

Looking Into Electric Cars

Session 2: Chargers



“Before I can sell you an electric car, I’m required to disclose the fact that everyone will ask you how many miles it gets before you have to recharge it.”

Looking Into Electric Cars

Session 2: Chargers



Basic charging
is as easy as
toast

Session 2: Chargers



Convenience First

Changing a 40 year habit of pumping gas is the hardest thing to put aside when it comes to charging an EV. Gas pumps at only one speed and at a specific site. For EVs literally any parking space can be a charger with a choice of dozens of speeds.

This is real important - I'll be saying it a lot.

The goal is to charge when
==> it is convenient. <==

Session 2: Chargers



Convenience First

- 1). The inconvenience of going to a gas station is why people always fill up.
- 2). Unlike gas, where you have to watch the gas pump, with an EV you plug in and just walk away.
- 3). If you have enough charge and you don't leave, you're not doing it right. Unless you're at a good restaurant.
- 4). Remember your goal is convenience



Gas
Vs
Elec



Gas

Most gas pumps transfer the fuel at the same speed. And require and underground tank. The need for a tank restricts where a gas pump can be located. Tank requires proper zoning and limits locations

Elec

Practically any parking space can be an EV charger.
But wiring some is harder than others

Electric chargers have multiple plug types
The there most common are Tesla, J-1772 and CCS.

Electric chargers have multiple levels of charging.
120V Level 1
240 V Level 2
Direct Current DCFC - commonly referred to as level 3

Charging power of the three levels.
Level 1 1.2 kw 1.4 kw
Level 2 3.3 kw 6.6 kw 9.5 kw 11 kw 19 kw
DCFC 20 kw 25 kw 50 kw 62.5 kw 100 kw 125 kw 150 kw . . . 350 kw and up.
and these are just the ones that I am aware of.

This is part of an information sheet that I made up that lists the 3 levels and about 15 different charging speeds.

Session 2: Chargers

Convenience First

Some of the information I present is originally worked up as a PDF.

It is or will be put it on the OLLI download site.

And now we'll go over the one on the right.



Gas
Vs
Elec



Gas

Most gas pumps transfer the fuel at the same speed. And require and underground tank. The need for a tank restricts where a gas pump can be located. Tank requires proper zoning and limits locations

Elec

Practically any parking space can be an EV charger. But wiring some is harder than others

Electric chargers have multiple plug types
The three most common are Tesla, J-1772 and CCS.

Electric chargers have multiple levels of charging.

120V	Level 1
240 V	Level 2
Direct Current	DCFC - commonly referred to as level 3

Charging power of the three levels.

Level 1	1.2 kw	1.4 kw			
Level 2	3.3 kw	6.6 kw	9.5 kw	11 kw	19 kw
DCFC	20 kw	25 kw	50 kw	62.5 kw	100 kw 125 kw 150 kw . . . 350 kw and up.

and these are just the ones that I am aware of.

for home charging = 3.3 and 6.6 kw chargers fit best. With 10 or more hours, the vehicle is fully charged.

for home charging = 19 kw charger finishes too quickly - no benefit for the extra money spent.

for work charging = a shared power 6.6kw could be a good choice. With the varying distances the workers travel.

The Electrify America location at Meijer (under construction) with 150kw and up will be appreciated for travelers and those shopping at Meijer. With shopping trips of 20 minutes or so fits the charging time. On the other hand - if EV driver goes to the movie theater across the street, the EV will finish charging long before the feature is over and the EV driver will be charged extra.

Restaurants might prefer the lower DCFC or fastest level2. Locals might tend to not charge & while those from out of town would like the higher speed to match the distance travelled.

Level 1 speeds are slow but for extended parking, fills a void and for some is adequate for home charging.

As EV Drivers get familiar with their cars they will become selective regarding these characteristics. And choose a charger/location combo with the goal of optimizing the balance between convenience and charging speed.

2023-03-01

Charging - in a perfect world on the top - more like reality below

Level one (AC)
yes its a standard 110 outlet

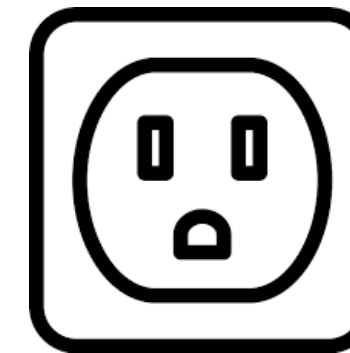
1.3 kw (kilowatt)
10 hours (a good night sleep)
13 kWh or 40 miles

Level 2 (AC)
uses a 220 volt connection

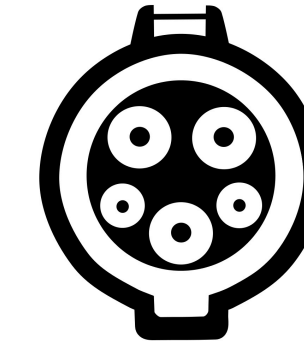
6.6 kw (some are higher)
10 hours
66 kWh or 200 miles

DC Fast Charge (not AC)
sometimes called Level 3
Approaching gas station speed. Most 150 kw
More than 100mi in 15 min
10. Hr -comparison N/A

Newest up to 350 kw



Since fees are hard to collect for level 1 - often free. Bad news - slow and you have to bring your home charger with you. With no fees collected, some locations will be poorly maintained.



The usual rate is \$.21/kWh. Mostly, you will find a charger that is 6.6 kw. The charger may or may not tell you. Some charging stations that can do two cars at a time can give 6.6 kw to each - some share power and give 3.3 kw to each when two cars are connected.



The usual rate is \$.43/ kWh
Charging speed will vary from car to car. (a few)
Ford Mach E 115 kw
VW ID.4 120kw
BMW i3 50 kw
Porsche Taycan 400kw
Don't worry - your car knows and tells the charger what to give. Also with all cars - the charging speed slows as the battery fills to avoid damage to battery and extend battery life.

Note : at all levels (one, two and DCFC) The chargers list how much electricity can be delivered. But each car determines how much it will accept. e.g. I have a car that will only accept 10 amps at level one, even when plugged into a 12 amp or higher charger.

Considering that most EVs use about 33 kWh to go 100 miles at Interstate speeds and no-one will drain a battery to zero. An EV with a 77 kWh battery will allow you to drive a little more than 2 hours at interstate speeds. (Based on 75% of battery used - drivers braver than me might go farther by driving from 100% - 5%) After two hours, most of us would appreciate a break for a rest room and a snack. At a DCFC location you could be back on the road in less than a half hour.

How do drivers find them ?

Newer cars include them on the navigation systems. For myself, I like to look for chargers in the comfort of my home or at a restaurant or coffee shop. Phone Apps. Plugshare finds the most. Chargepoint. ElectrifyAmerica, EVgo, Blink, Supercharger (Tesla), etc. If there is a charging service you like - there is probably an app.

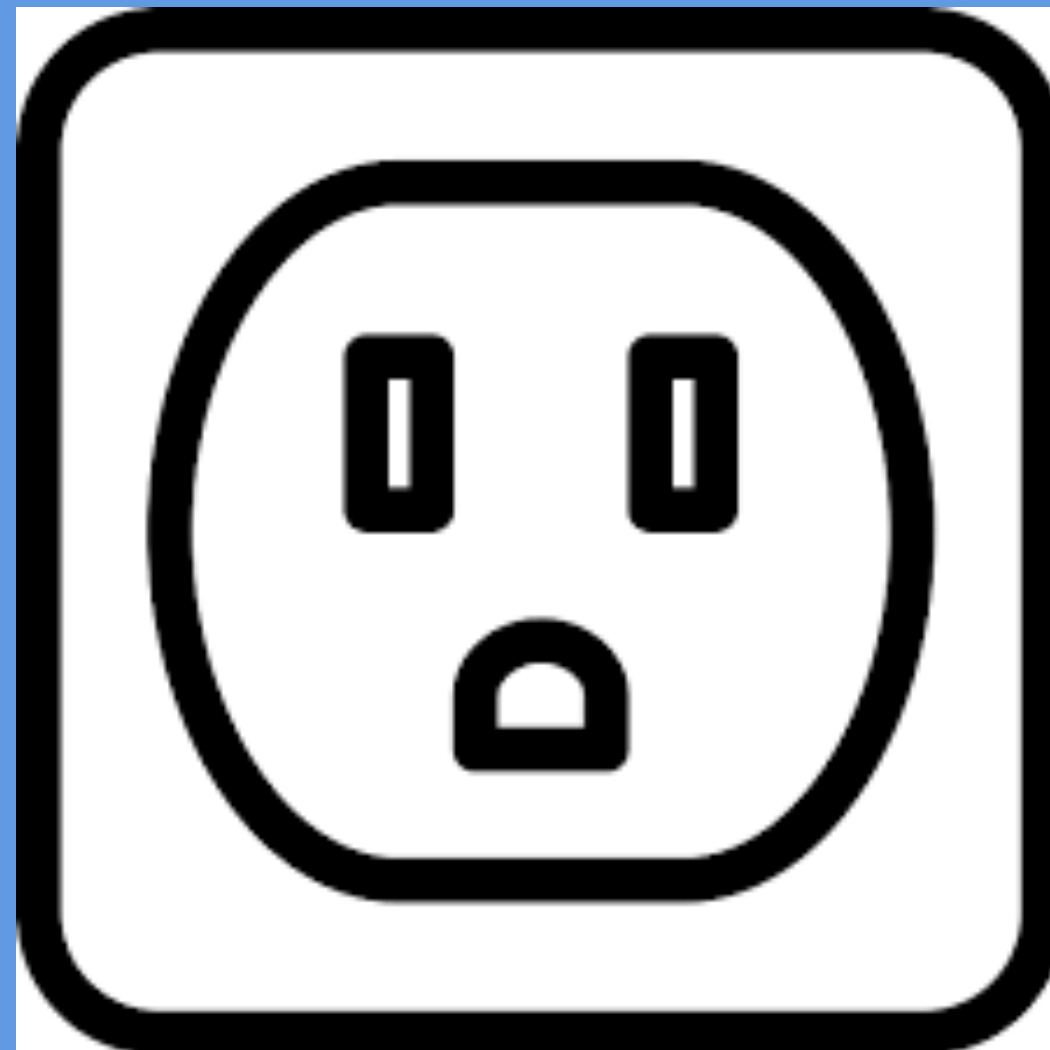
2023-04-04

Session 2 : Chargers

The Basics

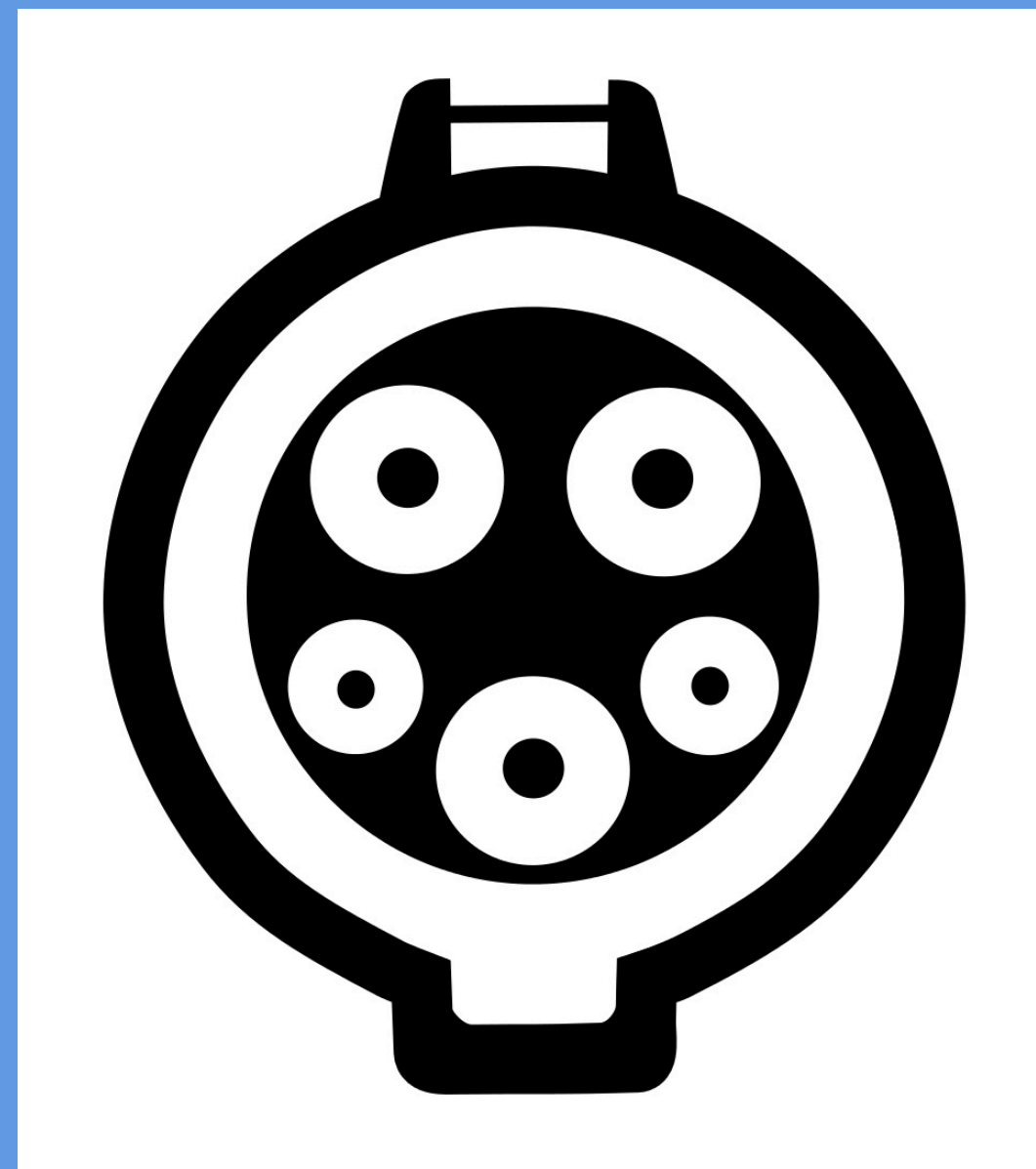
Level one (AC)
yes its a standard 110
outlet

