Looking Into Electric Cars

Session 2: Chargers

Basic charging is as easy as toast

Session 2: Chargers

Convenience First

The goal is to charge when it is convenient.

The goal is to charge when it is convenient.

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

The goal is to charge when it is convenient.

The goal is to charge when it is convenient.

Session 2: Chargers

Convenience First

1). An “opposition” to gas, you have to watch the gas pump, with an EV you plug in and just walk away.

2). The inconvenience of going to a gas station is why people always fill up.

3) If you have enough charge and you don’t leave, you’re not doing it right.

Session 2 : Chargers

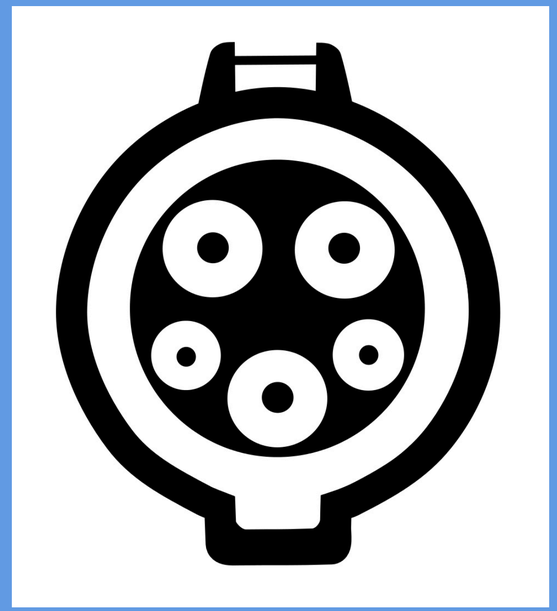
The Basics

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

Session 2 : Chargers

Level 1

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 soooo 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.

Session 2 : Chargers

Level 1

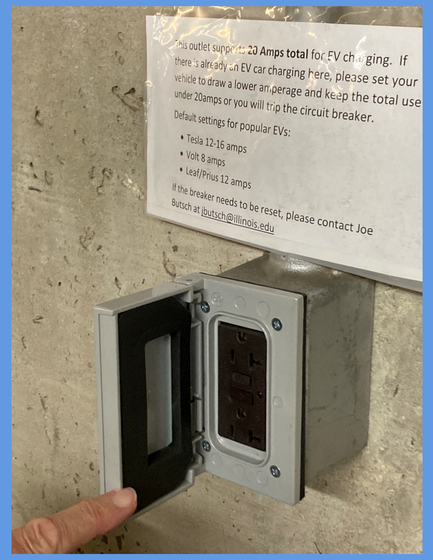
As a public charging station, there will only be a sign and an outlet.

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.

