

## TODAY'S PRESENTATION WILL ADDRESS

Past & Present EV Electrical Chassis

EV batteries –*the Achilles Heal of the EV's*

Charging an EV vehicle

Towing an EV Vehicle

Buying a used EV

Closing - Web Sights to visit and Updates

# WHAT GOES AROUND COMES AROUND



# THOMAS Edison's Car

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Thomas Edison poses with his first electric car, the Edison Baker, and Edison's batteries, 1895

The First Nickel- metal Battery Car

- There are **three basic type of batteries** used during the last 130 years:

**Lead Acid** of 1859- invented by, Gaston Plante a French physics researcher -- modified but still used today (costly)

**Nickel-metal hydride** 1894 –"NIMA" - Thomas Edison Battery used from 1895 to 1999... (Low build price) is used today with solar systems.

**Lithium-ion** " Li-ion " of 2003 (Expensive ) --- ----Quebec , and Manitoba have lithium graphite, Ontario has nickel and Cobalt--then there is the Canadian talent, Jeff Dahn Canada's & "Worlds foremost Lithium-ion battery expert.

**Note**– The Li-on battery is primarily used today from (2005 to 2020 and Future) – in all rechargeable electronic devices. It is the lightest of the 3 types of batteries. But requires an optimum temp of 15 to 25C range for longevity

SEPTEMBER 7, 2019

# Tesla battery researcher unveils new cell that could last 1 million miles in 'robot taxis'

Fred Lambert - Sep. 7th 2019 4:33 pm ET [@FredericLambert](#)



uses Solar systems—Golf carts—Lawn mowers—Lap tops—Camera's— Cell phones—Flash lights—Hearing aids—Factory lifts—Snow blowers— Air planes—race cars— Boats.