1.3 kw (kilowatt)
10 hours (a good night
sleep) =
13 kWh or 40 miles



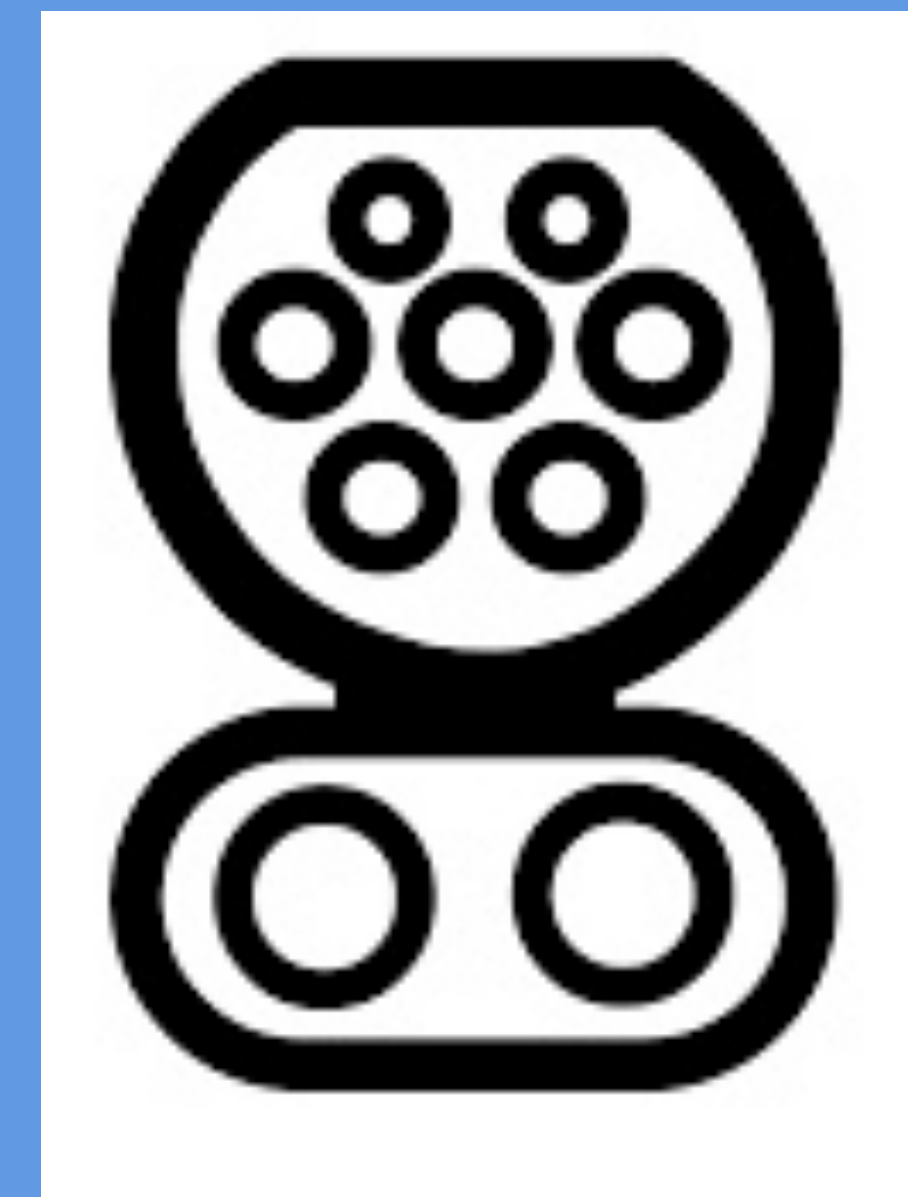
Level 2 (AC)
uses a 220 volt
connection

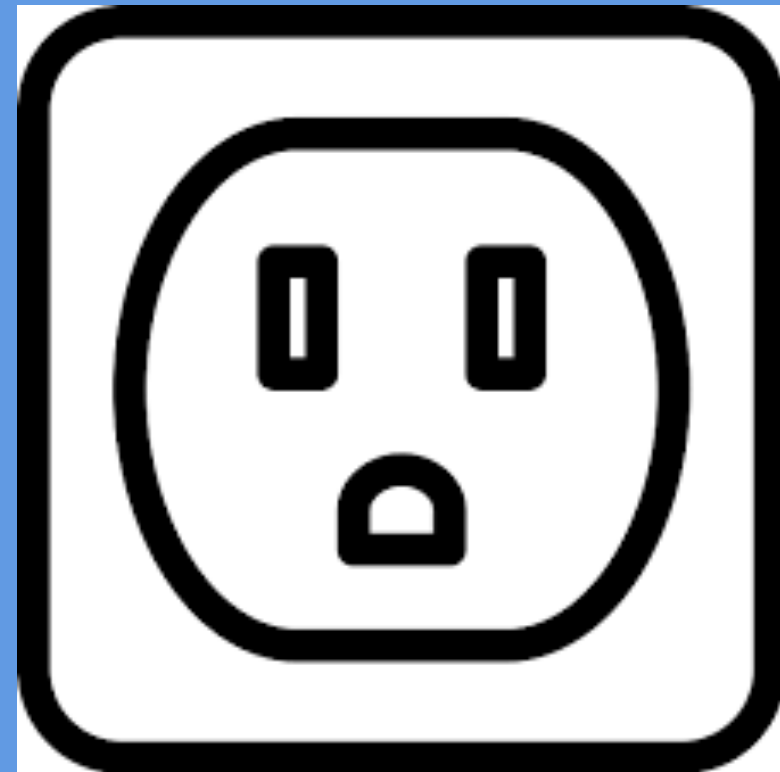
6.6 kw (some are higher)
10 hours. =
66 kWh or 200 miles



DC Fast Charge (not AC)
sometimes called Level 3
Getting closer to a gas
station speed. Most are 150
kw.

Adds more than 100mi in 15
min. (Varies by car and state
of charge)
10 hour comparison not
applicable





This is the home charger that came with the car.

And is plugged into a standard 110 outlet. And not wanting to overload a circuit limits how fast they can be. I have a 15 amp circuit and I think a 12 amp charger is the highest that should be used.

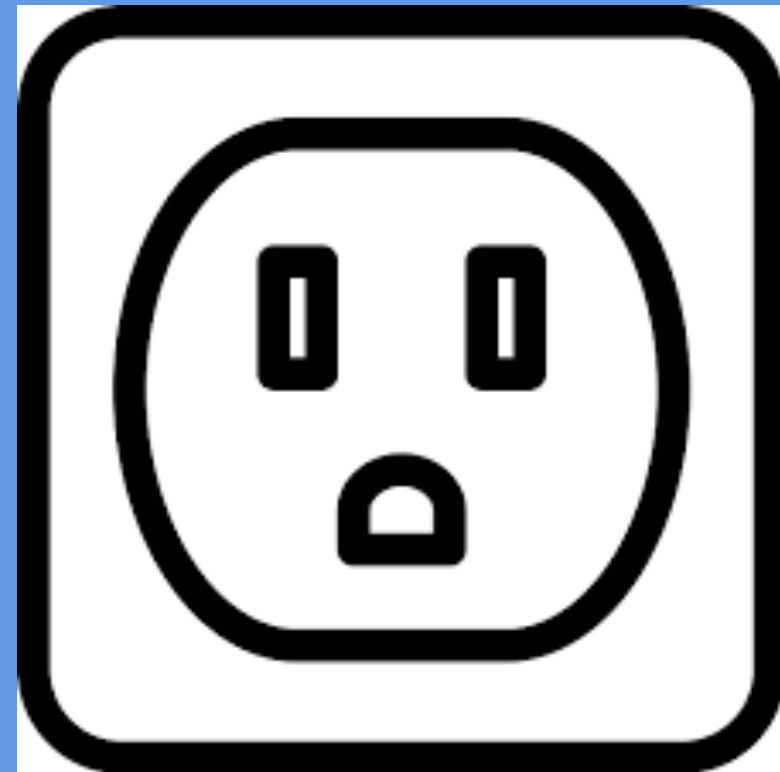
Most of us go home every night.

Plugging in is sooooo easy.

Doing a partial charge each night at home is easier than that weekly trip to the gas station.

Note: 5 nights in a row can equal 200 miles.

And so very convenient.



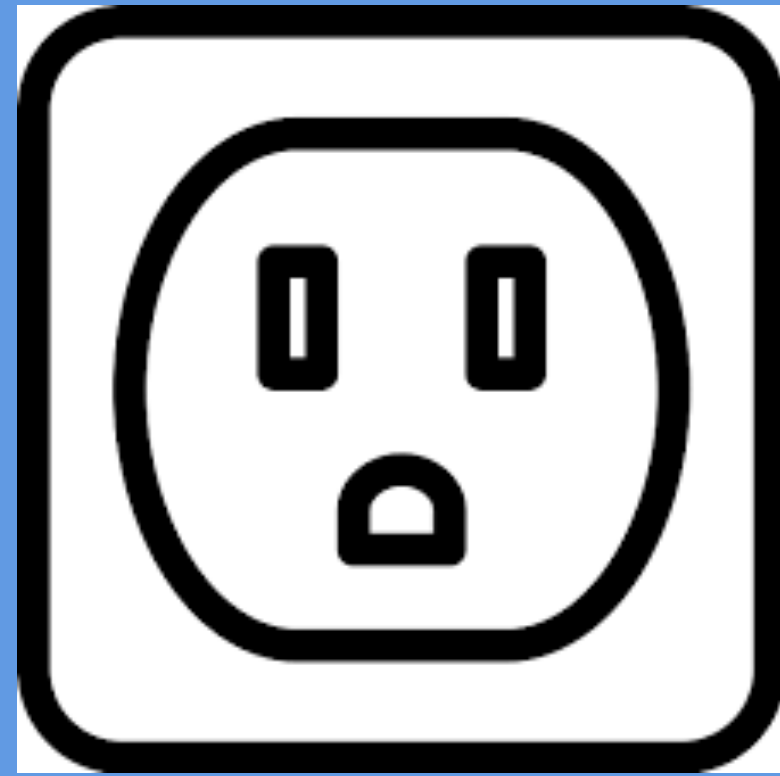
As a public charging station, there will only be a sign and an outlet.

Since fees are hard to collect for level 1 - charging is often free.

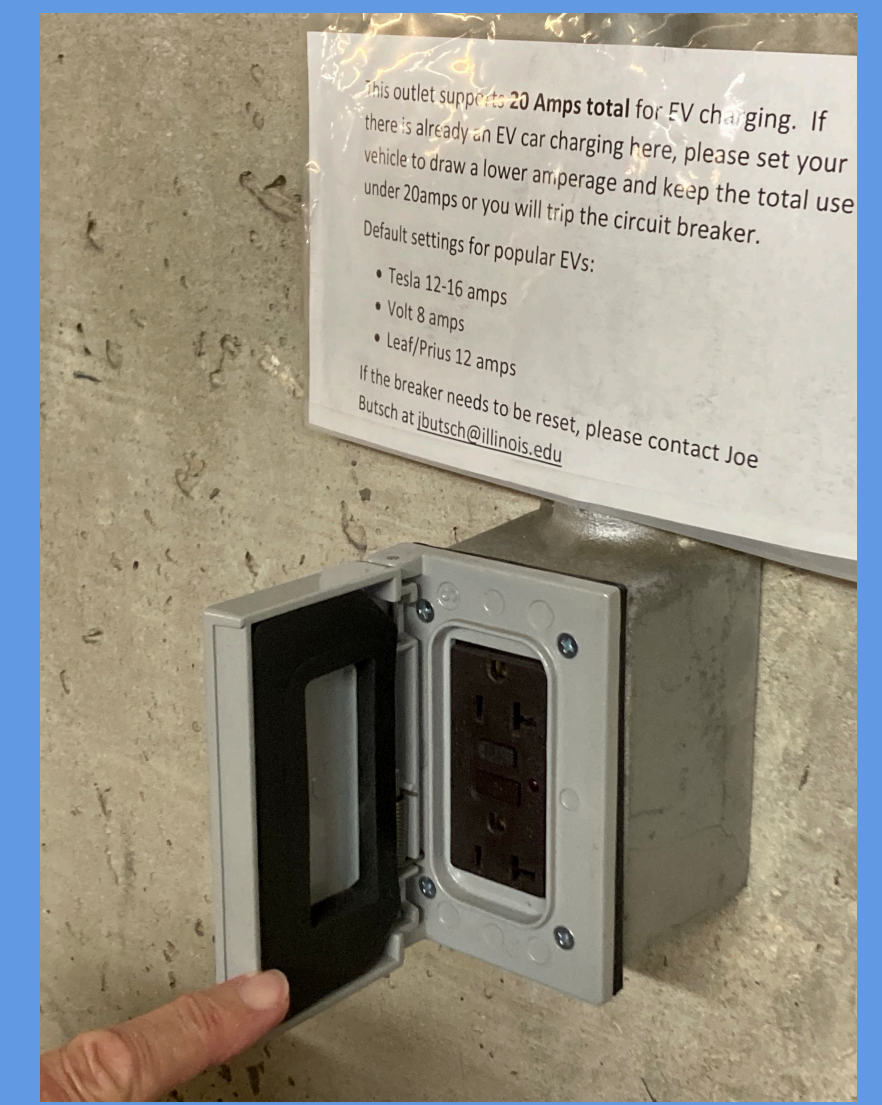
Bad news - slow and you have to bring your home charger with you. But useful for those that really need it.

With no fees collected, some locations will be poorly maintained.

In addition to 2 Level 2 chargers, a hotel in Champaign has 110 outlets on all of their parking lot light poles. Useful when someone else beats you to the Level 2 charger. As previously noted - Easy to get 40 miles a night - more if you've checked in for more than a day. Think Champaign downtown Hyatt Place and Ebertfest.

