

Why Your Next Vehicle Should Be Electric

Gary Heaton

November 10, 2021



Photo Credit: Ann Vail

Agenda

- Quick personal introduction
- Electric Vehicle (EV) presentation
- Q&A



Gary Heaton, President of Drive
Electric Cincinnati (Chapter of
Drive Electric Ohio)



Why talk about Driving Electric?

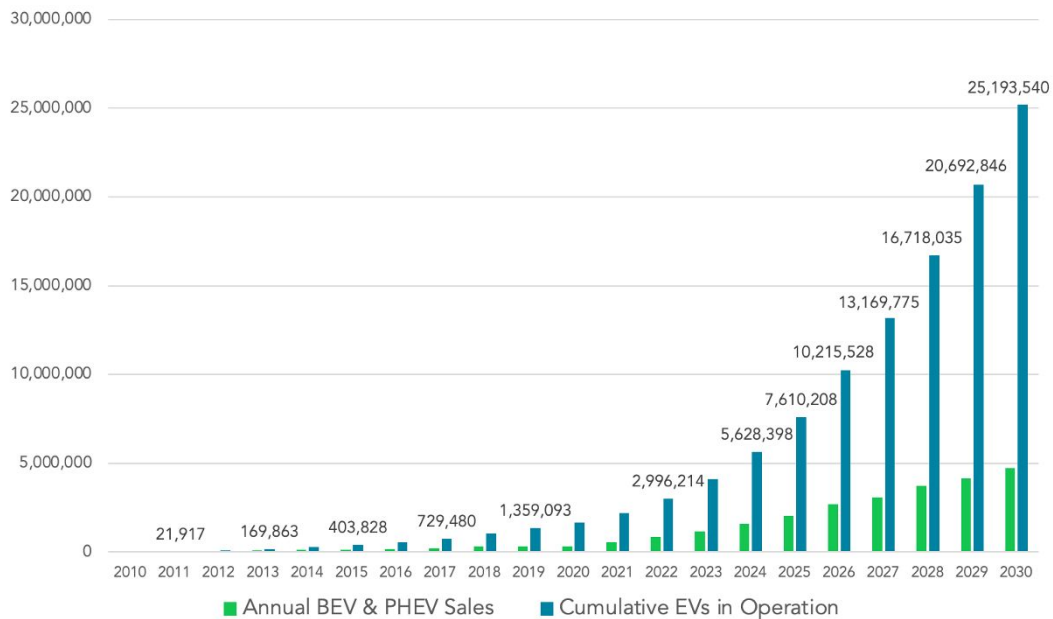
Recent EV Headlines

- Governors of five Midwestern states create an EV charging network
- Tesla Model 3 Is Best-Selling Premium Sedan in the World
- For the First Time in History, Electric Car Sales Overtake Diesel Vehicles in Europe
- GM boosts EV and AV investments to \$35 billion by 2025
- Tesla Appears on Cover of National Geographic October Edition—The Future of Driving is Here and it's Electric!



Why talk about Driving Electric?

Cumulative US Electric Vehicles In Operation: 2010-2030



Historical Data: GoodCarBadCar.net, InsideEVs, IHS Markit | Auto Manufacturers Alliance, Advanced Technology Sales Dashboard | Research, Forecast & Chart: Loren McDonald / EVAdoption

Deciding about Driving Electric

- Why drive electric?
- Where can I charge my Electric Vehicle (EV)?
- Driving electric: What will be different?
- EVs available now & coming soon



Why Drive Electric?

Driving Experience

- Zippy – experience the “EV smile”!
- Quiet
- Smooth – no gear changes



Safety

- Great front crash test ratings
 - Space up front for crumple zone
- Stable – low rollover risk
 - SUV with lowest rollover risk ever recorded is an EV



Why Drive Electric - continued

Public Health

- Zero tailpipe emissions:
better air quality



- Electric grid is getting cleaner!

Convenient & Cost Effective

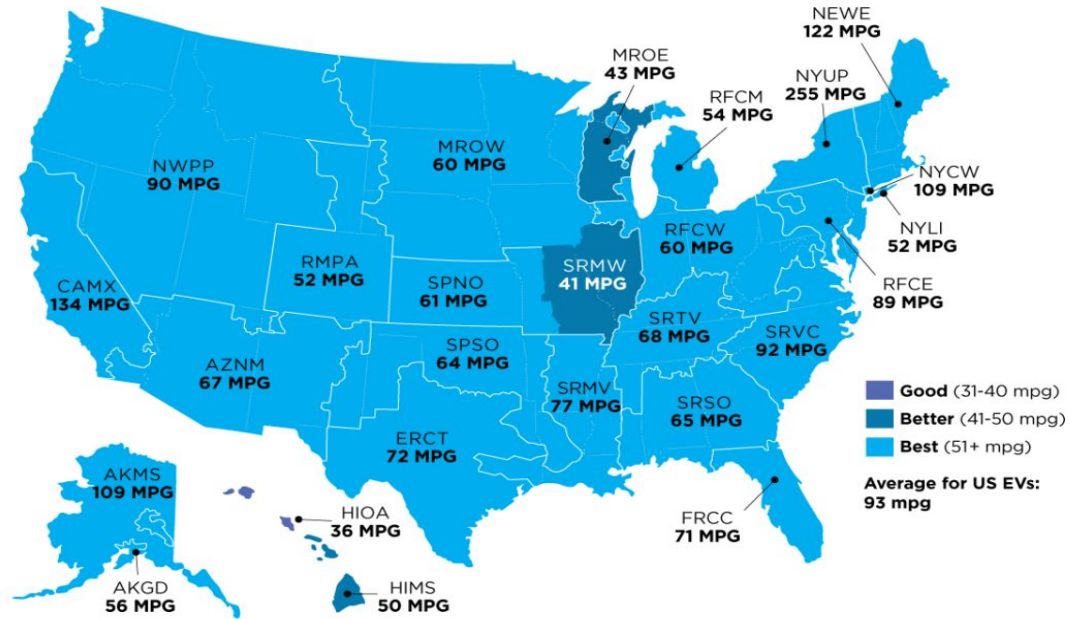
- No more oil changes, no more gas stations, far less maintenance and fuel cost
- # available EV models growing fast, tax incentives