Ford's 2022 "Rivian" EV MODERN CHASSIS

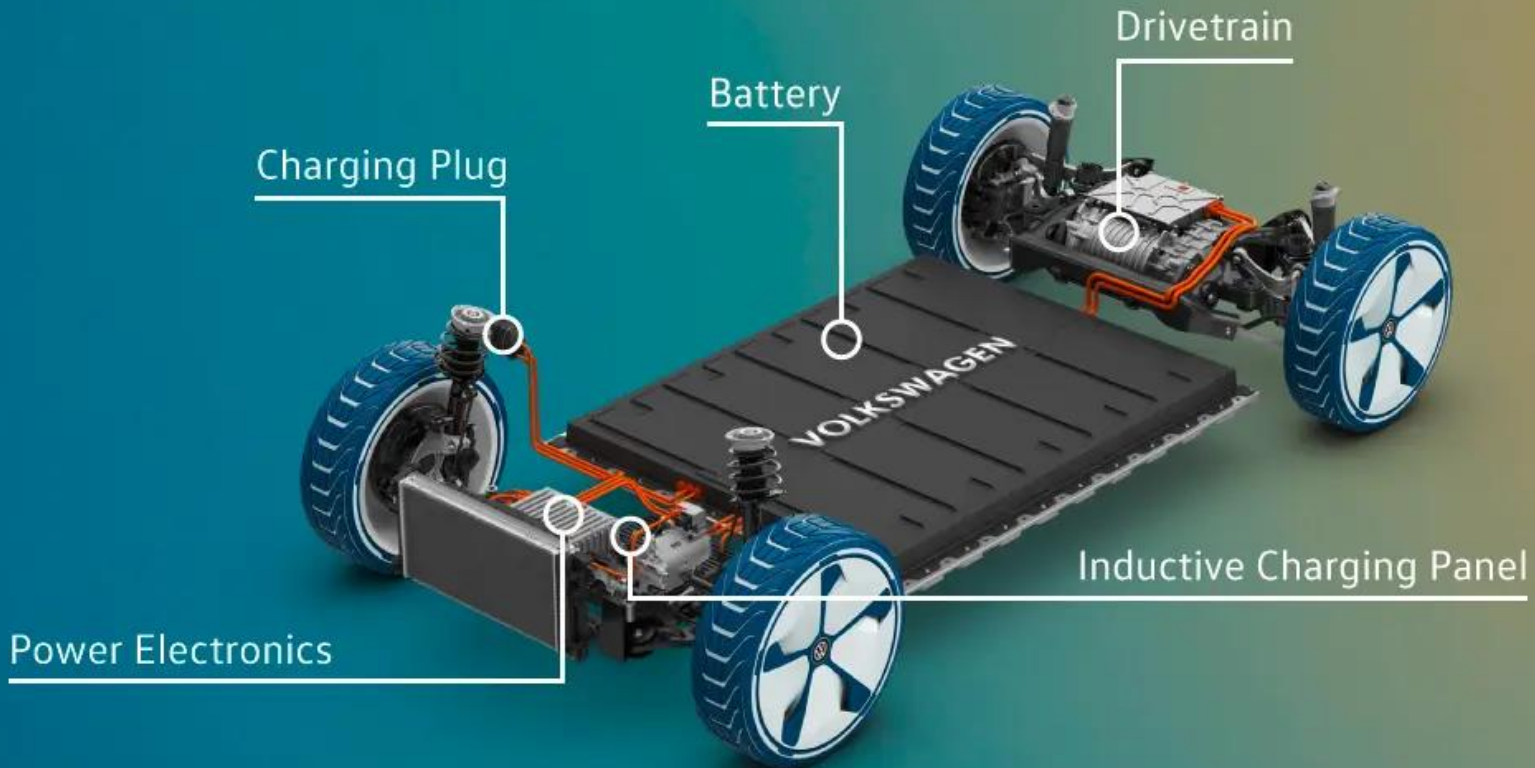




Volkswagen

# Inside the new ID. Chassis

An overview of the Volkswagen e-model family's most important components



ID.3 will be delivered this Sept. and priced in the older Golf with range of 540 KM. ID.4electric SUV is next.

# ID 4 VW Chassis







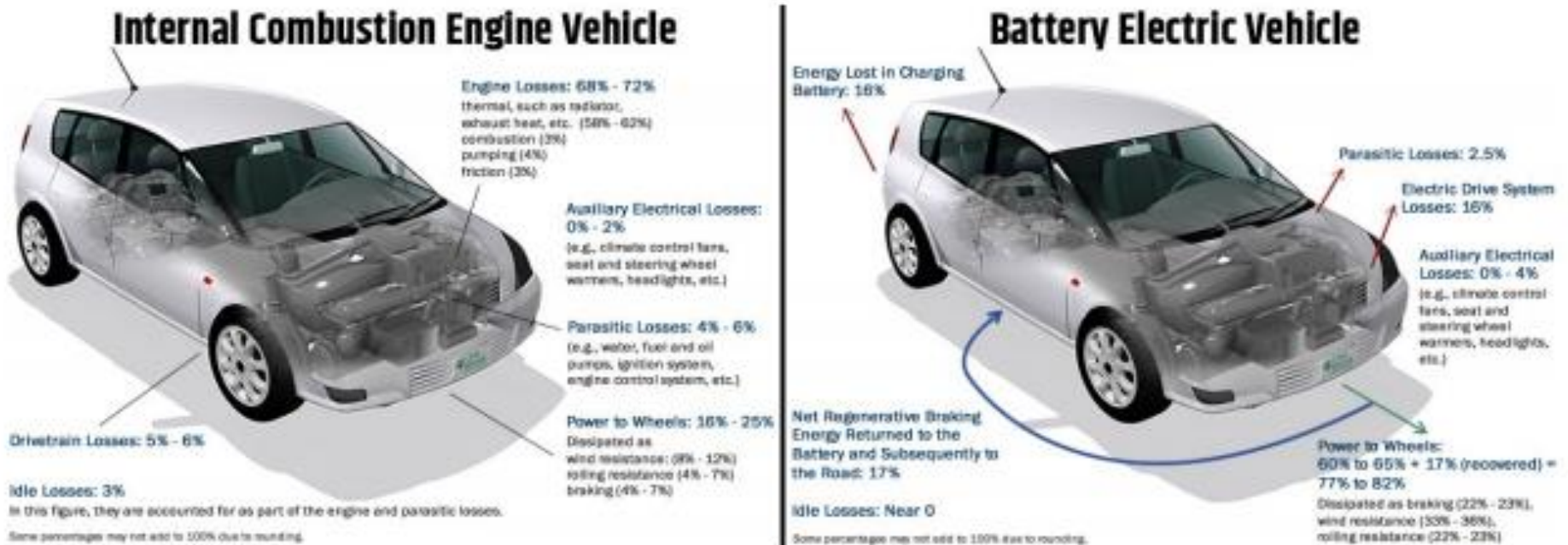
2019 – 1<sup>ST</sup> ALL ELECTRIC SEAPLANE TAKES FLIGHT IN BC.