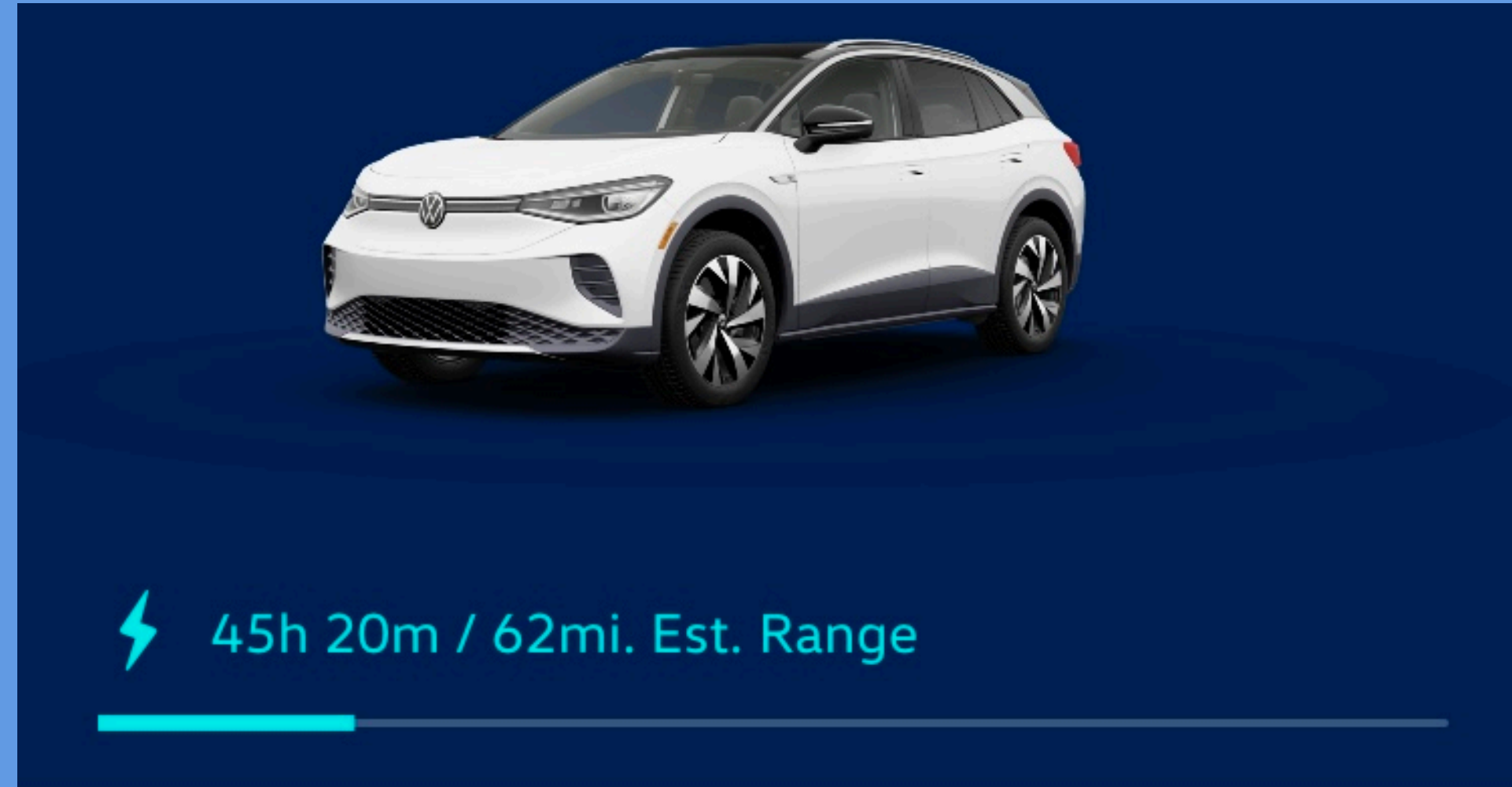


As a public charging station, there will only be a sign and an outlet.



Session 2 : Chargers

Level 1



The image on the dash is not encouraging.
But you get the same number of miles in 10 hours as you get at home.

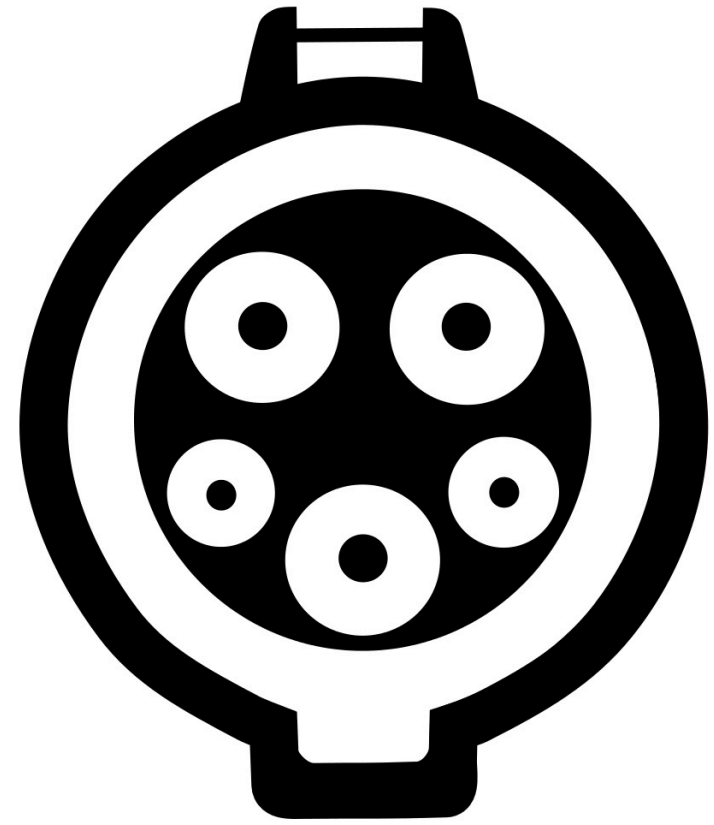
And those miles can be very convenient to get.

Remember its not how long until full

(With practice- never fill it -60% rule)

but how long to get the miles you need.

(Setting up a home charger is in session 3)



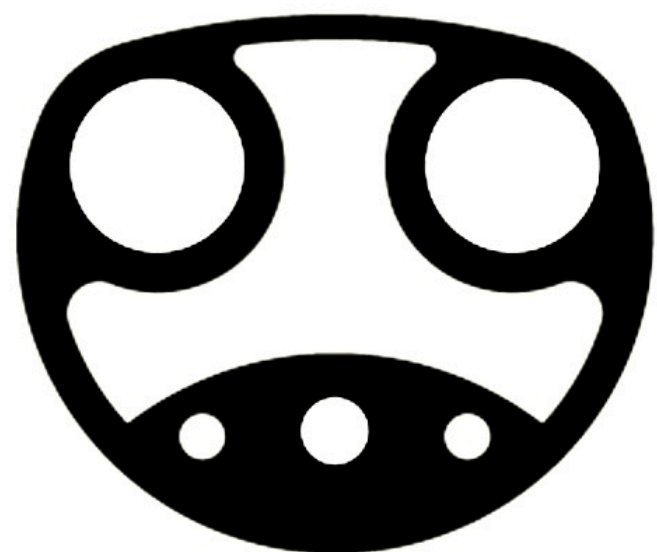
Level 1 charge speeds seem to top out at maybe 1.5 kw or 4 miles in an hour

Level 2 speeds range from about 3.5 to 19 kw or 12 to almost 60 miles after one hour.



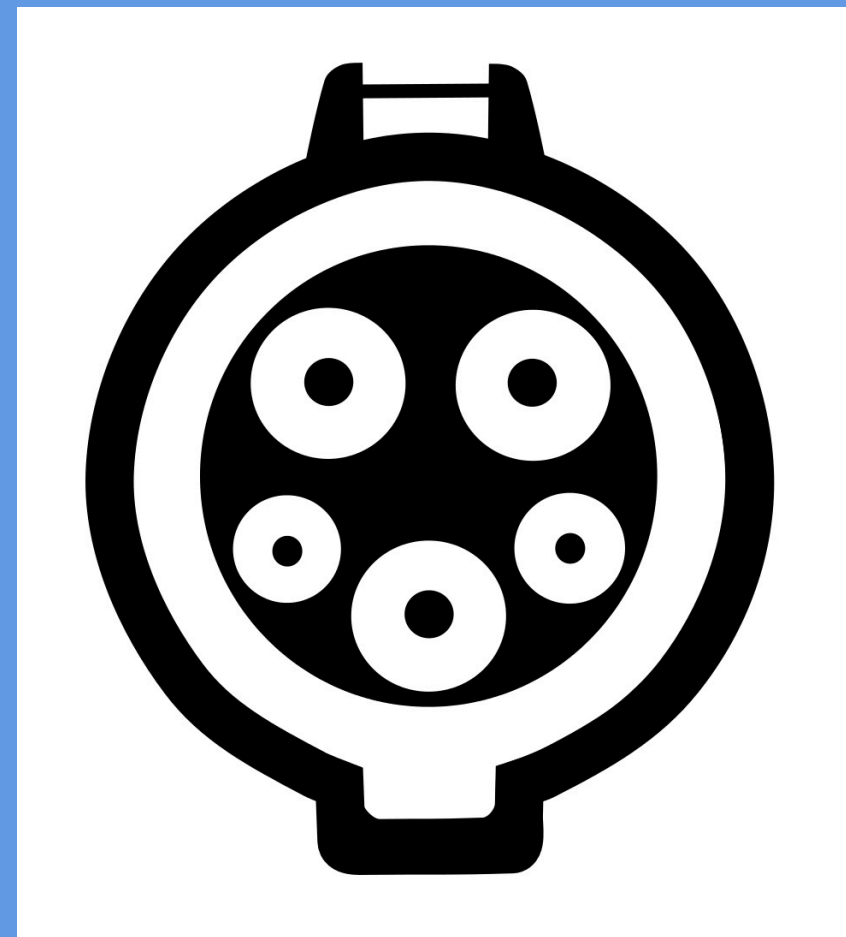
Most are 6.6 kw or about 22 miles per one hour.
Commonly \$.21 per kWh.

The 19 kw are few and expensive - if available a DCFC would be similar cost and you'll get done faster. Most EVs can only except 11 kw.



Session 2 : Chargers

Level 2



At home : my \$200 charger on the left.

In the wild : a sampling of public chargers in C-U on the right. Upper right is in Hill St Garage by OLLI.





ChargePoint at Fields East on the left.
6.6kw \$.21 per kWh.

Blink at Prospect Point Apts on the right.
80 amp, should be 19.2 kw (unverified) \$.49 per kWh.
Some EVs will only take 11kw.

It can be hard to know the fee before you arrive.





Chargers that require fees are accessed by contact free credit cards or phones. There are some that are completely free - just plugin and go. Others, like hotels ask that you checkin at the desk or the business near the charger.

Don't Forget These Tips

**When trying to use the network app to start a charge -
It is often better to turn your phone WIFI off.**

**Too many apps like Electrify America DON'T REFRESH THE
DATA - if you had the app running before starting a charge,
turn it off and back on, to refresh the data.**

**Sometimes “unavailable” chargers that won't start with the
app will start by tapping credit card.**

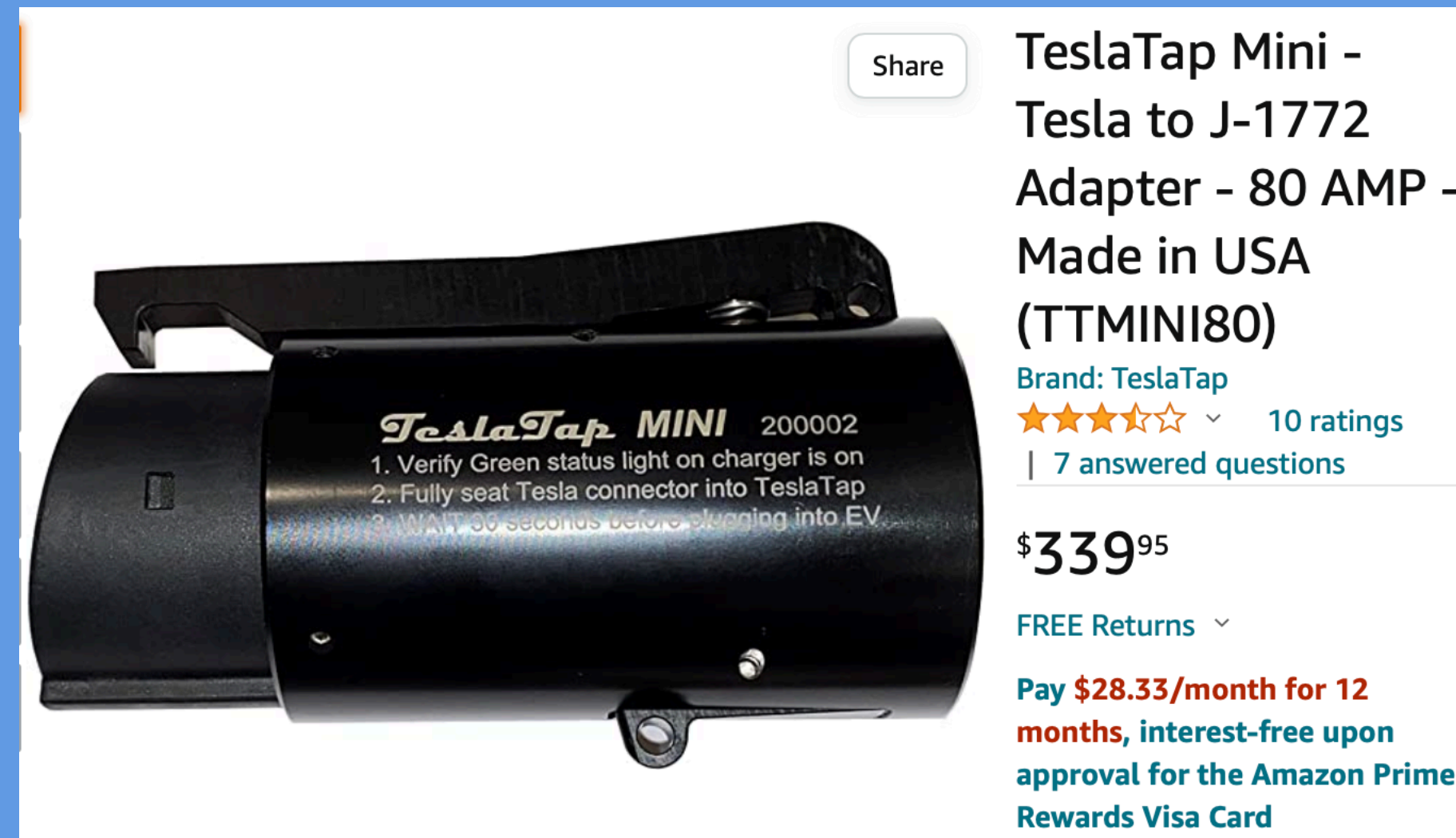
**This one sounds silly but at end of charge the connector
won't release - use you key fob to unlock the doors.
(sometimes needs a double click)**

The only adaptor I'm keeping track of



Teslas come with a J1772 =>Tesla, this adaptor costs \$50. This allows Teslas to use most public chargers. . . . and is not the adapter I'm referring to.