Session 2 : Chargers

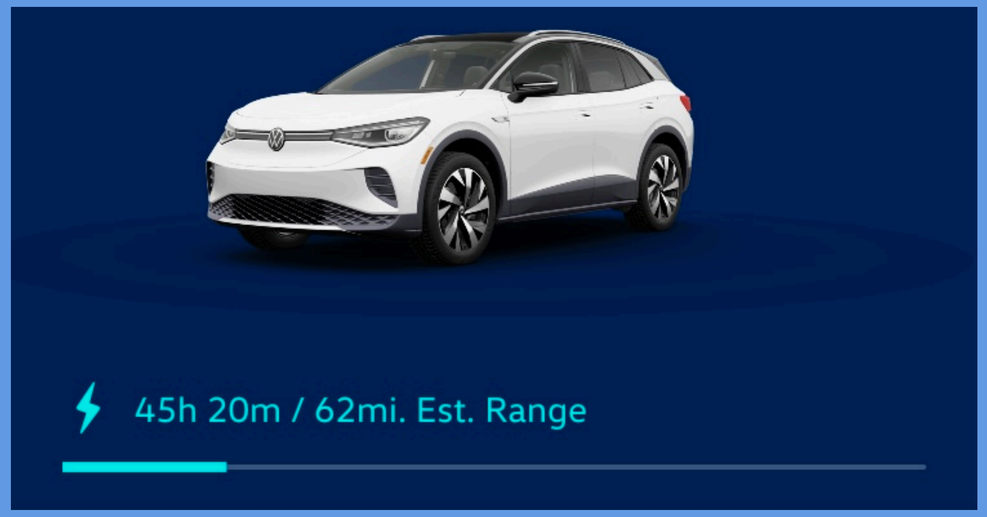
Level 1

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



Session 2 : Chargers

Level 1



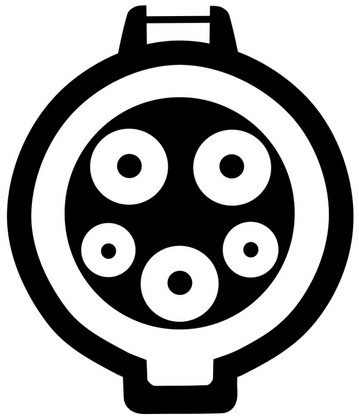
The image on the dash is not encouraging.
But you get the same number of miles in 10 hours as you get at home.

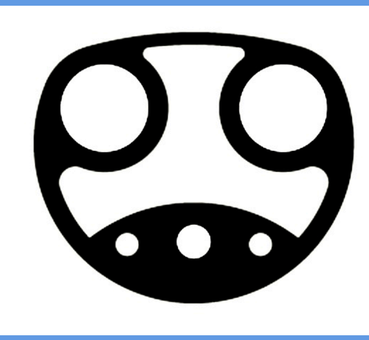
And those miles can be very convenient to get.
Remember its not how long until full
but how long to get the miles you need.

Setting up a home charger is in session 3

Session 2 : Chargers

Level 2





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

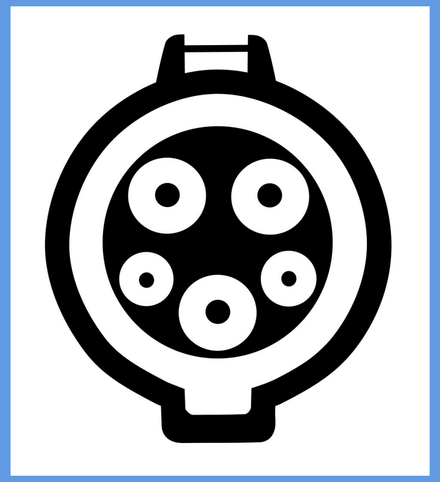
Level 2 speeds range from about 3.5 to 19 kw or 12 to almost 60 miles after one hour.

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

The 19 kw chargers 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.

Session 2 : Chargers

Level 2

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

Blink at Prospect Point Apts on the right.
80 amp, should be 17.6 kw (unverified) $.49 per kWh.
Some EVs will only take 11kw.

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

Session 2 : Chargers

Level 2

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.

Level 2

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.
Sometimes you can get connected to WIFI but not the internet

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.
The old data might still have previous EV still charging and won’t start your charge

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

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

Level 2

The only adaptor I’m keeping track of

Teslas come with a Tesla => J1772, this adaptor costs $50 and is not the adapter I’m referring to.

Level 2

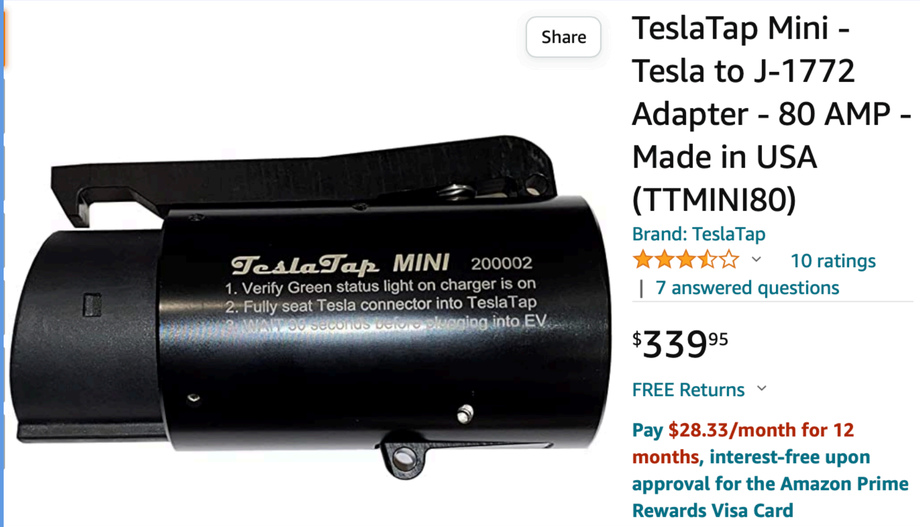
The only adaptor I'm keeping track of

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 only be on private property, like a hotel or friends house. Please ask for permision.