Drive the Future

- EVs get latest tech
- Software upgrades

Why Drive Electric - continued

EV Emissions as Gasoline MPG Equivalent Average EV, 2021*



* based on 2019 reported electricity generation emissions

More on EV Maintenance & Fuel Savings

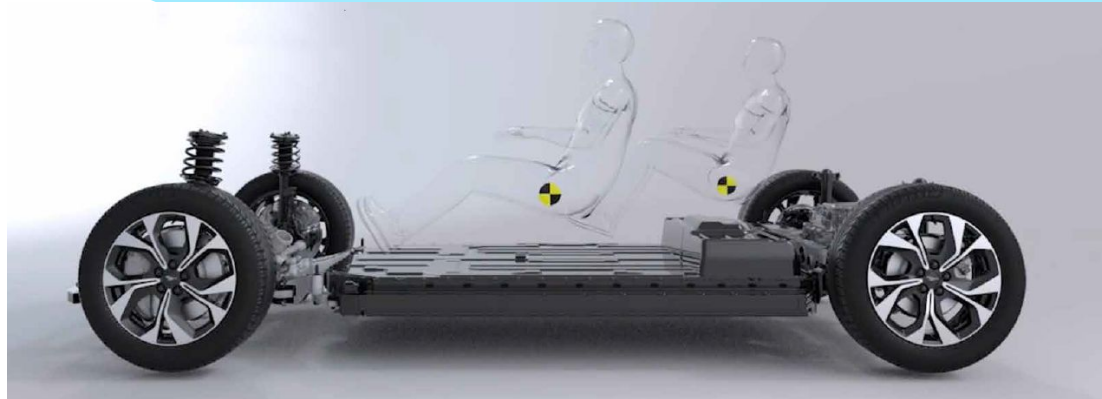
Maintenance

- **Save an average of \$4,600 (50%)** in vehicle lifetime repair/maintenance costs vs a gasoline-powered car ([Consumer Reports data](#))
 - Brakes don't wear out - deceleration charges battery!
 - Powertrain has 1/100 moving parts vs gas cars - "skateboard" design

Fuel (charging at home)

- **Save \$1,200/yr in fuel cost**
 - Gas cost/yr \$1,700 goes to zero
 - Electric bill goes up \$500/yr (using Chevy Bolt mileage)

(Using US averages: 13,500 mi/yr, \$3.19/gal gas, 13.3 cents/kWh)



If I Drive Electric, Where Can I Charge?

Charge at home if you can

- Cheapest and most convenient
- 30% EV charger federal tax credit available (faster charging with dedicated 220v circuit)
- Drive on sunshine if you have a solar array



Workplace Charging

- Second-most convenient
- Boon for street-parkers and renters who can't charge at home

Away-from-home charging: How to find it

- Built into car's app or nav system
- Google Maps & Apple Maps
- Plugshare, A Better Route Planner

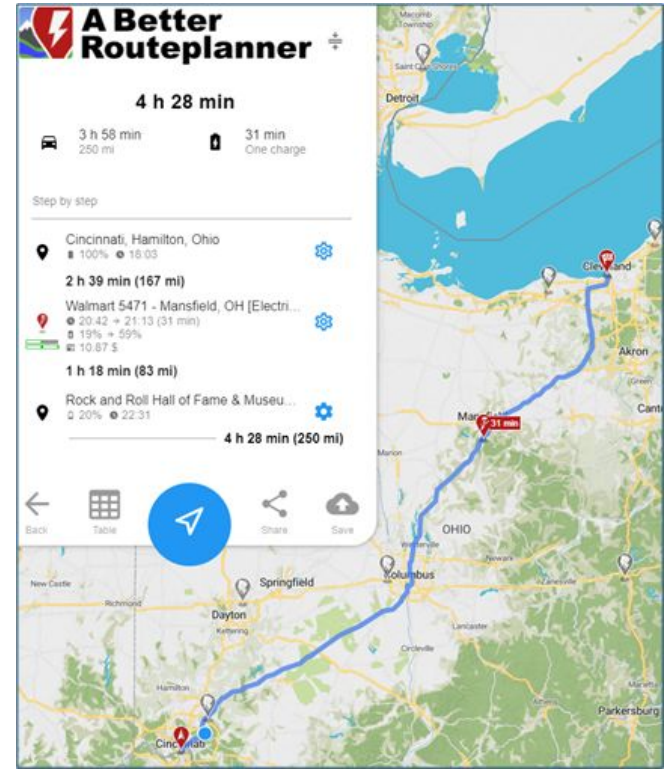
Number of public chargers is growing fast! May be accelerated by federal infrastructure bill

What Will Be Different Driving Electric?

Things to **START** doing

- Enjoy driving!
- Enjoy “preconditioned” comfort
 - No idling for heat/AC
- Refuel proactively
 - *Plug in (like your mobile), don't wait for near-empty*
 - *Charge overnight—ready to go in morning*
- If planning an EV road trip
 - *Plan charging stops (high-power “DC fast” chargers)*
 - *Consider stays at hotels with EV chargers*
 - *Add time for charging*

Road trip: Cincinnati to Rock n Roll HOF



What Will Be Different Driving Electric?