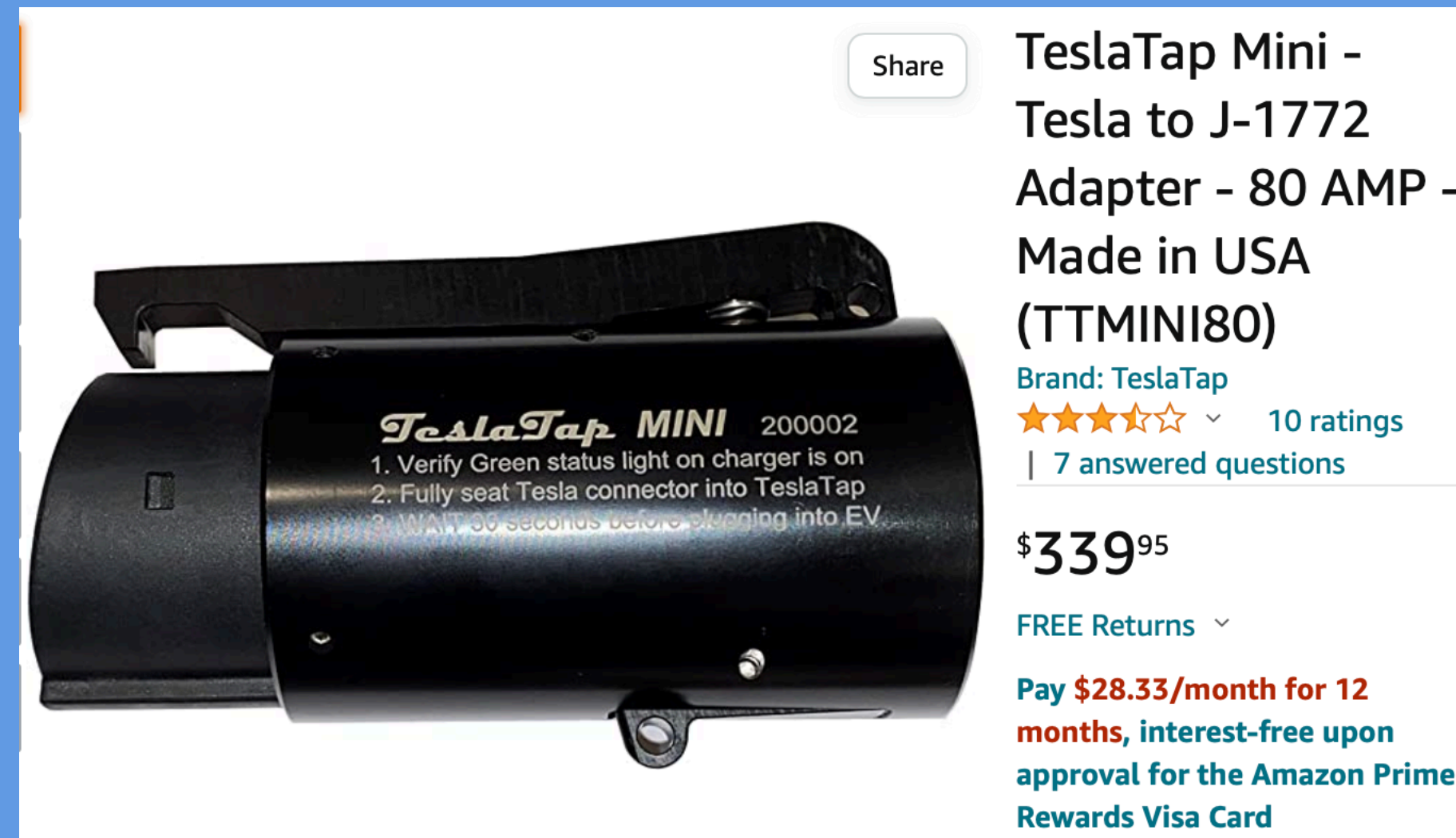
The only adaptor I'm keeping track of



This adaptor goes the other way. Allowing other cars to use a Tesla “wall charger” .

Adaptor for use **ONLY** with level 2 chargers. **NOT** Tesla Superchargers Chargers. Expensive but worth it for some. Drivers who might often be in a situation where a Tesla level 2 charger is the only or best option. These would mostly be on private property, like a hotel or friends house. Please ask for permission.


The only adaptor I'm keeping track of



This adaptor goes the other way. Allowing other cars to use a Tesla “wall charger” .

Tesla level 2 chargers tend to be double (or more) speed of most J1772 chargers. So the amp rating of the adaptor is very important. Most non-Teslas top out at 11kw for level 2. Current traveling through the adapter shouldn't get higher than that. But some cars might. Don't risk possible damage. Be safe and get the higher amp adapter. One rated at 80 amps which is the maximum amps for level 2.

The only adaptor I'm keeping track of



[For J1772 EVs Only] Lectron - Tesla to J1772 Charging Adapter, Max 48A & 250V - Compatible with Tesla High Powered Connectors, Destination Chargers, and Mobile Connectors

★★★★★ 4.9 (79)

Lectron

~~\$179.99~~
\$149.99

Save 17%

Quick shop

Choose options

OMG == I made a big mistake. This is NOT an 80 amp adapter. I bought the 48 amp, now I have to be careful that I don't plug into one of the 80 amp Tesla destination chargers. If I bought the 80 amp adapter I wouldn't need to be careful - it would always be correct.

A late change to this presentation - another company, Lectron, makes a similar 48 amp adaptor.

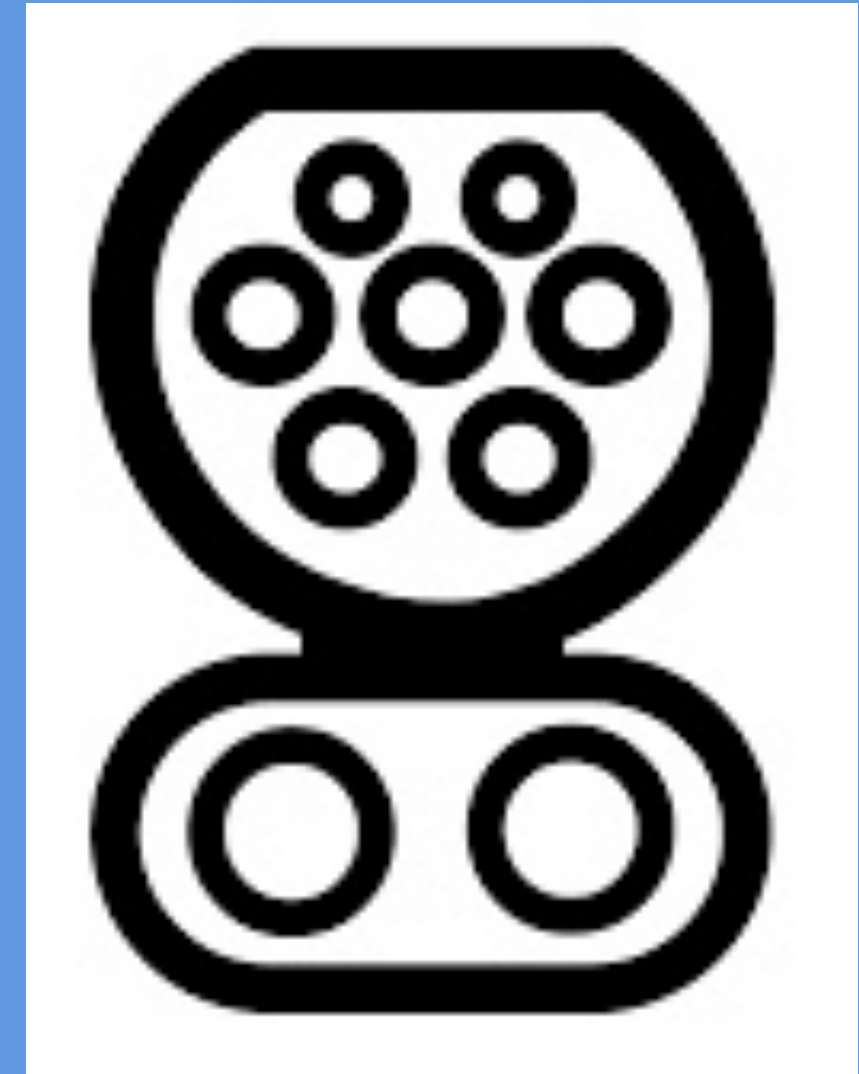


Electrify America station

The vast majority of these are 150 kw or higher. The two plug types are Tesla and CCS



Tesla Supercharger





A common rate is \$.40 to .45/ kWh
Charging speed will vary from car to car.

(a few examples)

Ford Mach E 115 kw

VW ID.4 120kw

Chevy Bolt 50 kw

Porsche Taycan 400kw

Don't worry - your car knows and tells the charger what to give.

Also with all cars - the charging speed slows as the battery fills to avoid damage to battery and extend battery life.



I spent 12 minutes at Target and got 75 miles of charge.

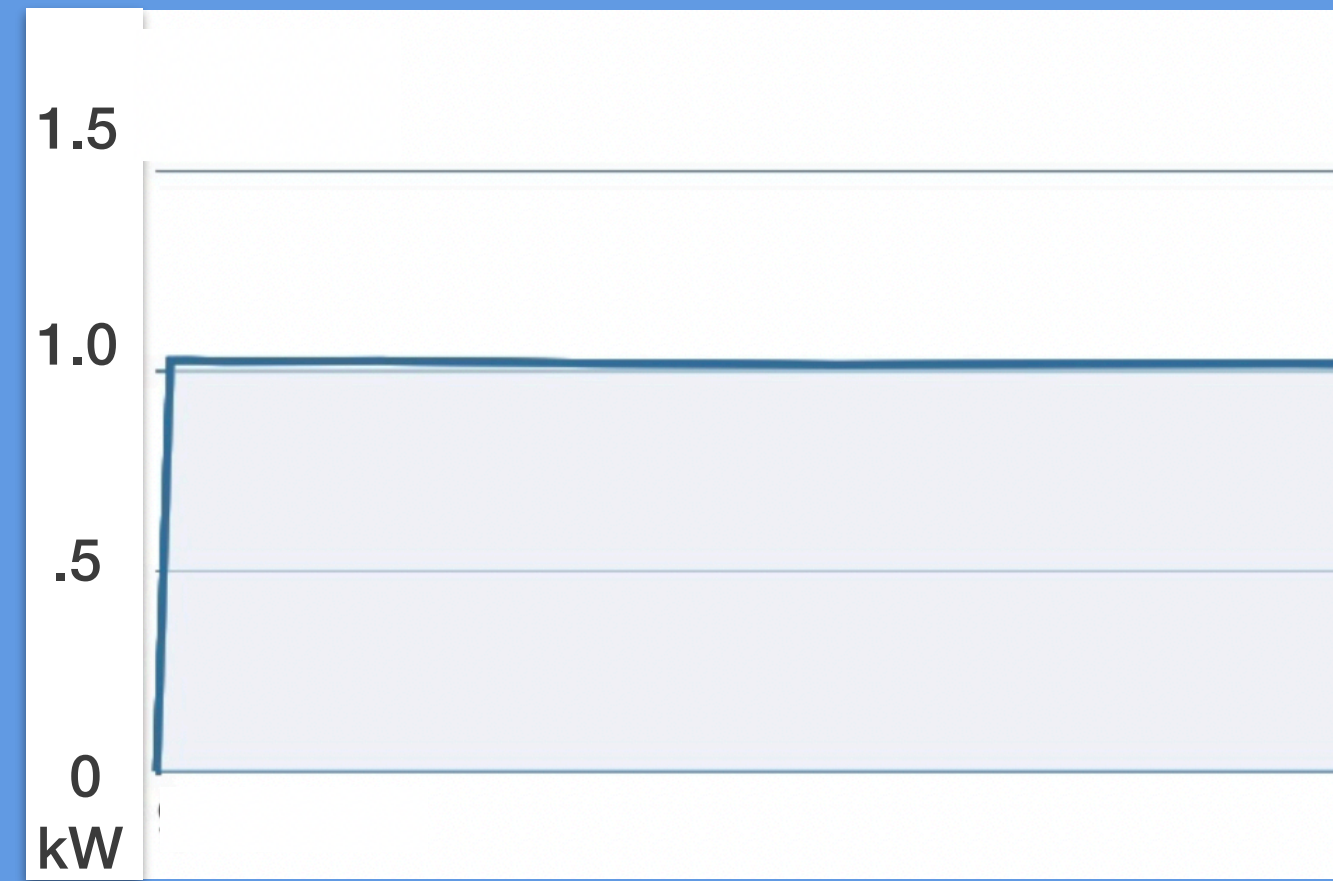


The 60% rule is to only charge between 20% and 80% (the 60% in the middle). This protects battery life and has the advantage of saving time. Time can be saved by charging in the range where DCFC is fastest. More on this later.