TOYOTA'S LEXUS 650 ELECTRIC YACHT



# Where does the Battery ENERGY GO

Figure 3: Where the energy goes (combined city/highway values).



Source: [US Department of Energy](#)

# Where Does The Energy GO?

## ICE ENGINE

Power at the wheels, wind resistance, tire resistance, braking, etc.	16 to 23%
Engine losses, radiator, exhaust heat, Auxiliary	68 to 72%
electrical losses, AC heater fans, power steer, windows headlights, etc.	2 to 4%
Parasitic losses, water fuel pumps, ignition, Air Bag EEC controls, and Chassis modules	4 to 6%
Drivetrain losses	5 to 6%
Idle losses	3%

## EV BATTERY with AC MOTOR

Power to wheels -Plus percentage of Regenerative braking	60 to 65% (17%)
Energy loss in charging battery	16%
Electric losses Drive	16%
Auxiliary Electrical losses, headlights, climate control seats, windows etc.	4 to 6%
Parasitic losses	2.5%
Idle losses	0%

# THINGS NOT TALKED ABOUT Rechargeable Lithium

- **BATTERY DEGRADATION** – affects energy level but  
doesn't affect mileage (loses about 2.5% to 4% yearly) --Affected by--  
Fast Charging  
Battery KW. Per weight of vehicle  
Mileage  
Extreme temperatures ( Too Hot or Too Cold)
- **CYCLE LIFE – ( 3000) or if you are lucky roughly 7years--** Is an estimate of how many times a battery can complete cycles of discharging and recharging.  
Which also Includes regenerative braking.
- **BATTERY RANGE** – Distance in Kilometers that the Auto Manufacturer estimates your EV should travel on full battery charge and at Optimum Temperature
- **ENERGY DENSITY – (Wh/kg)** is a measure of how much energy a battery can hold. The higher the energy density, the longer the runtime will be. Lithium with cobalt cathodes offer the highest energy densities. Typical applications are cell phones, laptops and digital cameras

## TEMPERATURE AFFECTS ON EV LITHIUM BATTERIES

OPTIMUM TEMP. FOR LITHIUM BATTERIES (+15C to +25C ) (+45F to 80F)

### Extreme Weather

Very hot or cold conditions impacts range in EVs.-- The additional heating and cooling needed for passenger comfort requires more energy. And Both Cold and Hot temperatures affects battery resistance and depending on air temperature the battery may not hold a full charge as well.