Level 2

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 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.

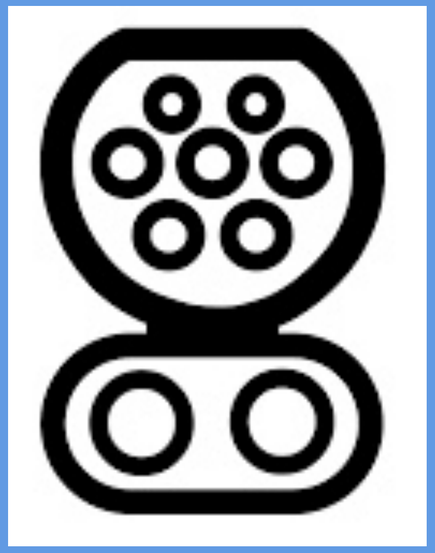
Session 2 : Chargers

DCFC - (Level 3)

Electrify America station

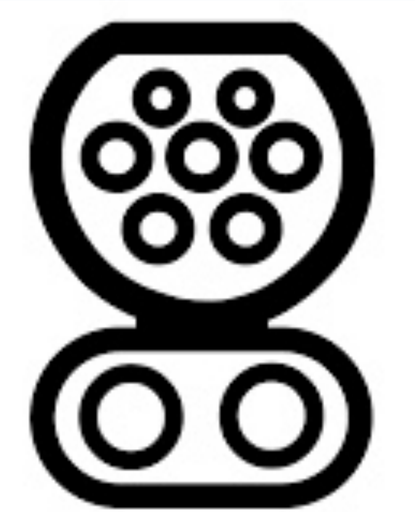
The vast majority of these are 150 kw or higher. The two plug types are Tesla and CCS

Tesla Supercharger



Session 2 : Chargers

DCFC - (Level 3)



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

(a few examples)

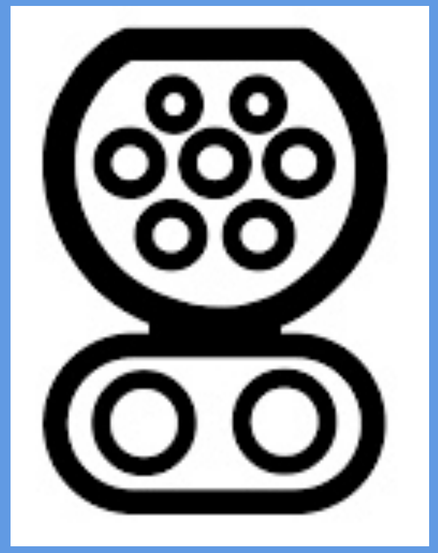
Ford Mach E	115 kw
VW ID.4	120kw
Chevy Bolt	50 kw
Porsche Taycan	400kw

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.

Session 2 : Chargers

DCFC - (Level 3)



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.

Session 2 : Chargers

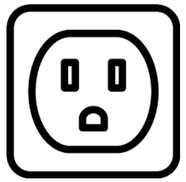
Here is that information on a PDF.

If you would like this PDF - It is or will be put it on the OLLI download site.

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

Level one (AC)
yes its a standard 110 outlet

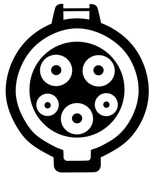
1.3 kw (kilowatt)
10 hours (a good night sleep)
13 kWh or 40 miles



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.

Level 2 (AC)
uses a 220 volt connection

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



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.

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

Newest up to 350 kw

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.

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. In two hours both Chicago and

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.

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.

2022-06-17

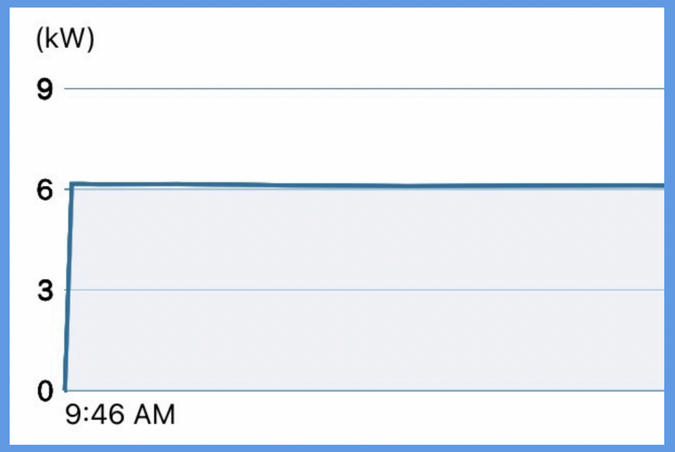
The Curves

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.