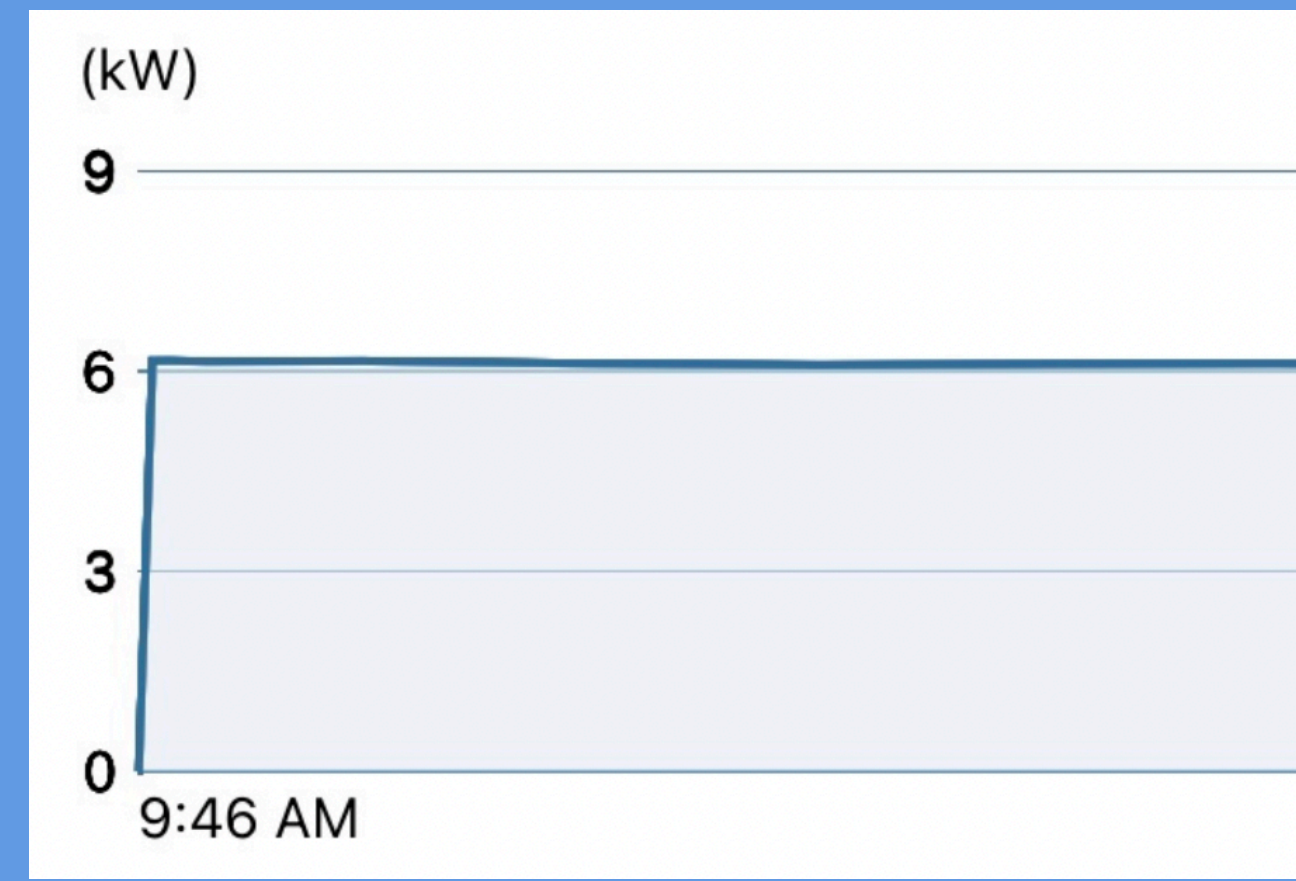


Note : at all levels (one, two and DCFC) The chargers list how much electricity they can deliver. But each car determines how much it will accept. e.g. I have a car came with a 10 amp level 1 charger, even when plugged into a 12 amp or higher charger it doesn't charge any faster.

The Curves

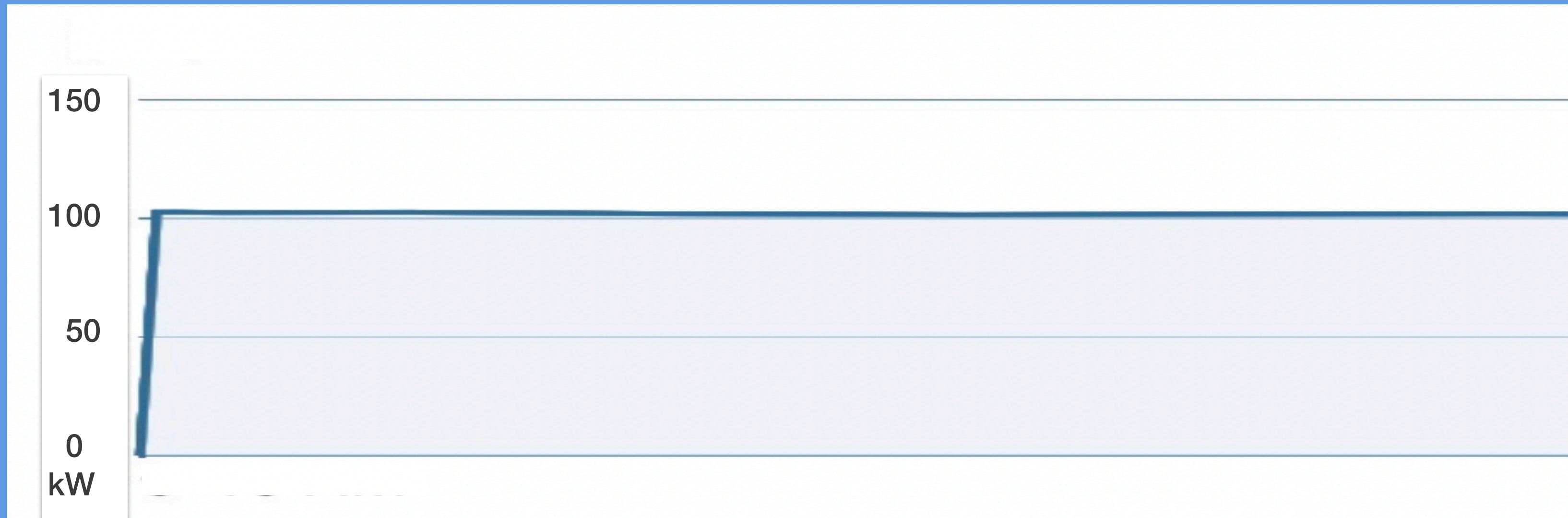


Level 1



Level 2

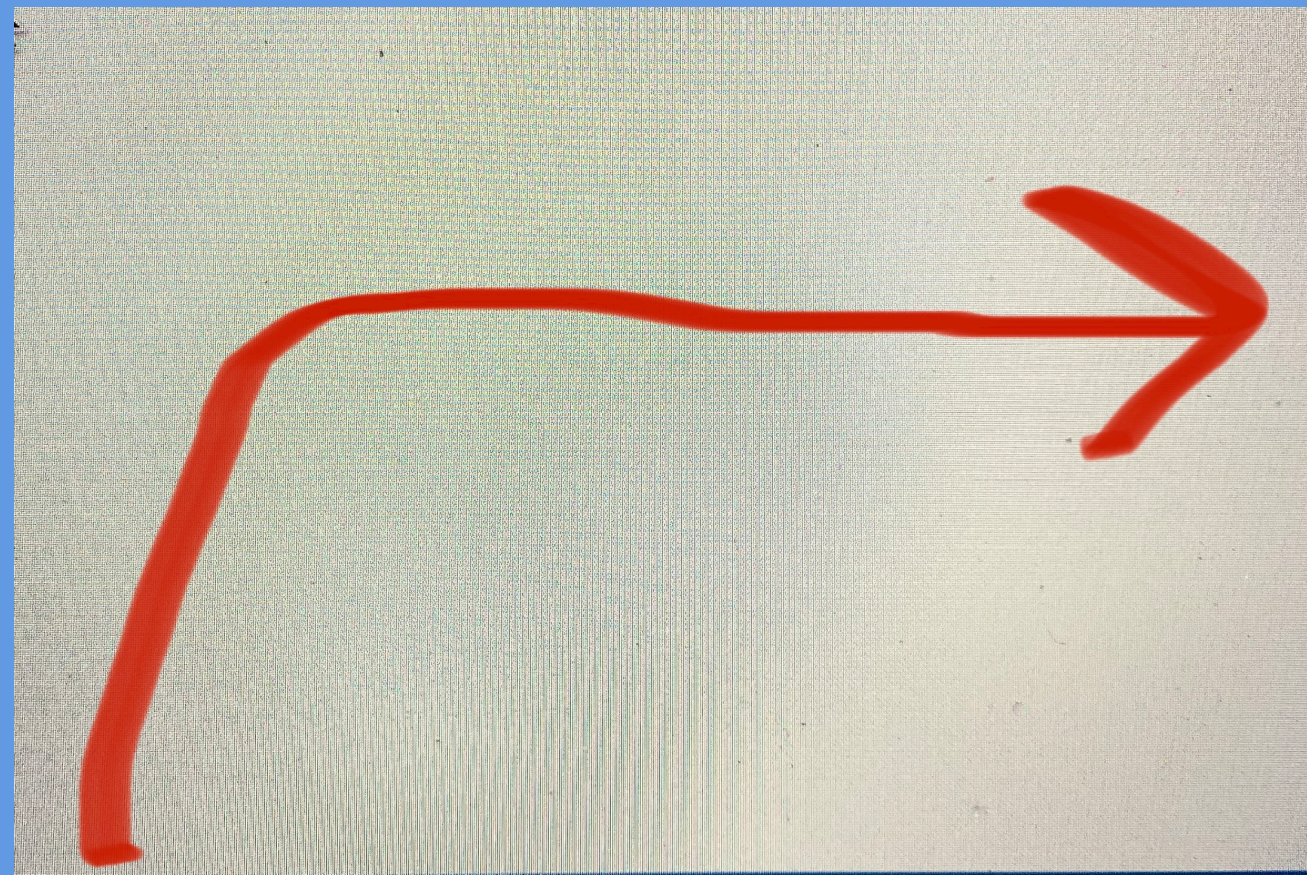
It is generally believed that all chargers deliver energy at a constant level



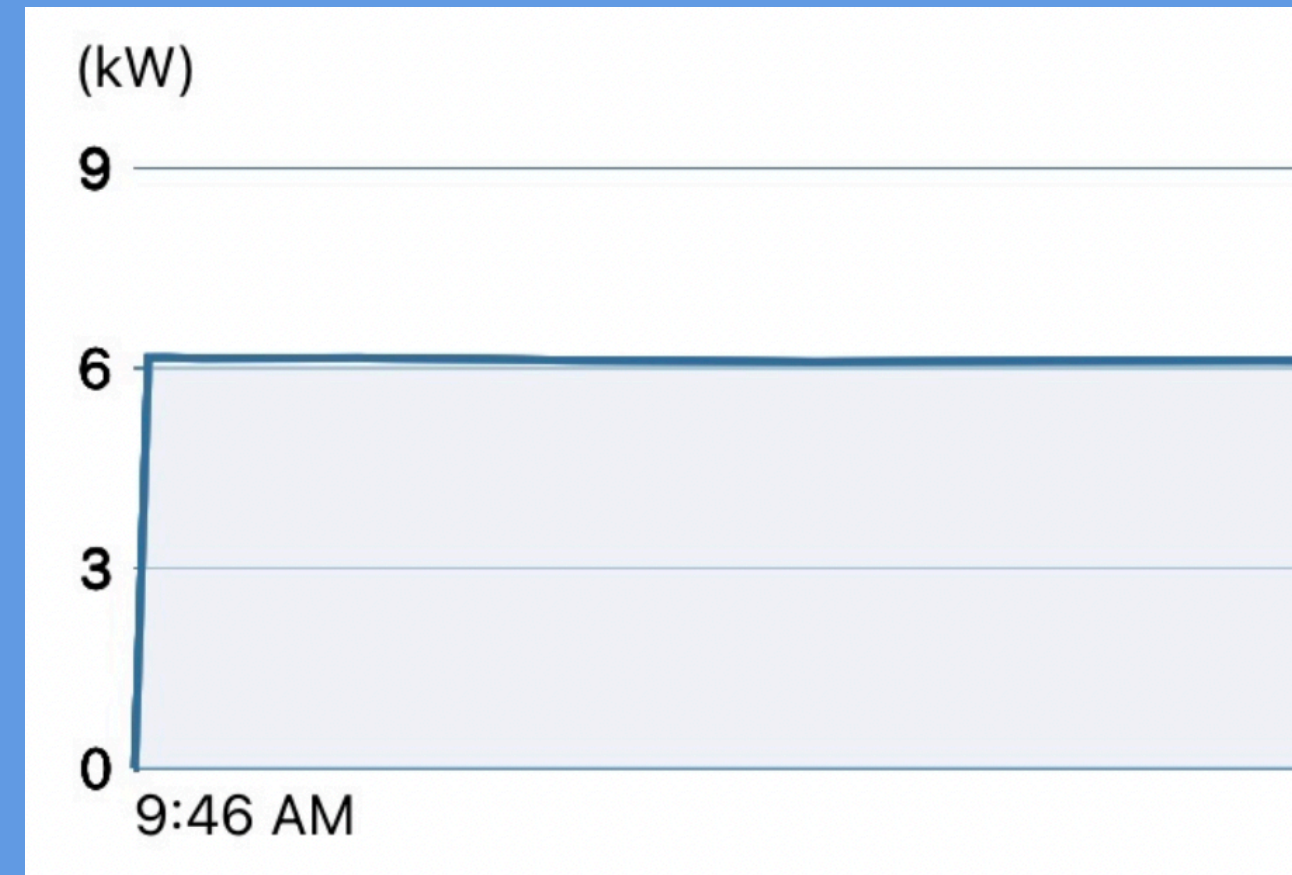
Direct Current Fast Charging

Charging for DCFC is usually referred as a certain number of kWh or miles in a 10 or 15 minute time period