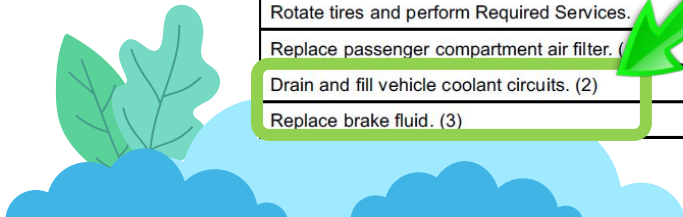
Things you can **STOP** doing 😊

- Braking going down hills! (charges battery)
- Going to gas stations & monitoring price of gas
- Taking car into the shop for
 - Oil changes, belts, spark plugs, brakes, catalytic converter, muffler, transmission, etc.

Example EV
maintenance
schedule
(Chevy Bolt)

Maintenance Schedule Additional Required Services	12 000 km/7,500 mi	0 km/15,000 mi	0 km/22,500 mi	0 km/30,000 mi	0 km/37,500 mi	0 km/45,000 mi	0 km/52,500 mi	0 km/60,000 mi	0 km/67,500 mi	0 km/75,000 mi	0 km/82,500 mi	0 km/90,000 mi	0 km/97,500 mi	km/105,000 mi	km/112,500 mi	km/120,000 mi	km/127,500 mi	216 000 km/135,000 mi	228 000 km/142,500 mi	240 000 km/150,000 mi
Rotate tires and perform Required Services.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Replace passenger compartment air filter. (1)			✓			✓			✓			✓			✓			✓		
Drain and fill vehicle coolant circuits. (2)																				✓
Replace brake fluid. (3)																				✓

Replace fluids at 150k mi or 5 yrs



EVs Available Now: “Sticker Shock”?

- Higher EV up-front cost is a barrier—but:
 - Up to \$7,500 federal tax credit (except Tesla and Chevy)
 - Use *cost per mile* (captures cheaper EV fuel & maintenance)
 - Battery replacement is not an issue – 100k mile warranty!
- Examples (including \$7,500 federal tax credit)
 - \$44k for Ford Mustang Mach-E comparable to \$30k for a Ford Escape over 5 years (Ford estimate)
 - BMW MINI Electric 2-door \$500 *cheaper* than gasoline version

POTENTIAL BENEFITS OF
ELECTRIC VEHICLE OWNERSHIP
OVER 5 YEARS:

\$14,120

\$7,500: POTENTIAL
GOVERNMENT INCENTIVE

\$431: POTENTIAL ANNUAL
SCHEDULED MAINTENANCE
SAVINGS

\$893: POTENTIAL ANNUAL
FUEL SAVINGS

Source: Ford web page for Mustang Mach-E

Sedans



Nissan Leaf

MSRP: \$27,400

Range: 149-226 EV miles

Zero-60: 6.5 to 7.4 sec

(\$7,500 fed tax credit)



MINI Electric 2-Door

MSRP: \$29,900

Range: 114 EV miles

Zero-60: 6.9 sec

(\$7,500 fed tax credit)



Tesla Model 3

MSRP: \$44,990

Range: 272-358 EV miles

Zero-60: 3.1 to 5.8 sec

(No federal tax credit)



BMW i3 (discontinued)

MSRP: \$44,450

Range: 153 EV miles

Zero-60: 7.2 sec

(\$7,500 fed tax credit)



Tesla Model S

MSRP: \$94,990

Range: 405 EV miles

Zero-60: 1.99 to 3.1 sec

(No federal tax credit)



Lucid Air Dream Edition

MSRP: \$169,000

Range: 471-520 EV miles

Zero-60: 2.5 to 2.7 sec

(\$7,500 fed tax credit)

SUV/Crossover/Minivan Plug-in Hybrids



Kia Niro PHEV

MSRP: \$29,590

Range: 26 EV miles

Zero-60: 8.7 sec

(\$4,543 max fed tax credit)



Ford Escape PHEV

MSRP: \$33,075

Range: 37 EV miles

Zero-60: 9.0 sec

(\$6,843 max fed tax credit)



Toyota RAV4 Prime PHEV

MSRP: \$38,350

Range: 42 EV miles

Zero-60: 5.5 sec

(\$7,500 max fed tax credit)



Chrysler Pacifica Hybrid

MSRP: \$44,920

Range: 32 EV miles

Zero-60: 7.8 sec

(\$7,500 max fed tax credit)

Crossover/SUV < \$40,000



Chevy Bolt EV

MSRP: \$31,995
Range: 259 EV miles
Zero-60: 6.5 sec
(No federal tax credit)



Kia Niro EV

MSRP: \$39,990
Range: 239 EV miles
Zero-60: 6.5 sec
(\$7,500 max fed tax credit)



Chevy Bolt EUV

MSRP: \$33,995
Range: 247 EV miles
Zero-60: 7.0 sec
(No federal tax credit)



VW ID.4

MSRP: \$39,995 (\$43,675 AWD)
Range: 260, 249 EV miles
Zero-60: 7.4, 5.7 sec
(\$7,500 max fed tax credit)

Crossover/SUV \$40k-\$60k



Ford Mustang Mach-E

MSRP: \$42,895

Range: 211-305 EV miles

Zero-60: 3.5 to 6.1 sec

(\$7,500 max federal tax credit)



Tesla Model Y

MSRP: \$57,990 AWD

Range: 330 EV miles

Zero-60: 3.5 to 4.8 sec

(No federal tax credit)



Volvo XC40 Recharge

MSRP: \$55,300

Range: 223 EV miles

Zero-60: 4.7 sec

(\$7,500 max fed tax credit)

Willing to spend more than \$60,000?