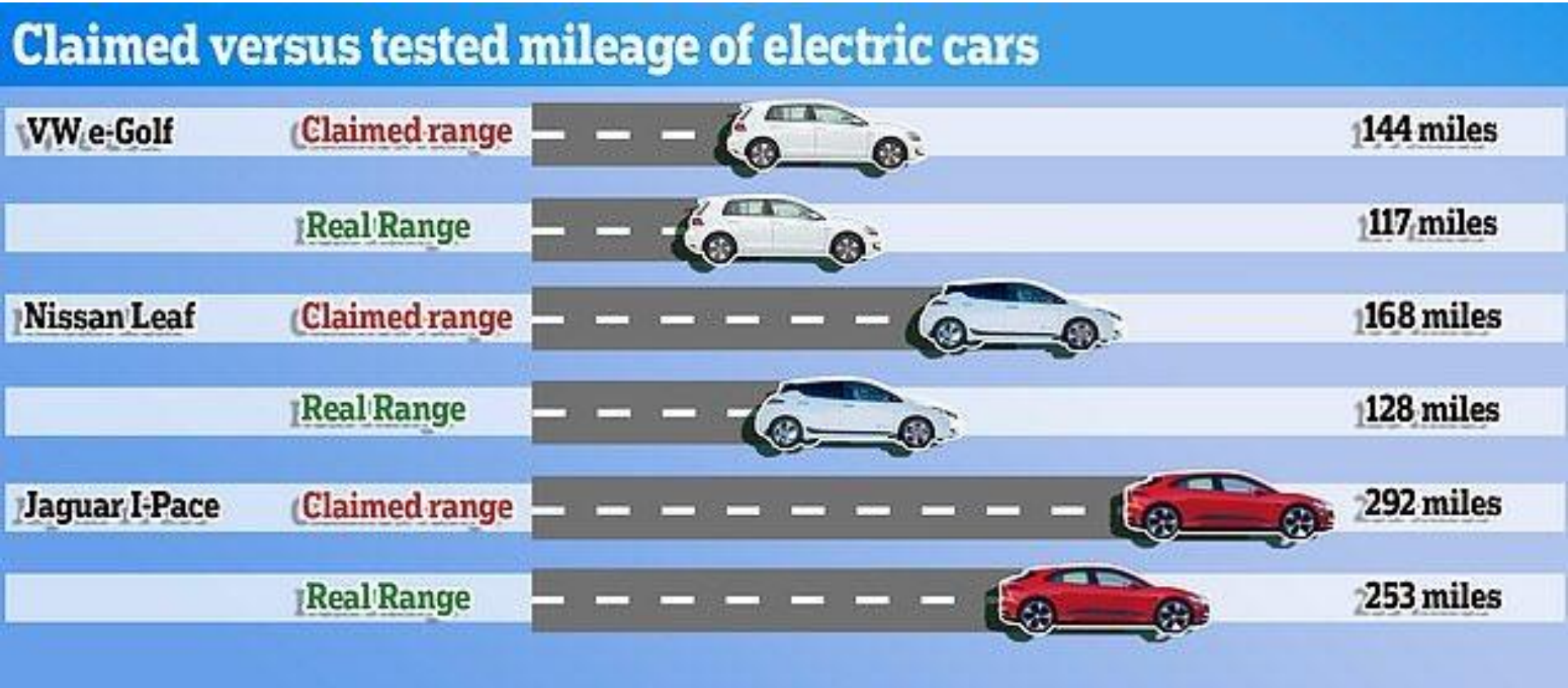
**EXAMPLE** Cold driving at (+ 6 degrees Celsius), will cause an EV battery to **lose as much as 45%** of its energy leaving only 55% of battery energy to power the vehicle without any more reductions, while also reducing the travel distance.

**Otherwise --Hot** testing show that at about (**30 degrees Celsius**) affects a battery's capacity by 43% . Again restricting travel, available distance

[https://uwspace.uwaterloo.ca/bitstream/handle/10012/7350/Lo\\_Joshua.pdf;sequence=1](https://uwspace.uwaterloo.ca/bitstream/handle/10012/7350/Lo_Joshua.pdf;sequence=1)

# BATTERY RANGE- (real example)

Full Battery Charge of 100% and Optimum Temp.



# How to Extend the Life of EV Battery

- Watch your speed
- Stop Charging to the Minimum –20% energy level
- Plan for Vacation Storage
- Park in the shade in Hot weather and park in **Garage in Winter**
- **Take time** to Charge slowly in Heat and Cold
- Search Your Route Ahead of Time
- Avoid Full Charging when you can
- Minimize DC Quick Charging (480 Volt)
- Avoid Deep Discharging to Zero %
- Time your Charge
- If your EV Battery has a thermal management system and the weather is extreme, plug in whenever you can.
- **These Tips can extend the life of an Electric Car's Battery**



## OTHER ISSUES

**NOTE:::** government concerned because EVs don't use gasoline.

Lithium EV batteries need little or no maintenance, however EV batteries don't like extreme temperatures and require a thermal system to keep from overheating in hot weather and or heating in cold weather.