The Curves

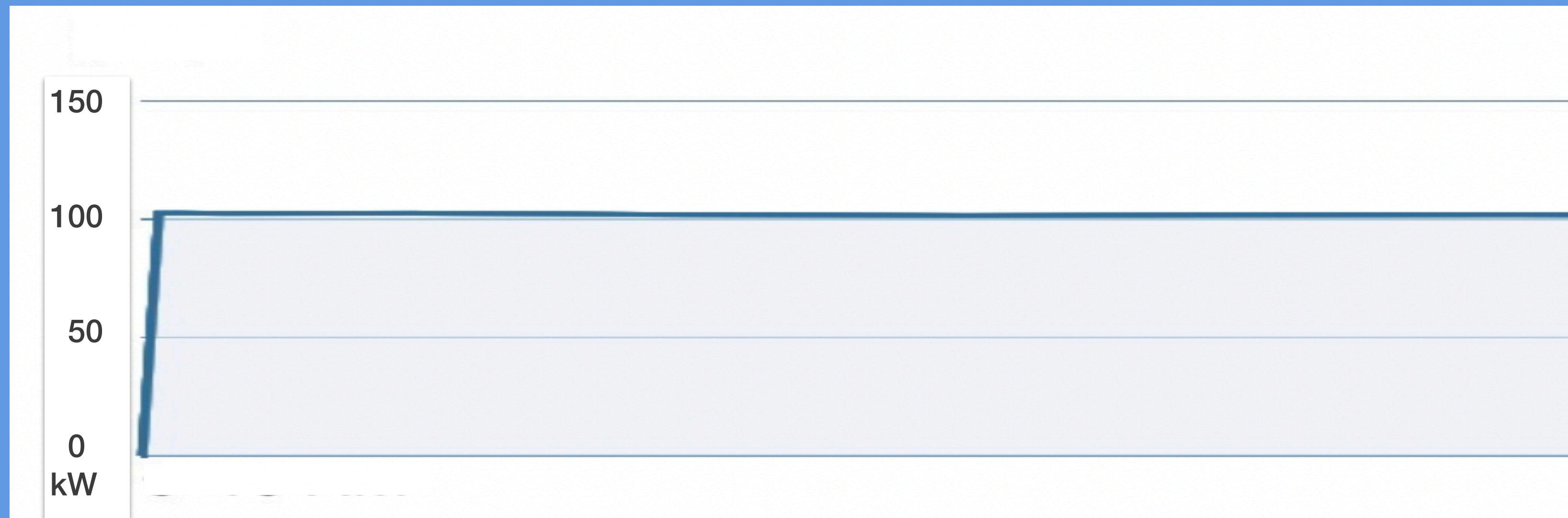


Level 1



Level 2

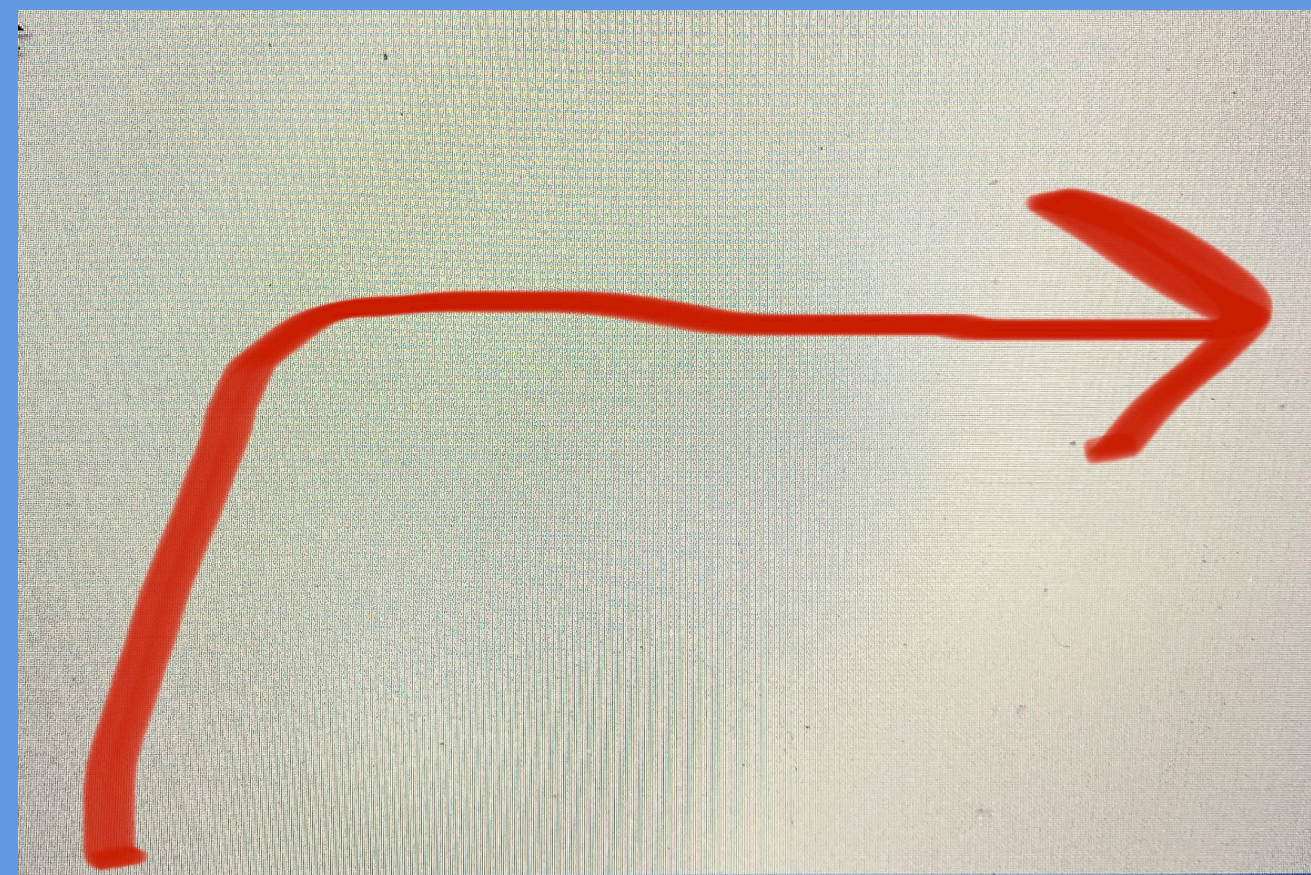
The level 1 graph was fake.



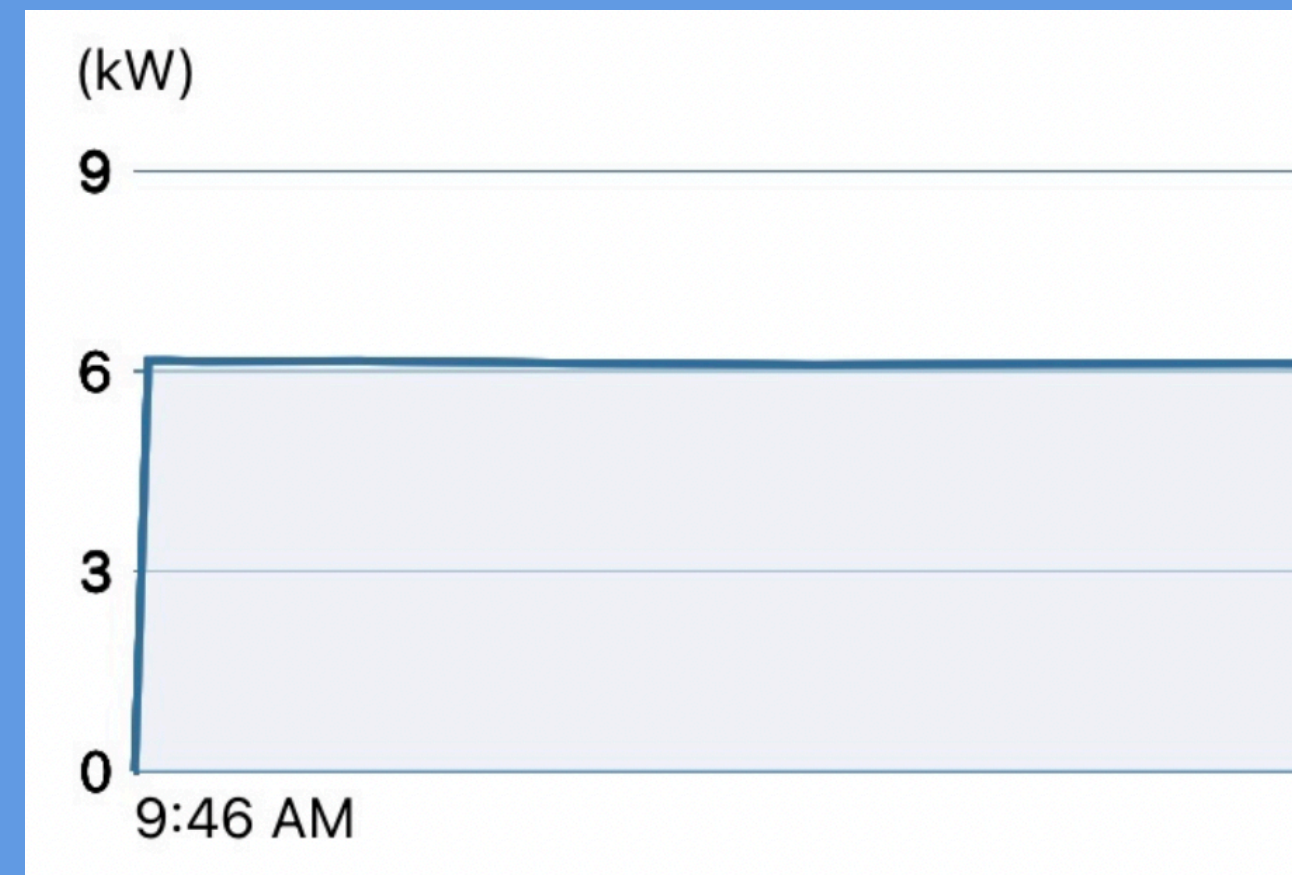
Direct Current Fast Charging

There is no graphing available with level 1 chargers.

The Curves

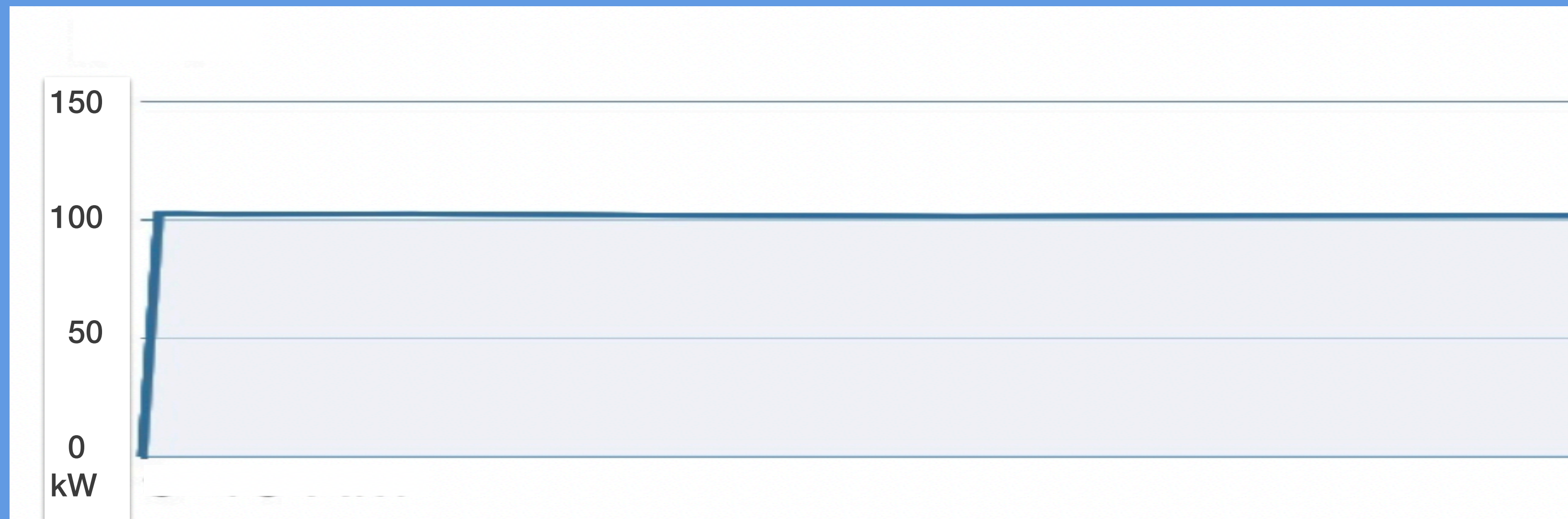


Level 1



Level 2 *ChargePoint screen*

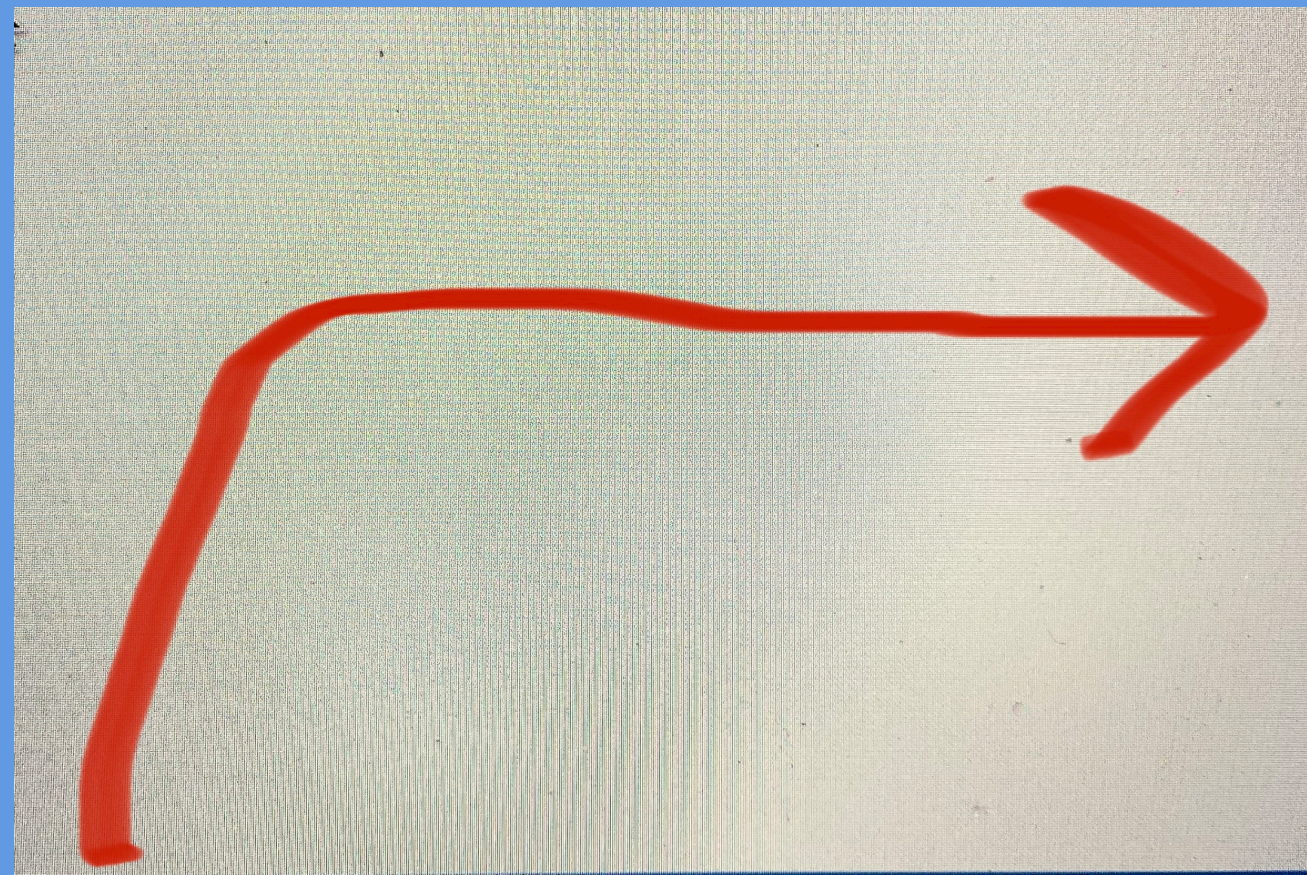
The level 2 graph is from an actual charging screen.