Audi e-tron S & Sportback

MSRP: \$65,900, \$69,100
Range: 212, 212 EV miles
Zero-60: 5.5 sec
(\$7,500 max fed tax credit)



Jaguar I-Pace

MSRP: \$69,900
Range: 222 EV miles
Zero-60: 4.5 sec
(\$7,500 max fed tax credit)



Porsche Taycan

MSRP: \$82,700
Range: 200-227 EV miles
Zero-60: 2.6 to 5.1 sec
(\$7,500 fed tax credit)



Tesla Model X

MSRP: \$104,990
Range: 351 EV miles
Zero-60: 2.5 to 3.8 sec
(No federal tax credit)

Used Electric Cars under \$20,000

Good choices likely to be available:

Plug-In Hybrid: Chevy Volt













All-Electric:

- Chevy Bolt
- Nissan Leaf
- BMW i3

(sample search results from [MyEV.com](https://www.myev.com))

218 EVs for sale near Cincinnati, OH

Sort by Relevance Grid Save

 <p>ALL OF OUR CARS COME CARVANA CERTIFIED</p> <p>2015 BMW i3 </p> <p>Price: \$18,990 Mileage: 21,037 Location: Nationwide</p>	 <p>ALL OF OUR CARS COME CARVANA CERTIFIED</p> <p>2012 MITSUBISHI I-MIEV </p> <p>Price: \$10,580 Mileage: 12,725 Location: Nationwide</p>	 <p>2017 BMW i3 </p> <p>Price: \$19,990 Mileage: 23,206 Location: Nationwide</p>
 <p>2017 CHEVROLET VOLT </p> <p>Price: \$16,590 Mileage: 35,844 Location: Nationwide</p>	 <p>McCLUSKEY</p> <p>2017 CHEVROLET BOLT </p> <p>Price: \$20,699 Mileage: 25,497 Location: Cincinnati, OH</p>	 <p>SOMETIMES PHOTOS JUST DON'T CUT IT.</p> <p>TAKE A 360° HIGH RESOLUTION TOUR OF THIS CAR!</p> <p>CLICK VISIT DEALER WEBSITE TO EXPLORE THIS VEHICLE AND SEE:</p> <ul style="list-style-type: none">• High-quality views from any angle• Close-ups of vehicle features and any visible imperfections• Stunning detail of the interior <p>2017 CHEVROLET VOLT </p> <p>Price: \$16,590 Mileage: 28,436 Location: Nationwide</p>

Electric Pickup Trucks: Coming Soon



Ford F150 EV "Lightning"

Cost: \$39,974 commercial,
\$52,974 consumer up to
\$90,474

Range: 230, 300 mi target

When: mid-2022



Rivian R1T

Cost: \$67,500

Range: 314 mi

When: Now



*First EV
truck to ship!*



Tesla Cybertruck

Cost: \$39k, \$50k, \$70k

Range: 250+, 300+, 500+

When: late 2022



GMC Hummer EV

Cost: \$80k, \$90k, \$100k+

Range: 250+, 300+, 350+

When: Fall 2021-Spring 2024



Jeep Wrangler 4xe PHEV

Cost: \$48k Sahara; \$51.7

Rubicon

Range: 21 EV miles

When: now



Lordstown Endurance

Cost: \$53k

Range: 250 mi

When: uncertain
(focus on fleet sales)

Next Step: Experience It Yourself

Try driving electric to experience:

- Instant acceleration 😊
- Quiet cabin
- One-pedal driving



2021 Mustang Mach-E

Example: Ford Mach-E

- Zero-60: 3.5 – 6.1 seconds
- Range: 211 – 300 miles

EVs available for test drive

- Tesla, Chevy, Ford, VW, Nissan, BMW, Jaguar, Audi, Volvo, Porsche, Kia



Want to Connect with EV Owners?

Ask EV owners about driving electric, or read latest EV news

- [“Drive Electric Cincinnati”](#) Facebook page
- [“Electric Auto Association”](#) website or Facebook page
- [EVOlveKY](#) website

My contact info

Email: gary.heaton@outlook.com



Drive Electric Cincinnati

Public group · 243 members

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About this group

An affiliate of Drive Electric Ohio (DEO), Drive Electric Cincinnati brings together electric vehicle owners and enthusiasts in the Cincinnati area to provide EV education and work to make driving EVs more accessible. Members share their experience to help others on their drive electric journey. We staff events like ride & drives for driving electric and promote the build-out of local charging infrastructure. We seek to accelerate Cincinnati's transition to electric vehicles as sustainable transportation. [See less](#)



Electric Auto Association

@ElectricAutoAssociation

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View As

4.8 4.8 out of 5 · Nonprofit Organization

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Why Drive Electric

- Much more fun!
- Cheaper to maintain & fuel
- Better for our health
- Safe



Q & A – Ask Your Own, or One of These...

Range, Charging & Road trips

1. Will I get the EPA rated range in my own driving?
2. Is it worth paying thousands more for an “extended range” version of an EV?
3. On a road trip, what EV plug types do I need to know about?
4. What happens if I run out of battery charge?

Batteries

5. How long do EV batteries last?
6. Are EV batteries recycled, or do they go to a landfill?

Clean air

7. Are EVs better for the environment even if fossil fuels generate the electricity to charge them?
8. Why are countries and big cities around the world banning internal combustion engine (ICE) vehicles?

Cost of owning an EV

9. Is my EV eligible for the EV federal tax credit?
10. How can I calculate my fuel cost savings from driving electric?
11. Are there any extra fees for EV drivers?
12. What’s the cost to install a 240v EV charging circuit at home? Is it worth it?