Session 2 : Chargers

The Curves

Level 1



Level 2

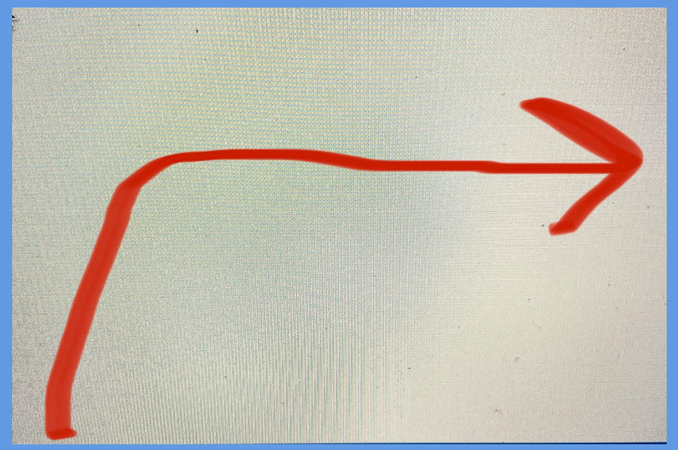
It is generally believed that all chargers deliver energy at a constant level

Direct Current Fast Charging

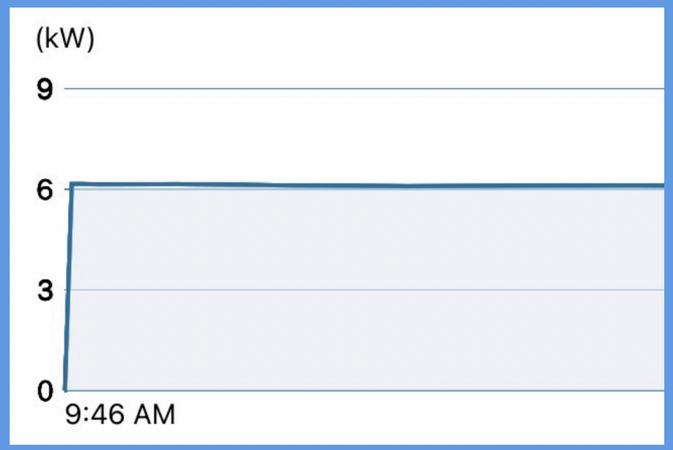
Charging for DCFC is usually referred as a certain number of kWh or miles in a 10 or 15 minute time period

Session 2 : Chargers

The Curves



Level 1



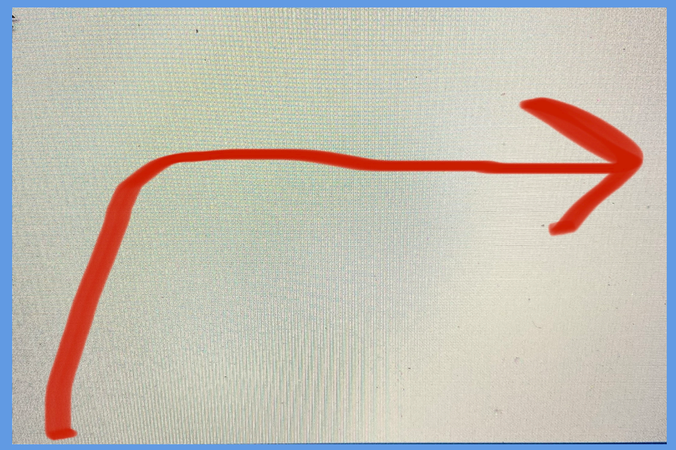
Level 2

The level 1 graph was fake.