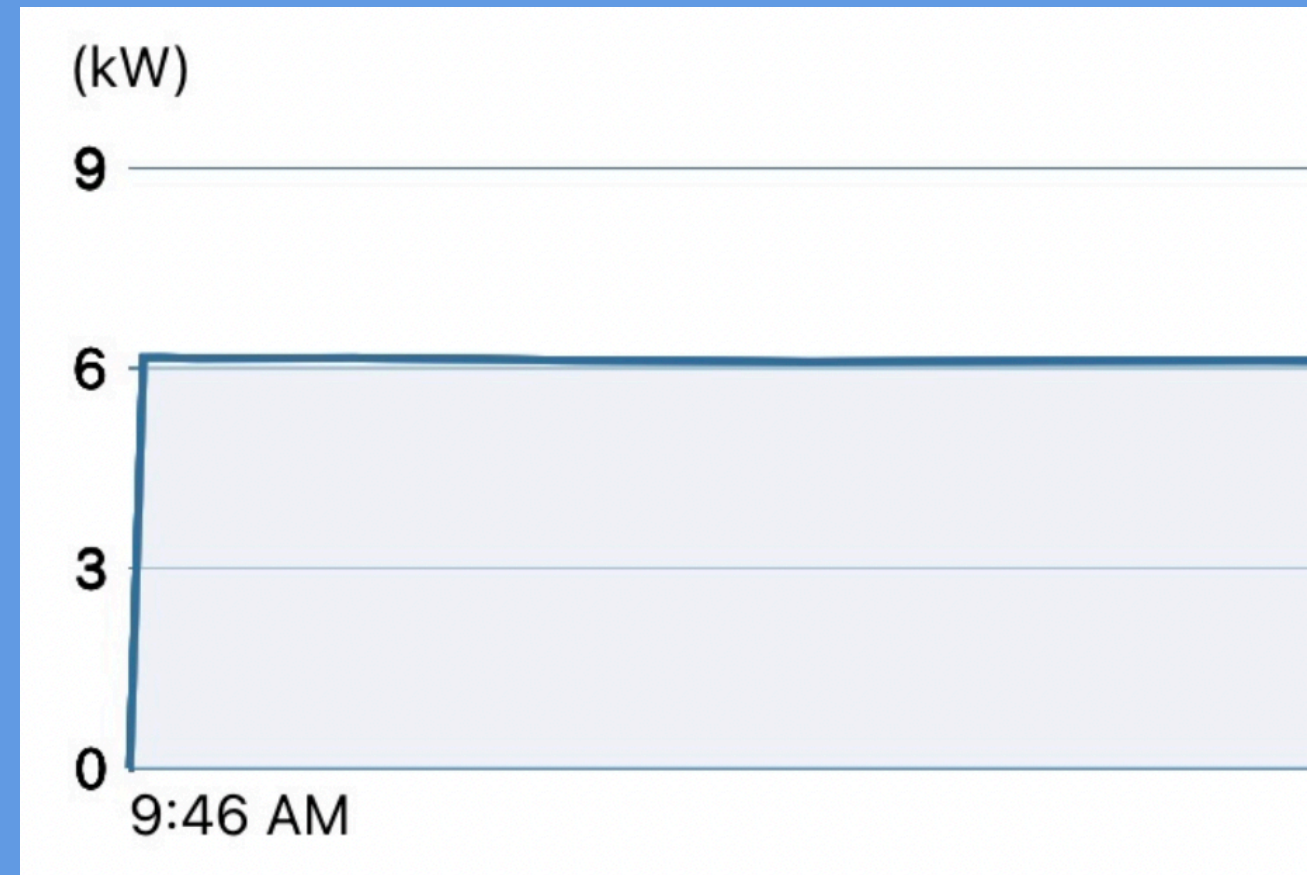
Direct Current Fast Charging

Charging level is constant but might change on a shared power charger. When two cars are charging, the power is split between them.

The Curves

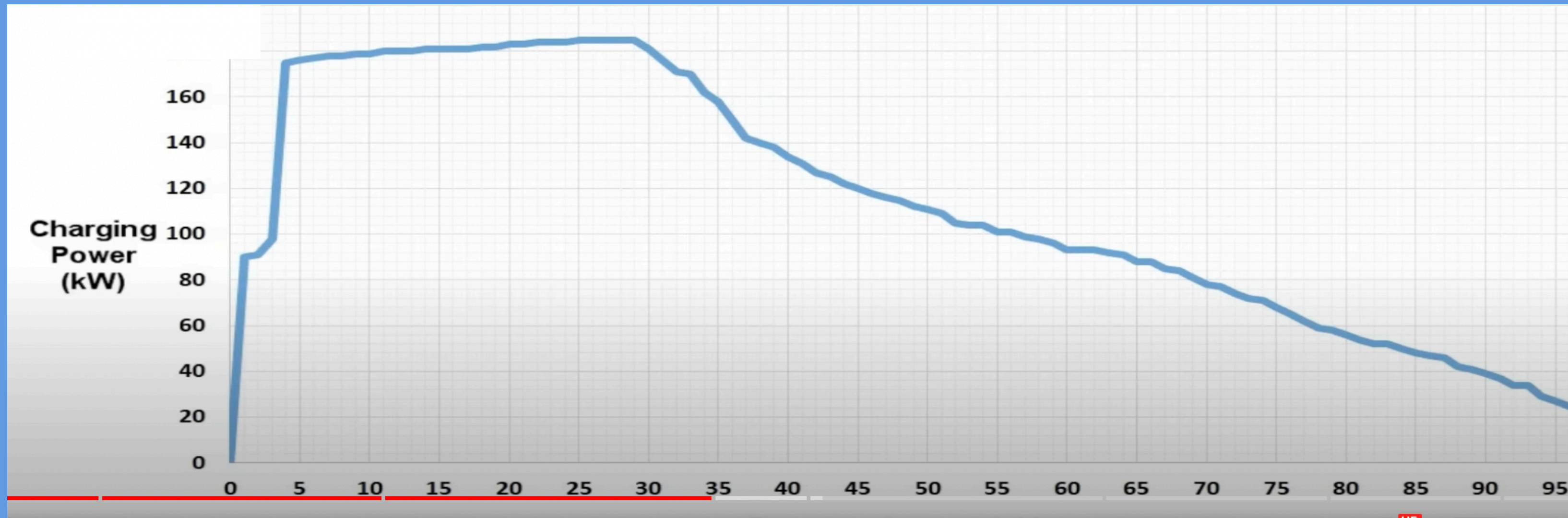


Level 1



Level 2 *ChargePoint screen*

The DCFC graph for a Tesla Model 3 at a Electrify America charger.

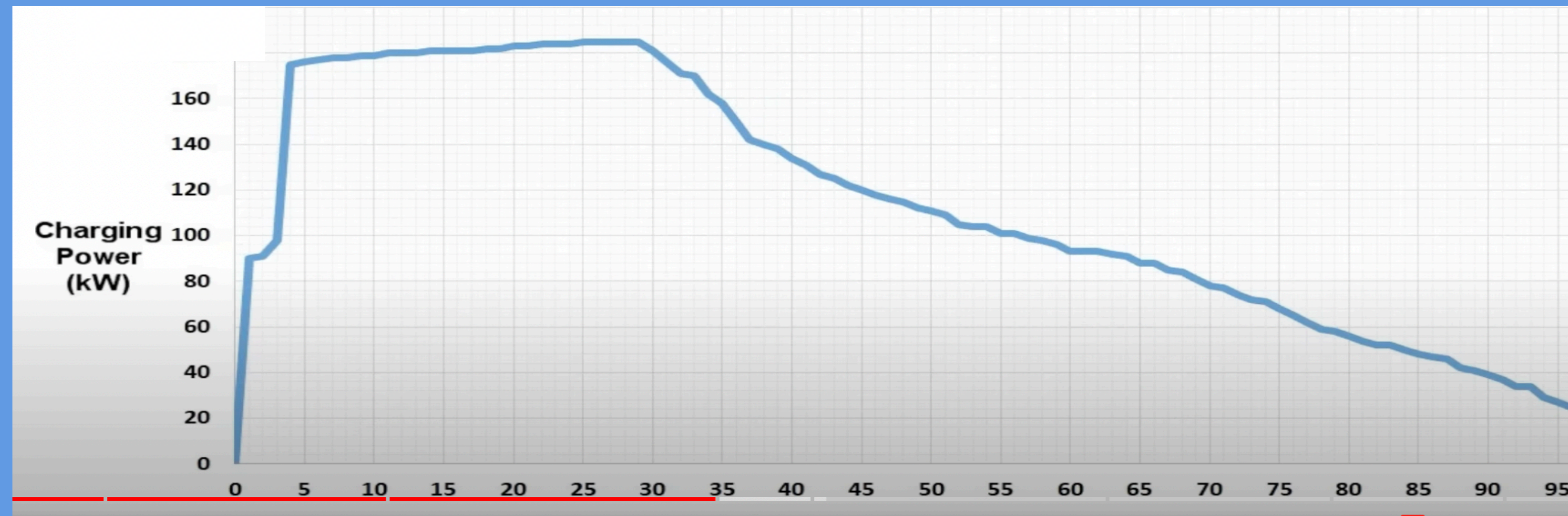


Direct Current Fast Charging

Graph was created by "State of Charge". They do many EV videos on the web.

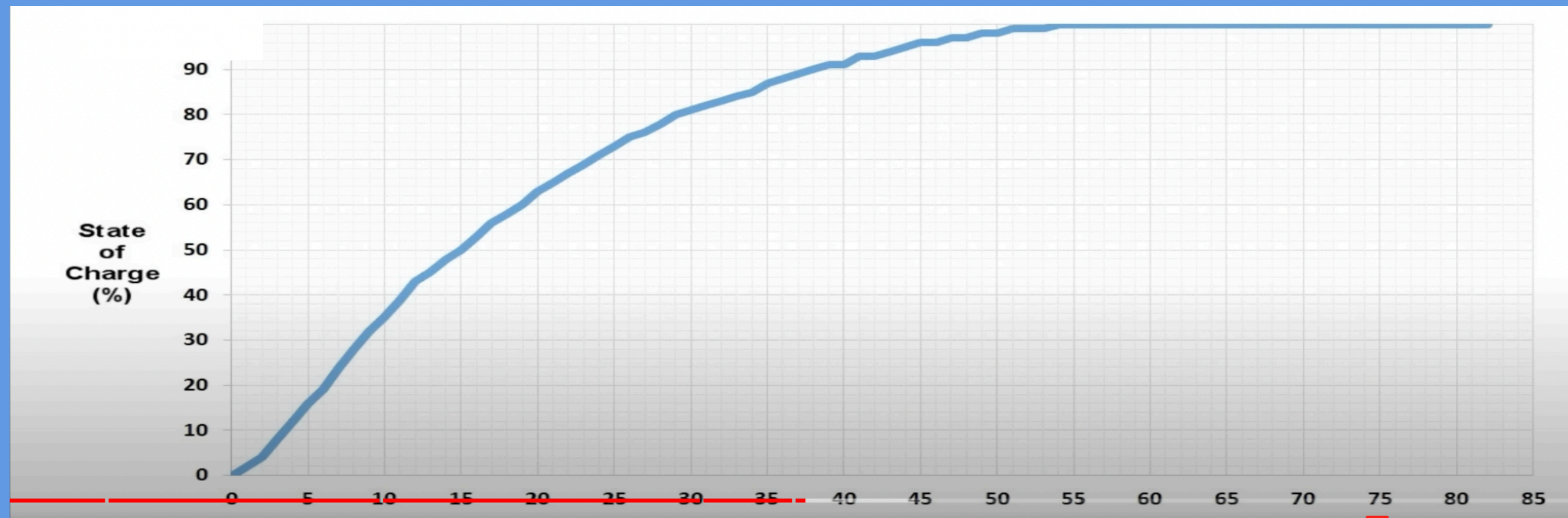
Charging the battery from 5% to 35% at 150 kw or higher would add over 100 miles of range in less than 15 minutes.

This shows us how the speed of the charge is higher early and lowers as the battery approaches 100%. This helps protect battery life.



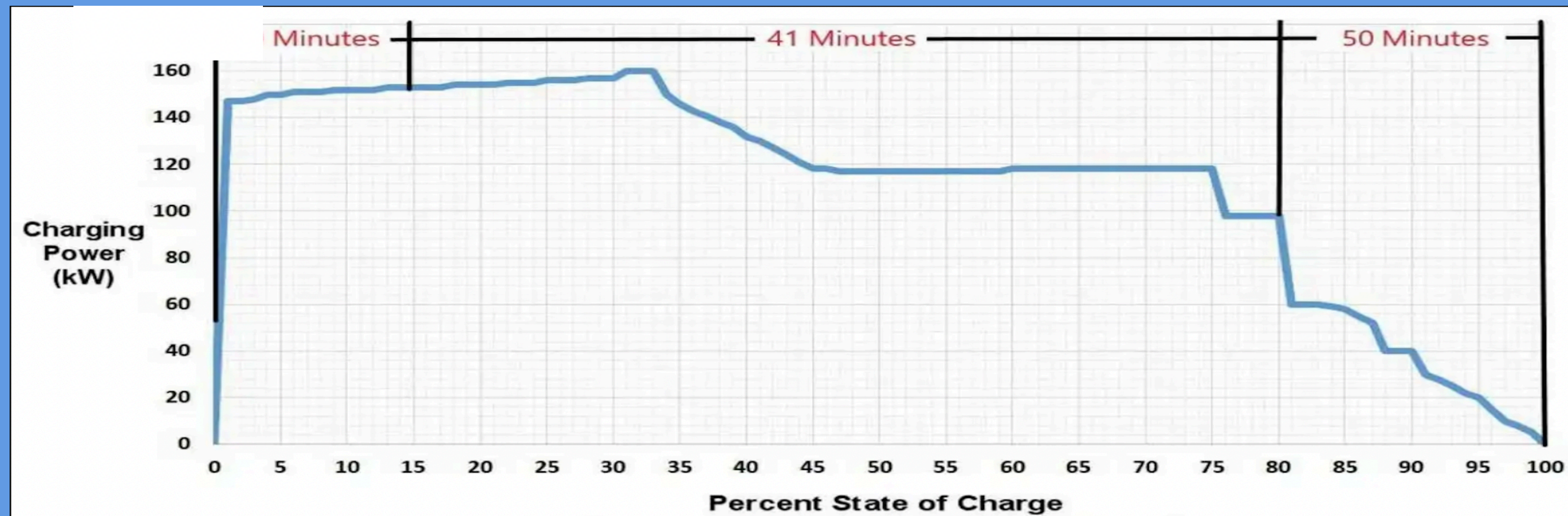
Direct Current Fast Charging Tesla model 3

This graph shows how the percentage of charge as it changes during the time of the charge. The battery reaches 80% in less than 20 minutes. After that the battery is filling slower & slower & slower. This helps to apply the 60% rule.