They also need protective circuits to prevent them from overcharging. ( *keep alive electric circuits that drain Battery.*)

Although the cost of EV batteries have come down they are still relatively pricy. (year **2010-\$1,300** ) (year **2016 \$1,000.00**) future forecast for **2030 is \$130.00**

Some research companies are working to develop solid-state electrolytes which have two or three times the energy compared to current EV batteries

EV Lithium Batteries have been known to catch fire during a vehicle accident. ( If overheated circuit fails)

**UPCOMING VERY QUICKLY** Electricity can be created by a **HYDROGEN**

**Fuel Cell** BUSES //TRACTOR TRAILERS/  
FARM TRACTORS Etc.

While battery technology has recently come a long way there are still certain aspects of the electric vehicle that change when the weather drops and these can have several effects on how the vehicle operates.

- Cold weather shrinks an electric vehicle's travel range. The Lithium Batteries that almost all car companies use are very sensitive to their environment. They have a specific optimum Temperature range in which they operate most efficiently ---usually between 15C and 25C although it depends on the individual battery system design
  - . If the winter gets colder or hotter then the battery's efficiency drops. Most electric vehicles have built- in battery systems that are intended to keep the power pack within it's preferred temperature range, however when faced with particularly cold weather, there's really only so much can be done. In fact some of the heat needed to keep the battery warm is actually generated using energy from the battery itself, which greatly reduces the amount of energy available to operate the vehicle. **Overall it's not unusual to see a 20 to 30% drop in overall driving mile range.**

NOTE: A lithium battery operating at capacity under optimum conditions will loose about half it's strength when the temperature reaches minus -17 C or 0F. A cold snap can do an older battery in, especially when the temperature moves back and forth between optimum and extreme conditions.

- Another factor that can impact range when driving an electric vehicle in winter is the use of the heater, defrost blower, day-time-running lights, heated seats, and wind shield wipers.
- You can say good-bye to your regenerative braking, in cold winter weather. In warmer temperatures these regenerative systems transfer some of the energy created when slowing down an EV vehicle into electricity that can be fed back into the car's power battery supply. A cold battery isn't capable of being recharged efficiently because of very low to accept a charge. battery resistance so most new EV's shut down regenerative braking until the battery is warm enough . This means that a short winter trip around town way not produce any regenerative electricity flowing back into the battery. Additionally, the brake generators also become less efficient in cold weather which further effects your driving range from the battery.

**And Remember**—A battery is just like you. Fill it with food (**Electricity**) and tender care( **Treat it Nicely**), and it becomes full of (**Energy**) to make things go. It works at the same temperatures that you like ( **Not too Hot and Not too Cold** ). It likes to take a break from time to time to rest and rejuvenate itself, just like you do. And when it gets low on energy, that's the time to (**Recharge**) it with food (**Electricity**) so it becomes full again.

# Tesla's secret **BATTERY**

- Tesla CEO Leon Musk announces that its event called Battery Day, previously intended to be held in the spring, will now take place September 15<sup>th</sup> at the Fremont, Tesla's headquarters in California. Or perhaps September 22<sup>nd</sup>.
- **Canadian accomplishment – Jeff Dahn was awarded recently a Gold metal for Science and Engineering . Jeff and his research team have created a lower cost, longer lifetime, higher energy density, Lithium battery. Tesla owns the patent**
- Tesla is building an enormous new battery factory in Nevada and in Germany. ( currently Tesla purchases battery cells from Panasonic & LG )
- Tesla purchases Maxwell Technologies May 15<sup>th</sup> 2019 ( San Diego Ca.)
- Tesla purchased Hibar Systems Inc. Fall of 2019 (battery equipment manufacturer, located in Richmond Hill, Ontario)
- Panasonic has just released a 5 year plan that to increase battery energy level by 20% battery for Tesla.

**NOTE** : GM has just announced in April it has created a new electric vehicle battery that offers up to 640 KM and claims to be better than Tesla's batteries.

# The Million Mile battery

- Elon Musk started the whole concept by advising to Tesla share holders that he was making a special battery announcement this September –(date of Sept15th is the latest )
- Then GM said last month that it is almost there on making a million mile battery as well.
- And two weeks ago, the chairman of Chinese battery-making giant Contemporary Amperex Technology Co. Ltd. Zeng Yugun told Bloomberg, if someone places an order , we are ready to produce.
- IBM have stated that they have produced a new battery made of three metals found in any ocean. It is very safe, can accept a fast charge and retains much energy. But that is all that has been said.
- Nikola motors –claims that they have a new type of battery with double the energy density, only 40% of the weight and half the cost of current Lithium-ion batteries . But not providing many details until fall of 2020 at World technology summit in Phoenix.