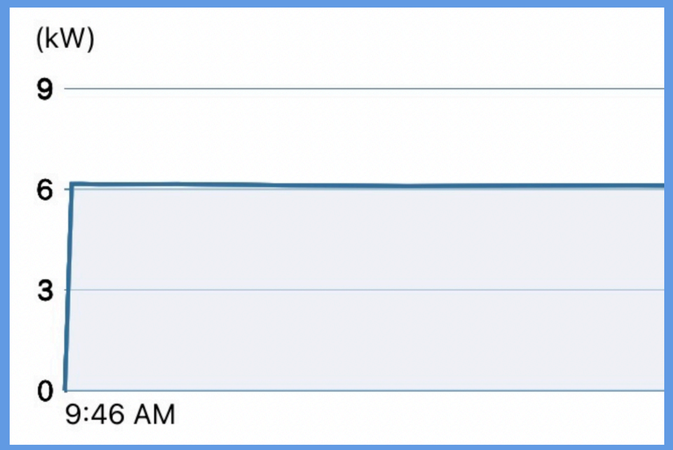
Direct Current Fast Charging

There is no graphing available with level 1 chargers.

The Curves



Level 1



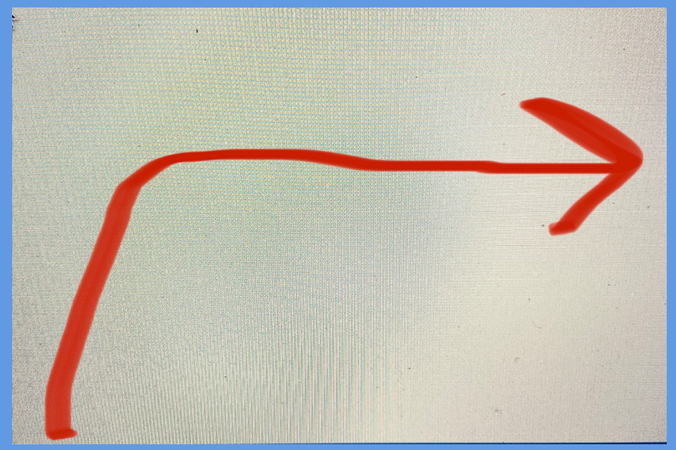
Level 2 *ChargePoint screen*

The level 2 graph is from an actual charging screen.