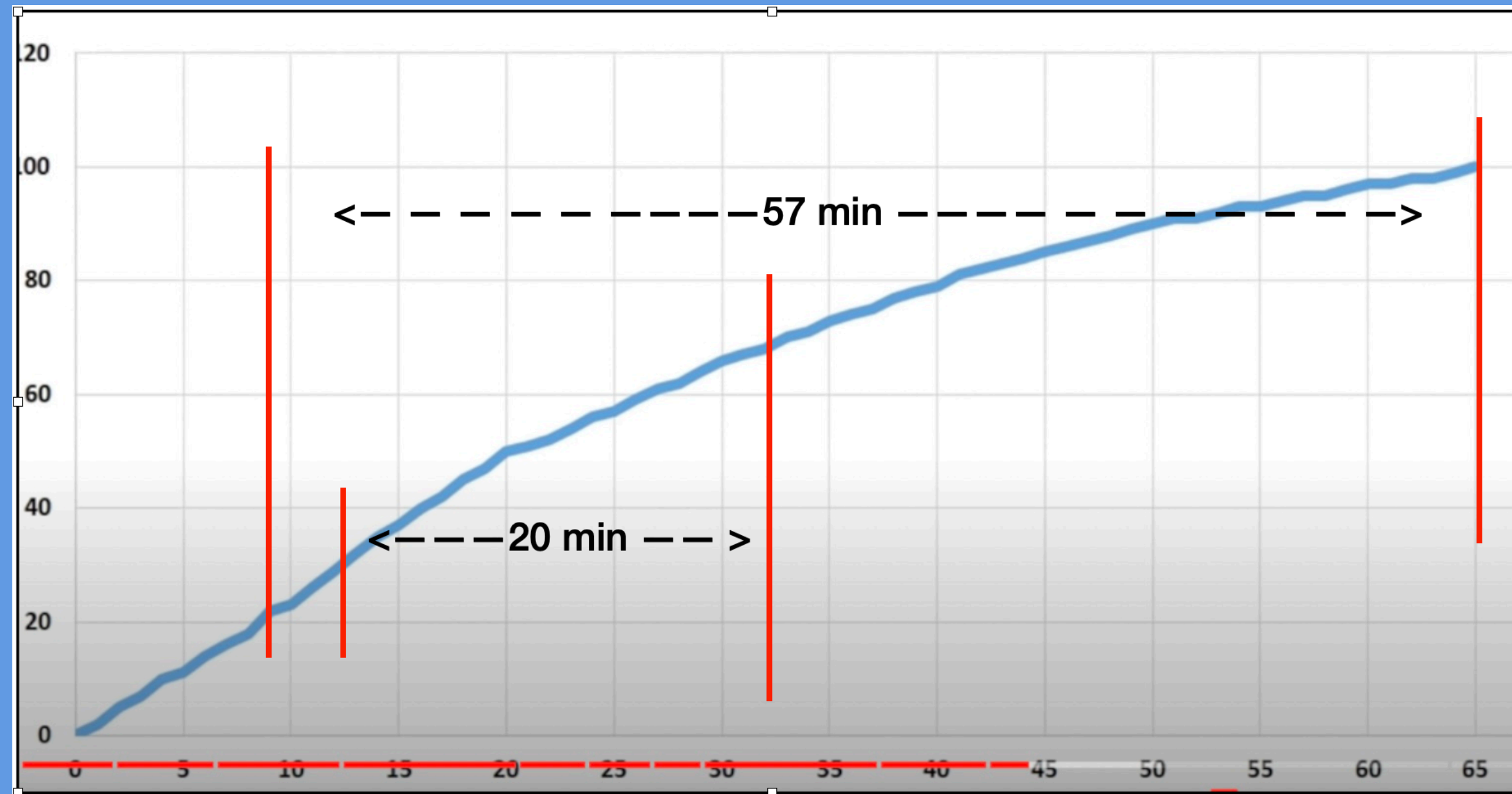
Direct Current Fast Charging Tesla model 3

The Ford F-150 Lightning w/ 135kWh battery pack. Going below 15% is to be avoided (if at all possible). That “sweet spot” of 15 to 80%, which takes 41 minutes to charge. The remaining 20% (from 80 to 100%) takes an additional 50 minutes ! If you are waiting, that 50 minutes is painfully long. That would not be convenient charging.



Direct Current Fast Charging Ford Lightning

Charging from 20%-100% takes 57 minutes and get 180 miles of driving. But if you charge from 30% - 70% twice (make 2 stops). You get 180 miles of driving with only 40 minutes of charge time.



Get out the car and stretch your legs. For a lot of people that second stop at 90 miles is going to happen whether or not you charge.

Direct Current Fast Charging VW ID4



The information in those last two graphs reveals why the specifications for the NEVI program are so on point.



But first - the practical application of those graphs in the real world. Slow charging to 100%





With six chargers, 150 miles apart most EVs need to charge about one hour to reach the 100% necessary to reach the next station. These six chargers would only service 6 vehicles in one hour.



Session 2 : Chargers

NEVI



Reducing the number of chargers to four and placing them 50 miles apart.

Now using the 60% rule and only charging from 30 - 70% (twice) each EV will be able to charge along the way and complete the 150 mile trip. And with only four properly spaced chargers the number of EVs completing their trip is still six.

Session 2 : Chargers

NEVI



Reducing the number of chargers to four and placing them 50 miles apart.

The remarkable thing about this is the benefit to the company. The company has a one third reduction in cost of charger installation and a the same income (since each car receives the same charge in 2/3 of the time).

The NEVI program specifies that 50 mile spacing.



**U.S. Department
of Transportation**

The NEVI Formula Program will provide nearly \$5 billion over five years to help states create a network of EV charging stations along designated [Alternative Fuel Corridors](#), particularly along the Interstate Highway System.

The total amount being made available to states in fiscal year 2022 is \$615 million. States will have to submit an EV Infrastructure Deployment Plan before they can access the funds.

A second, competitive grant program designed to further increase EV charging access in locations throughout the country, including in rural and underserved communities, will be announced later this year.

Federal DCFC Charger requirements

- No more than 1 mile from Interstate exits or highway intersections along the corridor.^d
- Stations should include four Combined Charging System (CCS) connectors - Type 1 ports (simultaneously charging four electric vehicles).
- Site power capability should be no less than 600 kW (supporting at least 150 kW per port simultaneously across 4 ports).
- Maximum charge power per DC port should not be below 150 kW.

There are four requirements each charging site must meet.

Federal DCFC Charger requirements

- No more than 1 mile from Interstate exits or highway intersections along the corridor.^d
- Stations should include four Combined Charging System (CCS) connectors - Type 1 ports (simultaneously charging four electric vehicles).
- Site power capability should be no less than 600 kW (supporting at least 150 kW per port simultaneously across 4 ports).
- Maximum charge power per DC port should not be below 150 kW.



#1 Locations have to be within one mile of the highway.

One of the EA stations I use is about 5 miles from I-55.

At city speeds, driving to and from the charger adds

20 minutes driving to a twenty minute charge.

Doubling the time.

Federal DCFC Charger requirements

- No more than 1 mile from Interstate exits or highway intersections along the corridor.^d
- Stations should include four Combined Charging System (CCS) connectors - Type 1 ports (simultaneously charging four electric vehicles).
- Site power capability should be no less than 600 kW (supporting at least 150 kW per port simultaneously across 4 ports).
- Maximum charge power per DC port should not be below 150 kW.



#2 Four stations is a good number. CCS is the standard for non-Teslas (Teslas do have an affordable adaptor mentioned earlier in this session. At the Tesla supercharger location I have rarely seen more than 4 cars at a time.

Federal DCFC Charger requirements

- No more than 1 mile from Interstate exits or highway intersections along the corridor.^d
- Stations should include four Combined Charging System (CCS) connectors - Type 1 ports (simultaneously charging four electric vehicles).
- Site power capability should be no less than 600 kW (supporting at least 150 kW per port simultaneously across 4 ports).
- Maximum charge power per DC port should not be below 150 kW.



#3 To me this looks like extra language to avoid loopholes.

Federal DCFC Charger requirements

- No more than 1 mile from Interstate exits or highway intersections along the corridor.^d
- Stations should include four Combined Charging System (CCS) connectors - Type 1 ports (simultaneously charging four electric vehicles).
- Site power capability should be no less than 600 kW (supporting at least 150 kW per port simultaneously across 4 ports).
- Maximum charge power per DC port should not be below 150 kW.

#4 This eliminates power sharing. Sometimes a charger with two connectors will share the power output. Which would be 150 kw for one car and split to 75 kw each car if a second car plugs in.



The next pages were session two preamble

Introducing myself

And “breaking news” items

How I got here



For me it started with a hybrid Subaru. After experience with several Subarus, I bought a 2014 Subaru hybrid, mostly to save some money on gas. I grew to love the electrical advantages of the car. I bought a short range EV in 2020. In December of 2021 I took delivery on my second EV.

How I got here



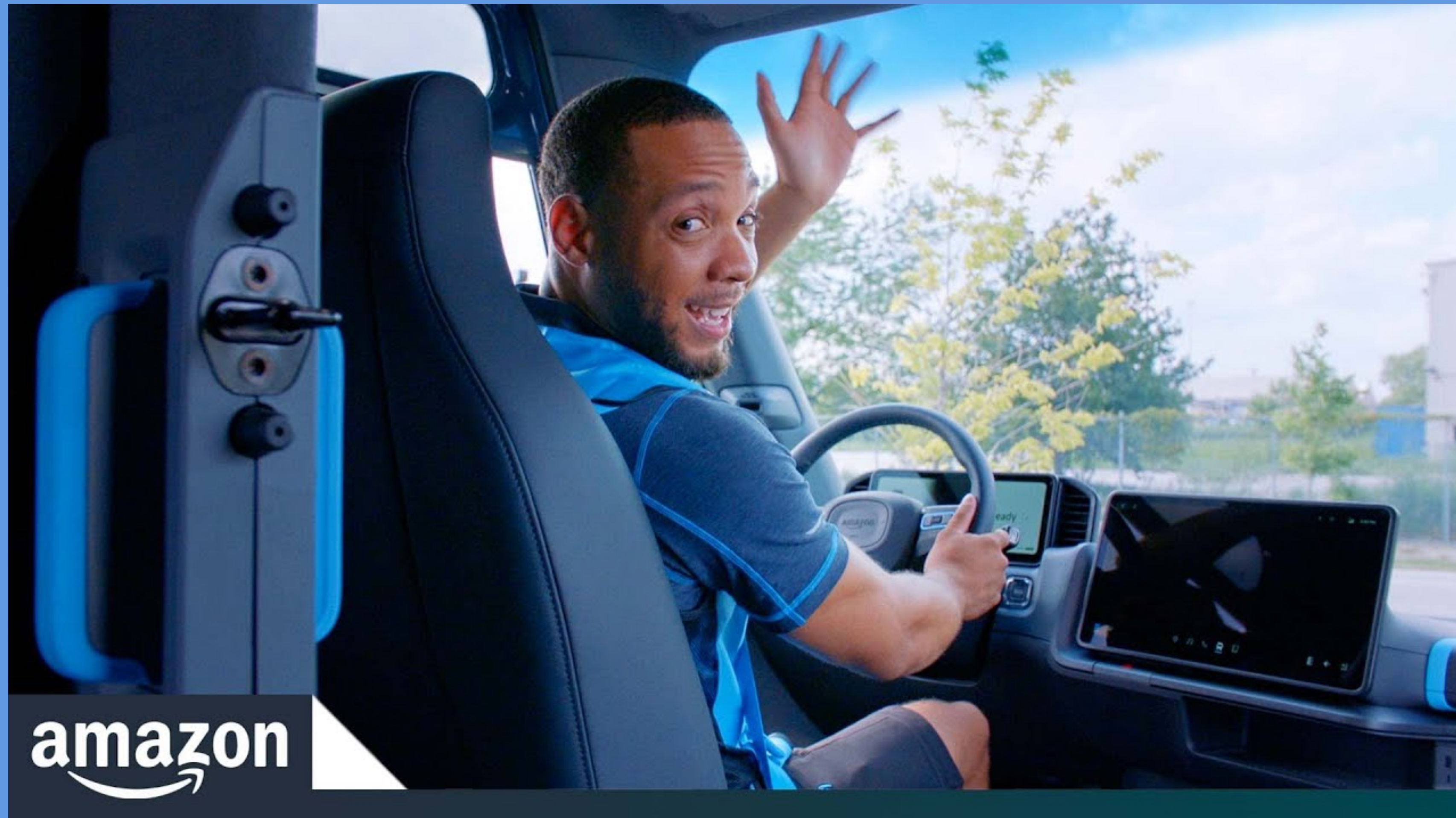
After driving the BMW for a while including a range challenging trip to Bloomington, I realized community differences would have an effect on adopting Electric vehicles.

I wanted to change that and encourage change in the EV landscape and help people realize that going electric was possible and could suit different needs.



I made mistakes buying each one of them.
But I love them both (and their differences)
I'm keeping both of them.

Amazon Loves Their Rivian Delivery Vans



Looking Into Electric Cars

Session 2: Chargers

Breaking news

Walmart - saying that 90% of US population lives within 50 miles of a Walmart. Will start its own Charging network and install 4 DCFC at every location by 2030.

(Speed of the chargers into in the press release)(Joining two truckstop chains, BP and Shell Oil - Shell bought the EV company I bought stock - I lost money)

Changing CEOs for the fourth ? Time. Toyota will try again to start up a BEV program that works.

(But still wants to mostly do PHEV)

Looking Into Electric Cars

Session 2: Chargers

More Breaking news

- Brakes
- Tires
- Cabin air filter
- High voltage battery
- 12V battery checks
- Lubricants
- AC

This is the maintenance list for an EV. I went to my favorite Gas vehicle mechanic to see if he wanted to do my brake fluid change. Said no, brake fluid is good for 200,000 miles. Don't get brake work done unless there is a symptom.

I will forever buy my tires at Beaumont Tire
812 Dennison, just east of the Dunkin' Donut on Prospect.

The End