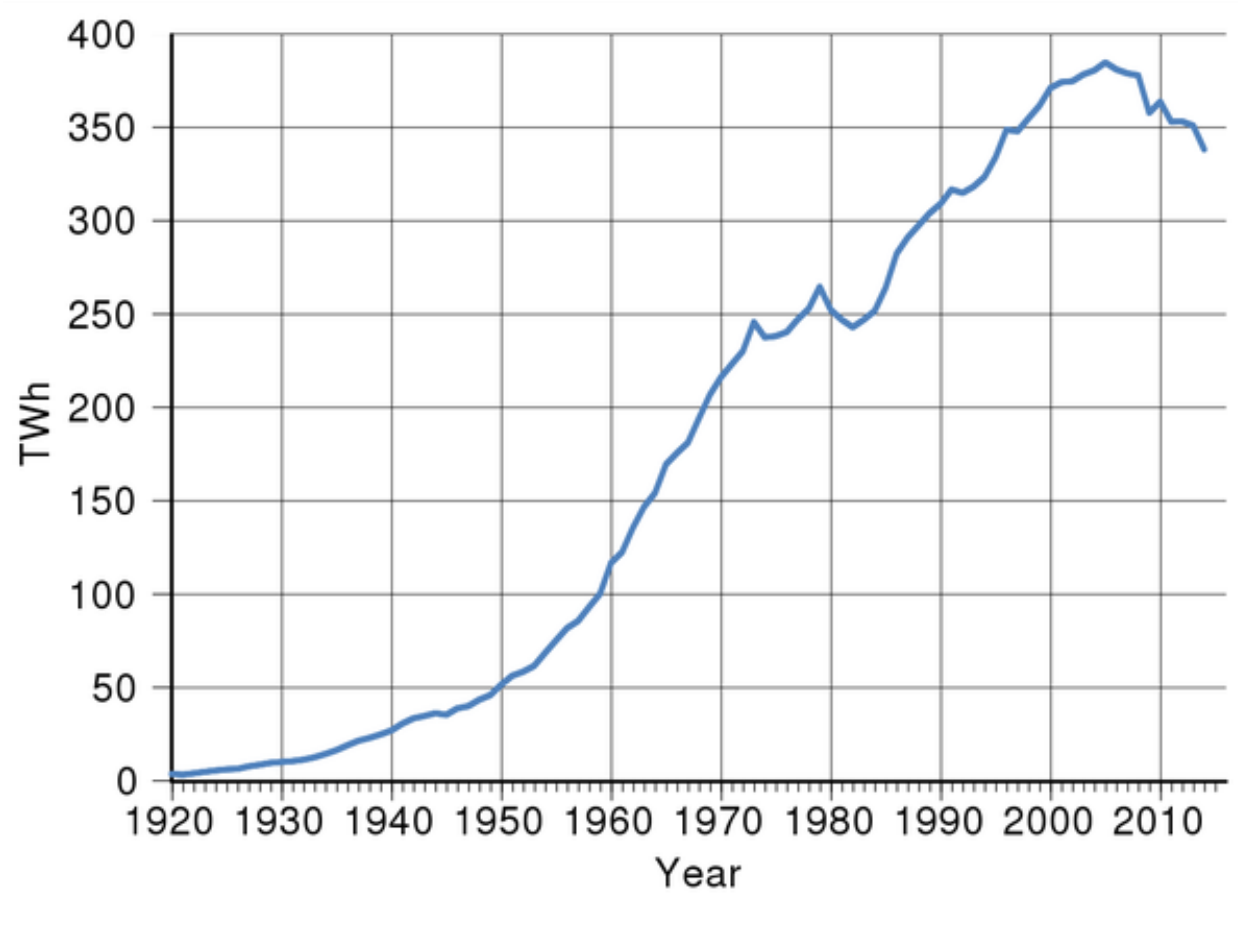


So this is total US electricity generation. It’s been oddly flat for a long time, why is this?

Efficiency.

Generation rose rapidly after WW2 until around the year 2000 when measures to reduce energy consumption took effect. Despite what you might imagine about population increase and the “ever-increasing demand” it is clear that this is not what is happening.

Things like low-energy lighting, more efficient computing etc.. have all reduced power consumption. Think how much power all of those millions of CRT tube TVs were using and how much less their LCD replacements use.



In the UK it's even more dramatic as we have managed to save even more electricity than the US has, though it took us until 2005 to begin:

It actually fell considerably beginning around the mid-2000s. I do not have a more up-to-date chart at this time but it's tracking down from 2005 onwards. **Down**.

So, now that these facts have been absorbed and this myth of “ever-increasing demand” has been busted, is it hard to imagine that in the UK we could just go back to where we were 10–15 years ago and we would have plenty of energy to power

electric cars? No, it's pretty easy to imagine.

In the US, yes, you will need to increase generation, or implement some greater efficiency measures to offset the electricity being used by electric cars. It is also interesting that the UK population 68 million uses around 300 TWh per year the US population 329.5 million uses 4000 TWh per year. So the average US citizen uses three times more electricity than the average Brit.

Consider this though - estimates for the amount of electricity consumed to produce a gallon of gasoline range from 0.2 kWh per gallon to as many as 6 kWh per gallon.

An EV can go 24 miles on 6 kWh.

Even if the real figure is much smaller, it is non-zero, switching to electricity for driving saves electricity in the oil industry, and this is not in dispute.

The following arguments are false, and are oil/engine industry nonsense:

“EVs cannot be supplied with electricity as the grid cannot cope” - false.

“EVs use more energy and produce more lifetime emissions than fossil fuel cars” - false.

“Mining lithium for batteries is so horrific that it shouldn’t be done” - false.

“Batteries die rapidly and end up costing you $10–20k” - false.

“EVs cannot be recycled efficiently” - false.

These arguments are stalling tactics (fear, uncertainty and doubt) by those invested in oil/engines to keep the gravy train rolling for longer. The climate needs action now, and it’s either that your next car is going to be an EV or you might not be driving at all

Do you seriously have no problem with having to charge your electric car so much, when there's hardly any convenient infrastructure to do so, and it takes so much time?

Read the comments. The answers are very positively in favour of EVs. Negative comments were almost all from those who have never owned or driven an EV.