Availability of an EV that meets my needs

13. How is a plug-in hybrid different than an all-electric car? Which is better?
14. Should I wait to buy an electric car?
15. What are the automakers themselves saying about switching to EVs?
16. When will my EV power my house during a power outage?

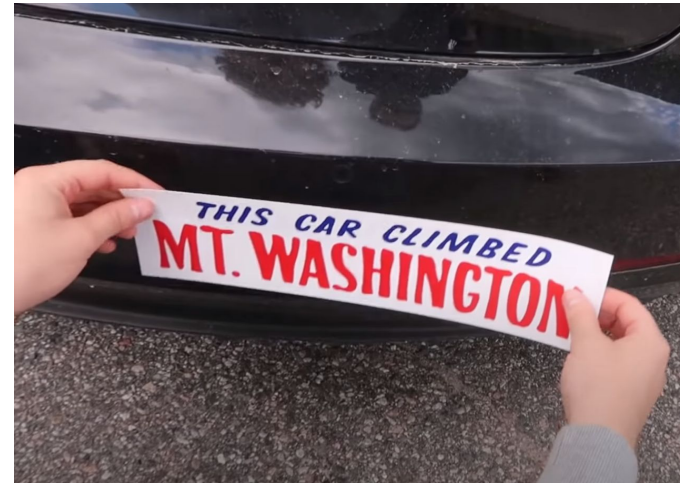
**Supplemental: Answer slides linked to
Questions on Q&A slide**



What Range Should I Expect ?

What to expect for real-life range vs EPA rating

- Close to EPA range in spring, summer, fall
 - More city driving \square better range (opposite of gas cars)
 - E.g. Chevy Bolt range is 215 highway, 278 city
- 20-40% less range in freezing temps
 - But no worries about your engine failing to start 😊
- 10% less in rain
- Uphill reduces range – get it back on descent
 - Mt Washington descent never used brakes!

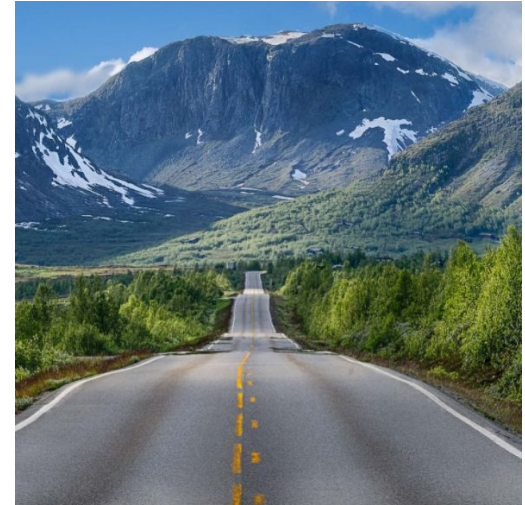


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Worthwhile to Buy More Range?

Buy “extended range”? (if offered, +\$5k or more!)

- No – if you plan to use a second vehicle for any road trips
- Yes – if you take road trips and want flexibility & shorter trip time (*fewer* and *shorter* stops)
 - **Big batteries add range faster**
 - What matters: # **charging minutes to reach next stop** (150-180 miles)
 - Bigger batteries accept higher max current (spreads over more cells)
 - Bigger batteries stay at high charge rate longer – EVs “taper” the rate once over about 50% charged
 - Trips use battery faster (due to 70+ mph highway speeds)



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EV Plug Types I Need to Know About

Road trip charging: **“DC Fast”** stations for highway stops, **“Level 2”** for overnight

Road trip charging:

“DC Fast” chargers add 40-120 miles in 10 min

**“CCS Combo”
plug***



**Nissan is switching to this*



Tesla plug



“Destination” charging:

“Level 2” chargers add ~25 miles per hour of charge (full charge overnight at a charge hotel)

**“J-1772”
plug**



Any EV can use J-1772!



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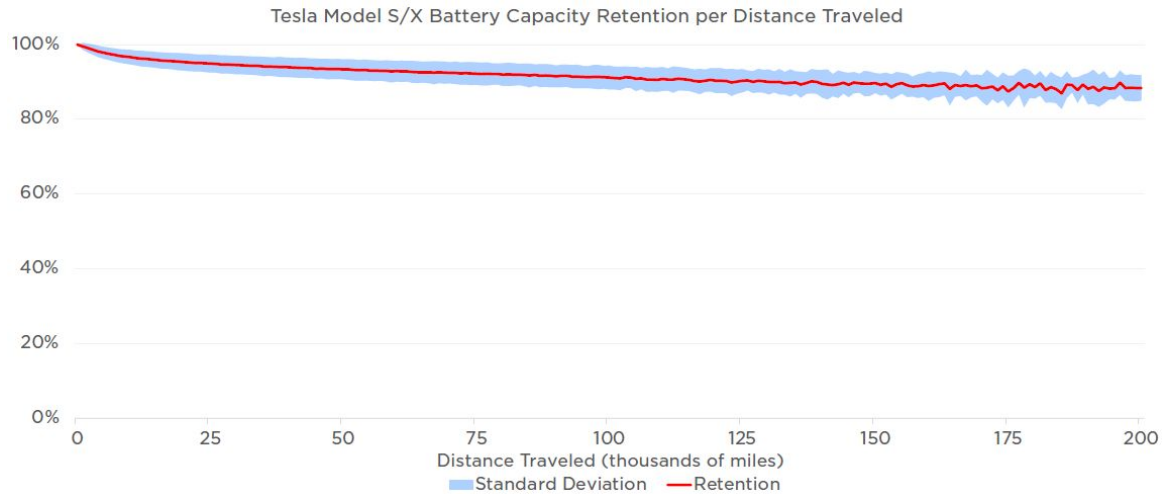
EV Battery Life