# CHARGING AN EV BATTERY

## CAUTION

As a guide, Try Not to Charge if the Weather Temp. is outside the range of (10-35C) ( 50-95F )  
Secondly ,batteries hate being too full or too empty, ideally, never let them charge over 80% or become lower than 20%

Level one- 20 hrs of charge = 200 KM

Level two - 8 hrs of charge = 160 km

Level three- 30 minutes = 200 km

### Plug in conductive connectors

SAE J1772-001 All EV's in Canada / USA can charge  
using this plug. (Level 1 and 2)

Note: The J1772 can also be used on Tesla EV's with adaptor  
I should advise you that some USA cars use inductive charging.

Europe uses connector type 2IEC 62196

## EV Battery Chargers

### Level 1 – Home charging

Standard 120 Volt outlet

Charging time

A level 1: charge simply requires a standard 120- volt outlet. The power demand is about the same as a 1500 – watt air conditioner

2 to 5 miles of range per hour of charging.

### Level 2 – Home charging

Charging Station 240-Volt

Charging time

A level two can be done using a 240-volt charging station installed outside your home or inside your garage. The power demand is comparable to a stove or clothes dryer.

10 to 20 miles of range per hour of charging.

**Level 3 – Not for home charging .These are Direct Current Fast Chargers. They use a 480 volt system and can charge a vehicle to 60 to 80 miles of range in 20 minutes of charging.**

## Public Chargers

Typical slow speed public ( **Level 2** ) EV chargers offer about 20 miles of driving distance per hour at the plug

The next ( **level three** ) **DC Quick** charger, called a fast charger, can add about 75 miles in 30 minutes at the plug

**Note...** Fast chargers are designed to quickly fill a car's battery—not all the way, which would stress the battery, but usually up to about 80% --so people can get back on their way.

Volkswagen is working on a charging network in the usa. It's being funded as part of there settlement with US regulators over the automaker's diesel emission scandal .



**# of PUBLIC EV  
CHARGING STATIONS**

CANADA --	BC 116, ALBERTA 46, SAS. 18
845	
	MANITOBA 10, <u>ONTARIO 190</u>
	QUEBEC 376, NB 37, NS 32, PEI 12
	NEWFOUNDLAND / Labrador 8
USA --	67,500
CHINA --	330,00 <b>NOTE</b> - Shanghai alone has a population 21 Million
MEXICO CITY	HAS A POPULATION of 21 .6 million

## **Other Things you should Know About LITHIUM BATTERY Chargers**

**GM is tripling the size of its EV fast charging network. 2,700 chargers over the next five years in conjunction with its Evgo partnership. To be installed in the USA.**

**Tesla on the other hand is adding Fast Charging network along Interstate routes to facilitate long –distant drives.**

**Note: Tesla's network only charges its own vehicles. While Evgo's pumps can charge a variety of vehicles ( including Tesla) models.**

## Towing an EV

- You cannot tow an EV vehicle –you will require a Flat Bed Tow Truck or Trailer

However if your EV runs out of juice while driving, most manufacturers have left enough energy in the battery to allow you to drive very / very slowly to the side of the road.

**NOTE.** The AAA in California and some other states have now equipped some of their trucks with auxiliary charging units to assist you.

In France a manufacturer has produced a small trailer to tow a reserve battery.

## Buying a USED EV

**Depreciation.** The purchaser of a used EV may encounter a sharp depreciation curve.

**Obsolescence.** The level of obsolescence will far exceed that of a conventional vehicle.

**Resale Value.** The resale value of such an EV vehicle could become a significant burden for those that own them.

**Battery Recycling.** While Lithium-ion batteries can be recycled, we do not have a massive market for them.

**Warranty.** One does wonder what will happen when the owner looks for a repair shop.

**Driving in Remote Areas.** Charging stations are not expected in off-the-beaten-track for some time yet.

Current Slides 31 to 38

## CLOSING AND CURRENT EVENTS

- **Special web sights to visit.**

[www.ChargeHub.ca](http://www.ChargeHub.ca) ... then scroll down 3or4 items to Canada EV Charging Station Directory.

then click on header \*MAPS-to see individual Provincial charge stations.

then click on header GUIDES- to receive all about charging your EV.

then click on to header CALCULATOR to see your location miles.

then click on to header STORES to locate where to purchase charging  
items

. **Special note:**

[https://unspace.uwaterloo.ca/bitstream/handle/10012/7350/Lo\\_Joshua.pdf:sequence=1](https://unspace.uwaterloo.ca/bitstream/handle/10012/7350/Lo_Joshua.pdf:sequence=1)

This web sight is a University of Waterloo, Student Thesis... Re: effect of cold weather on Lithium Batteries.

## Electric Vehicle Web Sights

- [https://unspace.uwaterloo.ca/bitstream/handle/10012/7350/Lo\\_Joshua.pdf:sequence=1](https://unspace.uwaterloo.ca/bitstream/handle/10012/7350/Lo_Joshua.pdf:sequence=1)  
 Student Thesis presented to the u of Waterloo – Re- effect of Cold temperature of EV Batteries
- . IVY Charging Network  
 Series of web sights of the Ontario Power generation re charging locations and much more
- . [www.ChargeHub.ca](http://www.ChargeHub.ca)  
 Charging location/maps of all provinces, and additional charging information
- . Canadian Tire charging stations  
 Trudeau Liberal Gov. gives Can. Tire 2.7 million for adding electrical charging stations.
- . Plug Share Canada  
 All about charging EV's and the use ?selection of charging cables
- . The Frontier for public EV charging : accessibility/electric Autonomy Canada  
 click on 4<sup>th</sup> item and see all about Canadian charging EV's --- you can receive requested updates
- . List of Canadian Roadside assistance Organizations
- . [GetElectricVehicle.com](http://GetElectricVehicle.com)
- . Electric Mobility Canada
- . [PlugNDrive Canada](http://PlugNDrive Canada)
- . Hibar systems Ltd  
 Richmond Hill Company owned by Tesla

## More Web -Sights

- Electricity generation in Ontario
  - Considerations When Buying an Electric Vehicle
  - <https://electicautonomy.ca/2020/05/28/canadian-fuel-cell-technology/>
    - . Hydrogen Technology
    - .Electric Vehicle Motors
    - .Interesting Engineering
- A Daily mailer to your computer

- The world's biggest auto companies are preparing their most aggressive push to date, with **200 new EV car models** set to launch in the next **FIVE** years.
- Ford & GM combined as production ramps up despite the Corona Virus.
- VW is investing \$50 billion in electric vehicles, laying the groundwork for a family of new cars and battery factories. GM is pouring \$20 billion into EVs and Ford is investing \$11 billion. VW's mammoth investment stands out as a substantial shift in EV support from the world's largest automaker and raises the odds of electric vehicles.
- It's one of the most active time frames in the history of electric cars.
- Nikola –an electric van maker, Workhorse Group has invested in Lordstown Motors an new EV startup pickup truck company preparing to start production later in 2020. The factory is located in Ohio, ( old GM plant). Nikola produces Hydrogen fuel cell vehicles and is located in California. Just broke ground for new factory in Phoenix Arizona.
- Rivian– will be producing the Rivian pickup truck in 2021 and Ford will be using the Rivian electric chassis to mount their 2021 F150 EV pickup. And later a Lincoln EV. Combined Ford and Rivian motors will be building the first of 10,000 of 100,000 delivery vans for Amazon, starting in 2021.
- Ford Motor Co. is planning to develop 13 Electric models by 2021.
- Ford is also planning to build a Gas / hybrid, with 700 mile range during 2021.



Slide 32- continued.