Battery Life – Peace of Mind

- Designed to last life of car
- 100,000-mile or more battery warranty on all EVs

Available data

- Tesla: at 200k miles, over 85% of original capacity
- Older Leafs lacked robust battery cooling
 - Check battery capacity if buying a used Nissan Leaf



Source: Tesla 2020 Impact Report

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Battery Re-use & Recycling

Battery re-use

- Used battery packs prized for gas-to-electric car conversions (\$10k on eBay)
- “Second life” batteries for energy storage (e.g. grid or DC fast charging stations)

Battery recycling – active R&D to reduce long-term cost of new batteries

- China requires car battery collection/re-use/re-cycle; EU legislation pending
- Tesla & VW: Recycle all they receive; most of pack is recycled
- Metals in batteries (lithium, nickel, manganese...) infinitely recyclable
- Opportunity beyond auto! Redwood Materials founder JB Straubel:
 “The largest lithium mine is in the junk drawers of America”

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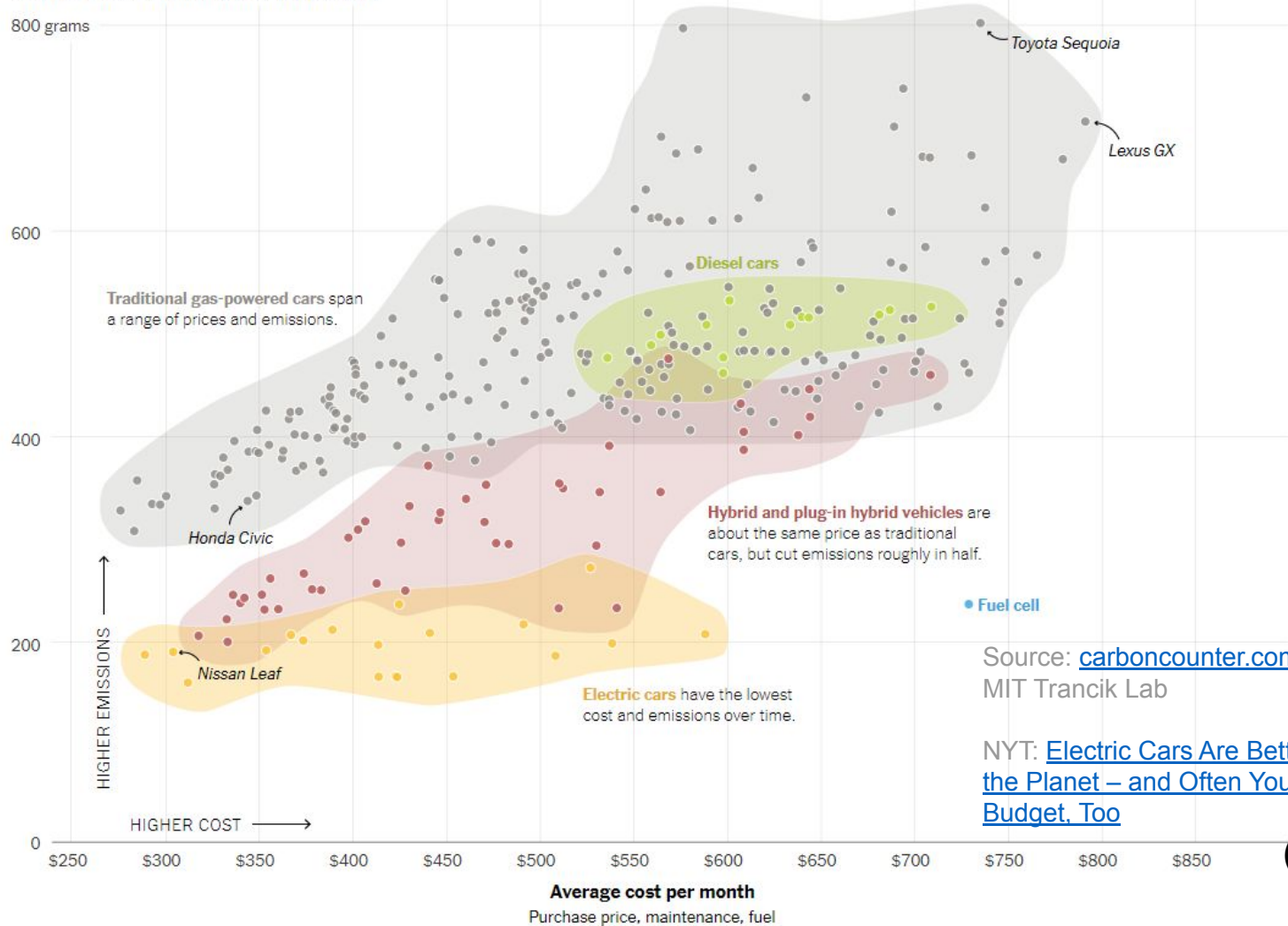
Why EVs Are Better for Environment Even with a “Long Tailpipe”

- Where air pollutants emitted matters!
 - Which do you prefer: miles away, or on street where you’re walking?
- EVs 3x more efficient
 - ICE cars: gasoline-burning furnaces – ~75% waste heat, only ~25% power the wheels.
 - EPA at [fueleconomy.gov](https://www.fueleconomy.gov) uses MPGe to compare gas & electric. EVs > 100 MPGe!
- EVs consistently less polluting
 - How much less depends on state’s electricity generation mix
 - Home solar: Drive on sunshine!
- EVs cleaner over time—[76% of new generation capacity in US](#) now renewable. ICE cars pollute same or worse every year until they are junked.