- Ford Motor Co. is planning to develop 13 Electric Models by 2021, and to build a Hybrid F150 Pickup with gas / electric Rivian chassis capable of 700 Mile range in 2021.
- VW aims to produce 1 million electric vehicles by 2023, and over the next 10 years, the world wide goal is 22 million. And has joined forces with a Swedish company Northvolt to invest 450 million in a new Battery factory to be built in Germany
- Next updated Ford Mustang Mach-E will feature a 15 –inch touch screen display, over-the-air software updates and remote parking with automatic highway driving added remotely.
- GM is getting aggressive in EV cars targeting 1 million in EV sales by 2025 . Coming first are the Hummer truck and SUV, the Cadillac Lyriq SUV and the Cadillac Celestiq sedan. GM is taking this Expensive vehicle market because EV cars cost more to produce than gas or diesel and with the expensive luxury vehicles they plan to make a profit. Before tackling the Family vehicles.

**THE BIG QUESTION WILL BE---WILL PEOPLE ACTUALLY BUY MORE EV'S?**

TESLA.. Is currently building more Mega-Factories, especially for new battery introductions in Berlin, Germany and a new factory in Austin Texas to build the new Model Y SUV and the pickup truck and Tractor Trailer EV. Tesla state they will also have level 5 Autonomous Driving figured out some time this year

AMAZON... has awarded Rivian Motors to supply 100,000 Delivery Vans

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- Honda- plan to shift 2/3 of total production to electric vehicles by year 2030.
- BMW plan to sell 15 to 25% of their total cars as electric vehicles by 2025 and 12 EV's by 2025.

. MERCEDES –will use Nvidia Electronics technology in all their vehicles from year 2024 onward. And will have software capability including maintenance schedule & vehicle electronics updated using A1 Technology. Mercedes are planning to invest \$23 billion on new future Battery cells through 2030.

INFINITY- announced that by 2021 all newly introduced vehicles will be electric or hybrid.

NISSAN- unveils 300 mile ARIYA electric SUV with liquid cooled battery.

HYUNDAI –announced it plans 16 new electric vehicles by 2025

**NOTE:** South Korean Ministry of Environment - just announced that as of July 20<sup>th</sup>, 2020 that Korea pledge \$61 Billion for NET ZERO green society by 2025 . This will put many people to work following the tragic Virus situation.

The city of Edmonton just took delivery of 21 “Proterra Electric City Busses , with another 19 busses on order to be added to the fleet by end of 2020.

Toronto Transit have also purchased some Proterra busses ( made in USA)

- Quebec city has a fleet of electric busses, a fleet of Garbage trucks from Lion ELECTRIC CO. Saint Jerome Quebec and Pennsylvania USA.
- The Province of Quebec are planning to purchase a few Electric powered Saint Laurence ferries.

. MITSUBISHI MOTORS—on July 27<sup>th</sup> Mitsubishi announced to its retail Dealers in the UK their plans to EXIT the UK and European car markets.

And last month Mitsubishi's Alliance partners—Renault – and Nissan, both announced details of global efforts to cut costs and improve efficiencies across their manufacturing operations. And with the thought that Mitsubishi become the brand for America, Renault for Europe and Nissan for Asia. It remains to be seen if that plan materializes.

. SOUTH KOREA investigate safety issues in Tesla Vehicles. The investigation will take anywhere from 6 months to a year.

. New Lithium mines planned for Canada in Manitoba may challenge pollution rules.

Hyundai races to electric in place of Hydrogen.

Hyllion's Hybrid Heavy truck –California operation aims to compete with Tesla & Nikola in Electric-Powered Tractor Trailer ( Big Rig)

Daimler- just formed a joint venture with Sweden's Volvo AB to develop hydrogen fuel cell systems for heavy trucks

Flying Cars are now legal in New Hampshire , USA

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**There vehicles will no longer by built after 2020.**

**Acura RLX**

Alfa Romeo 4C

BMW i8

Chevrolet Impala

Chevrolet Sonic

Dodge Grand Caravan

Dodge Journey

Honda Civic Si and Honda Coupe, Honda Fit

Lexus GS

Lincoln Continental (temporarily) and Lincoln MKZ

Mercedes-Benz SLC/SLK

Toyota Yaris

NOTE: all- electric pickups from GM, Tesla, Ford / Rivian, Nikola, and Lordstown motors aren't expected to go into production until at least next year.