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Average carbon dioxide emissions per mile




Source: carboncounter.com by the MIT Trancik Lab

NYT: [Electric Cars Are Better for the Planet – and Often Your Budget, Too](#)

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Why Are Some Big Cities Banning ICE?

- Because the city air quality is poor and it's shortening lives!
 - Long tailpipe at powerplant still way better for health of city dwellers – [Toronto study](#)
- 10 EU countries have proposed ICE bans 2030 or earlier 
 - [Over 20 cities have proposed bans](#)
 - London, Brussels, Madrid, Paris, Berlin
- Seeing is believing...

Converting all cars and SUVs in the Greater Toronto area into electric vehicles would cause 313 fewer deaths per year, an estimated social benefit of \$2.4 billion.

“When you have an electric vehicle with no tailpipe emissions, you’re removing a wide range of contaminants – from nitrogen oxides to fine particulate matter – from the near-road environment and shifting them to power plants. The net effect remains a large improvement in air quality.”

New Delhi, India COVID Shutdown Effect

November 2019



April 2020 during COVID shutdown



NBER study: April 2020 shutdown temporarily reduced air pollution enough to save 360 (25%) of the monthly air pollution death toll of 1,500 in the US ([back](#))




European Country Internal Combustion Engine Bans

ICE Ban by European Country (Legislated or proposed)

Country	Diesel Ban	ICE Ban	Auto sales 2019 (MM)
Norway	2025	2025	0.1
Belgium	2026	2026	0.6
Austria	2027	2027	0.3
Denmark	2030	2030	0.2
Germany	2030-2035	2030-2035	3.6
Iceland	2030	2030	0.0
Ireland	2030	2030	0.1
Netherlands	2030	2030	0.5
Slovenia	2030	2030	0.1
Sweden	2030	2030	0.4
UK	2030	2030	2.3
Spain	2040	2040	1.3
France	2040	2040	2.2


Claiming the EV Federal Tax Credit

- Easy to claim with Form 8936. Credit can't exceed your federal tax liability.
- Official page listing tax credit amount for each EV model
 - <https://www.fueleconomy.gov/feg/taxevb.shtml>
- PHEV credits may be <\$7,500

Volvo			1/1/10 to Present
	2019 S60	PHEV	\$5,002
	2020-21 S60	PHEV	\$5,419
	2018-19 S90	PHEV	\$5,002
	2020-21 S90	PHEV	\$5,419
	2020-21 V60	PHEV	\$5,419
	2021 XC40 Recharge Pure Electric P8 AWD	EV	\$7,500

GM and Tesla are the only automakers so far to use up their tax credit quota

General Motors vehicles purchased after 3/31/2020 are not eligible for these tax credits.

Chevrolet		1/1/10 to 3/31/19	4/1/19 to 9/30/19	10/1/19 to 3/31/20
	2017-20 Chevrolet Bolt EV	EV	\$7,500	\$3,750 \$1,875

Tesla vehicles purchased after 12/31/2019 are not eligible for these tax credits.

Tesla Motors		1/1/10 to 12/31/18	1/1/19 to 6/30/19	7/1/19 to 12/31/19
	2012-20 Model S	EV	\$7,500	\$3,750 \$1,875
	2016-20 Model X	EV	\$7,500	\$3,750 \$1,875
	2020 Model 3 Standard Range	EV	\$7,500	\$3,750 \$1,875

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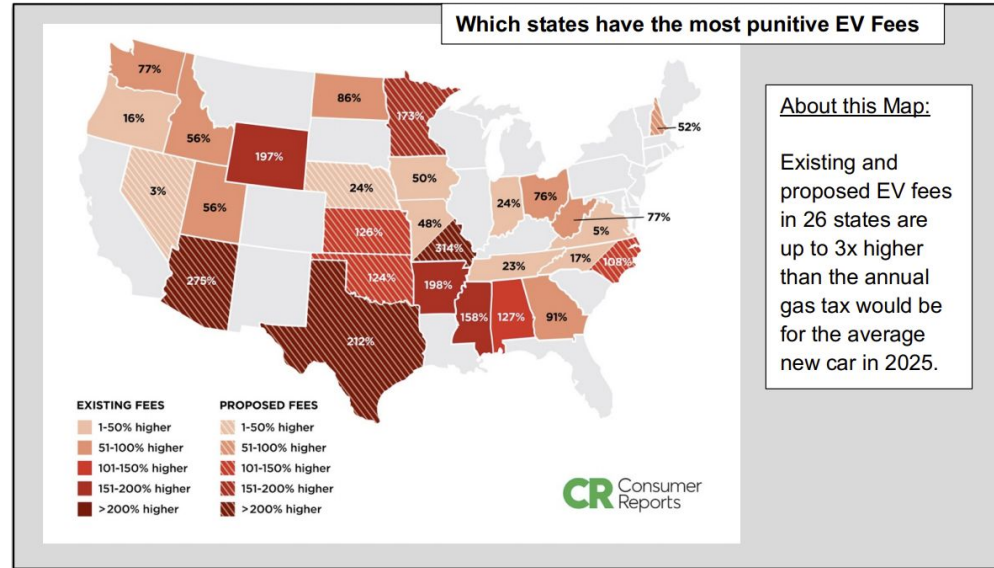
Calculate Fuel Savings from Driving Electric

Enter # miles you drive in a year <input type="checkbox"/>	13,500	National avg miles driven/yr (DOT estimate June 2020)
Gas car annual fuel cost calculation		
Enter MPG for your gas car <input type="checkbox"/>	24.9	EPA national average fuel economy miles per gallon including auto model year 2019
	542	Gallons of gasoline consumed by average vehicle to go national avg miles driven/yr
Enter gas price in your area <input type="checkbox"/>	\$ 3.19	US national average gas price per gallon (per AAA as of August 8, 2021)
	\$ 1,728	Gasoline cost/year to drive the national avg miles/yr
Electric car annual fuel cost calculation		
EV's EPA-estimated miles per kWh <input type="checkbox"/>	3.45	Your EV's miles per kWh (from www.fueleconomy.gov), using Chevy Bolt as example
	3,915	kWh your EV consumes to go national avg miles driven/yr
Your electricity price per kWh <input type="checkbox"/>	\$ 0.133	US average residential cost of electricity per kWh (rolling 12 months ending May 2021)
	\$ 521	Electricity cost/year to drive your EV the national average miles/year
(Reduce this fuel savings/year by the amount of your state's EV fee, if any)	\$1,207	EV fuel savings/year
	\$17,887	EV fuel savings lifetime of car
	200,000	miles in vehicle lifetime
	14.8	years for average vehicle to reach 200k miles

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Fees for Electric or Hybrid Vehicles

- **Depends on your state**
 - Annual fees for electric vehicles range from zero to over \$200
- **Ohio example**
 - \$200 if the vehicle has a plug
 - \$100 for hybrids (e.g. Toyota Prius)
 - 76% higher than gas tax paid by gas car driver, per CR analysis
- **Typical: Pay with registration** – no reduction if low miles driven



What's an Electric Car?

Three types of vehicles have batteries for propelling the car:

1. **HYBRID**... Drive on gasoline more efficiently with the help of battery and electric motor
2. **ALL-ELECTRIC**... Drive all-electric on battery-powered motor(s)
3. **PLUG-IN HYBRID (PHEV)**... Drive all-electric for a limited range. Gasoline engine takes over when the battery is depleted.



**If it has a plug,
it's an EV**

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Types of EVs to Consider

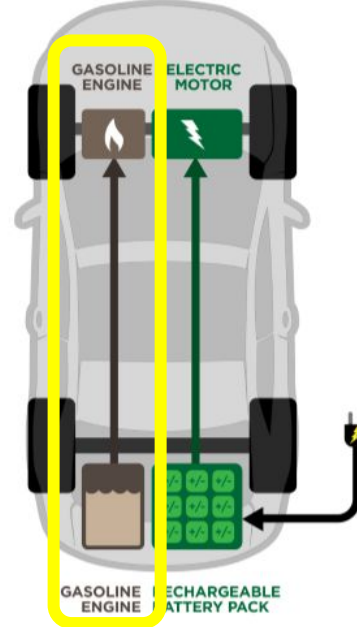
- **All-Electric**

- New EVs: All-electric range 110-405 miles
- Potential road trip “Range anxiety” until chargers more plentiful

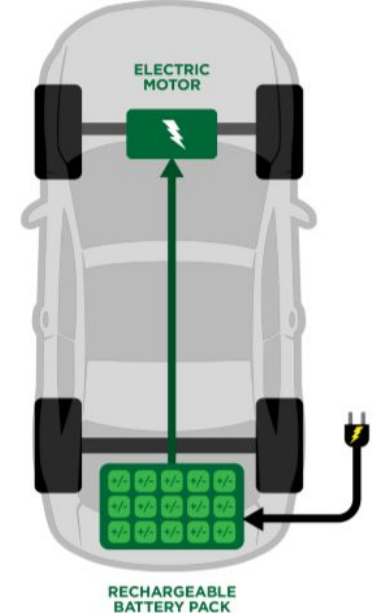
- **PHEV** (Plug-in Hybrid EV)

- No range anxiety (gas engine gives >300-mile total range)
- All-electric range only 10-53 miles—does it meet your “daily driver” need?
- PHEV best of both worlds?
 - Plug in frequently to maximize all-electric driving
 - Less interior space than same-size BEV
 - Gas engine complexity & maintenance

PHEV-Plug-in Hybrid
Electric Vehicle



BEV-Battery Electric
Vehicle



Who Should Wait to Buy an Electric Car

1. Charging convenience: Can't charge at home or work AND no convenient "DC fast" chargers available yet
2. Road trip convenience: No other vehicle available for road trips AND extra road trip time & planning unacceptable
3. Price point, body style or capabilities not yet available
 - E.g. Need to tow more than 3,500-5,000 pounds. (Wait for widespread electric pickup availability in 2022.)
 - New EVs for \$25k are coming!



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What Do Automakers Say about Switching to EVs?

Announced timing for switching to electric for passenger vehicles—earliest first:

- **Jaguar: 2025**
- **Audi: 2026**
- **Alfa Romeo: 2027** (North America, Europe, China)
- **Volvo, Fiat, Lincoln, Cadillac, Bentley, BMW MINI, Rolls-Royce: 2030**
- **Ford: Europe only: 2030**, with all models BEV or PHEV by 2026; 40% of global sales electric by 2030
- **VW: Europe only: 2035**, by 2030 70% Europe vehicle sales all-electric; 50% for US and China
- **GM, Renault: 2035**

Already all-electric in 2021: Tesla, Rivian, Polestar, Lucid



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Can My EV Power My House During an Outage?

Not easily done with today's EVs

- Designed to suck electricity in, not send it out!
(Nissan Leaf exception)

NEW! Beginning in 2022

- EV manufacturers starting to support “Vehicle to Load” (V2L) and “Vehicle to Home” (V2H)
- Long outage? Re-charge EV at DC Fast charger

I want to do this! How do I prepare?

- *Generically:* Budget \$500-\$1,000 for installing transfer switch and wiring to where you park your EV
- *Example solution:* 80-amp “Ford Charge Station Pro” bi-directional charger automatically powers home during outage



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