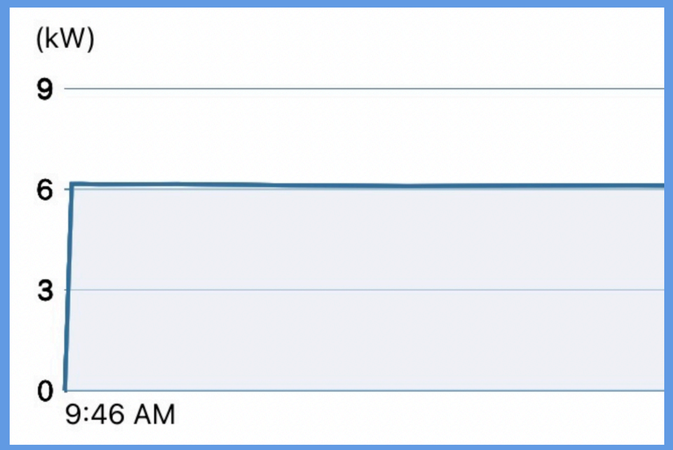
Direct Current Fast Charging

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



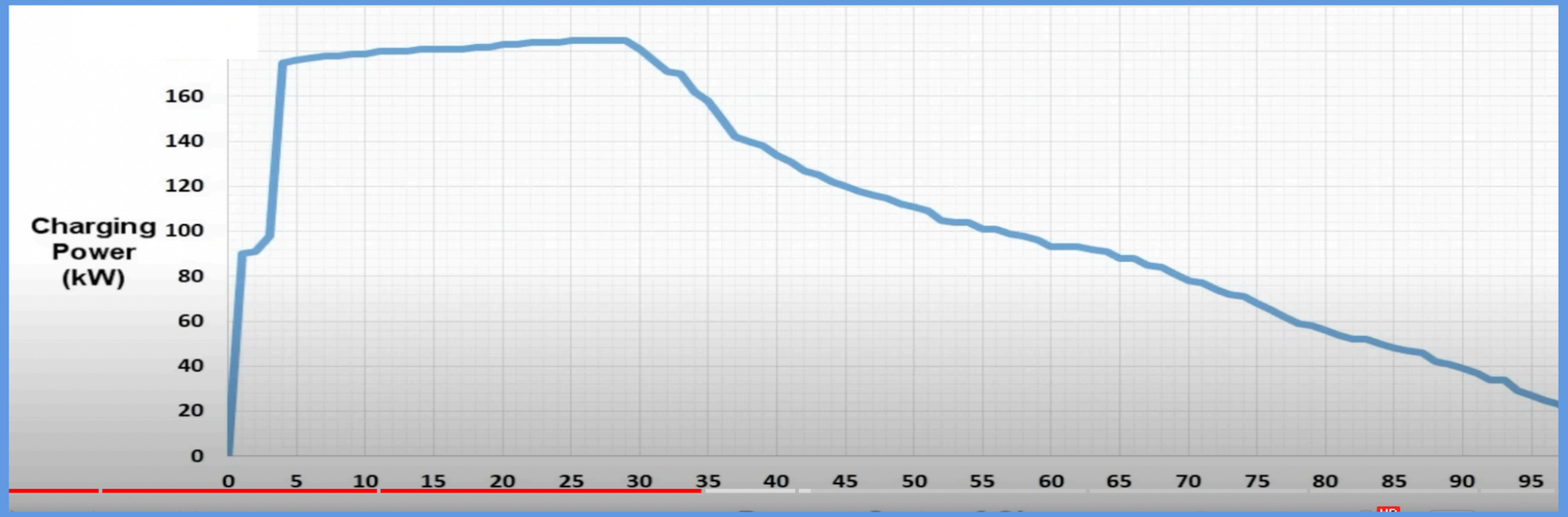
Level 1



ChargePoint screen

Level 2

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

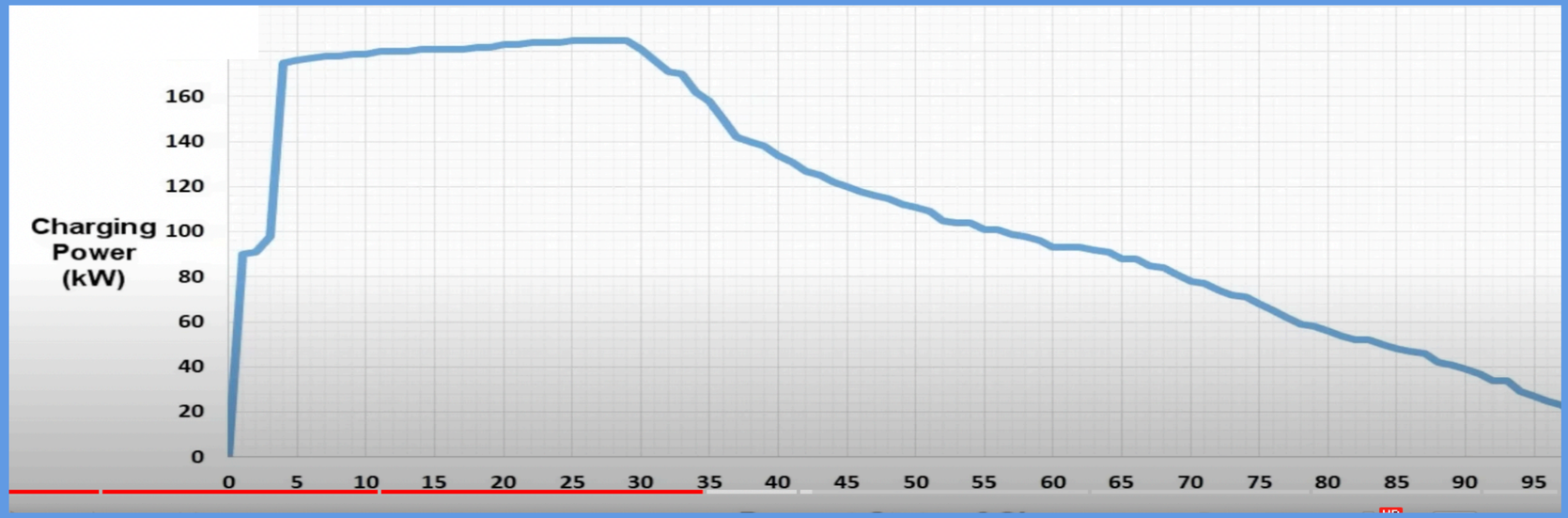


Graph was created by “State of Charge”. They do many EV videos on the web.

Direct Current Fast Charging

The Curves

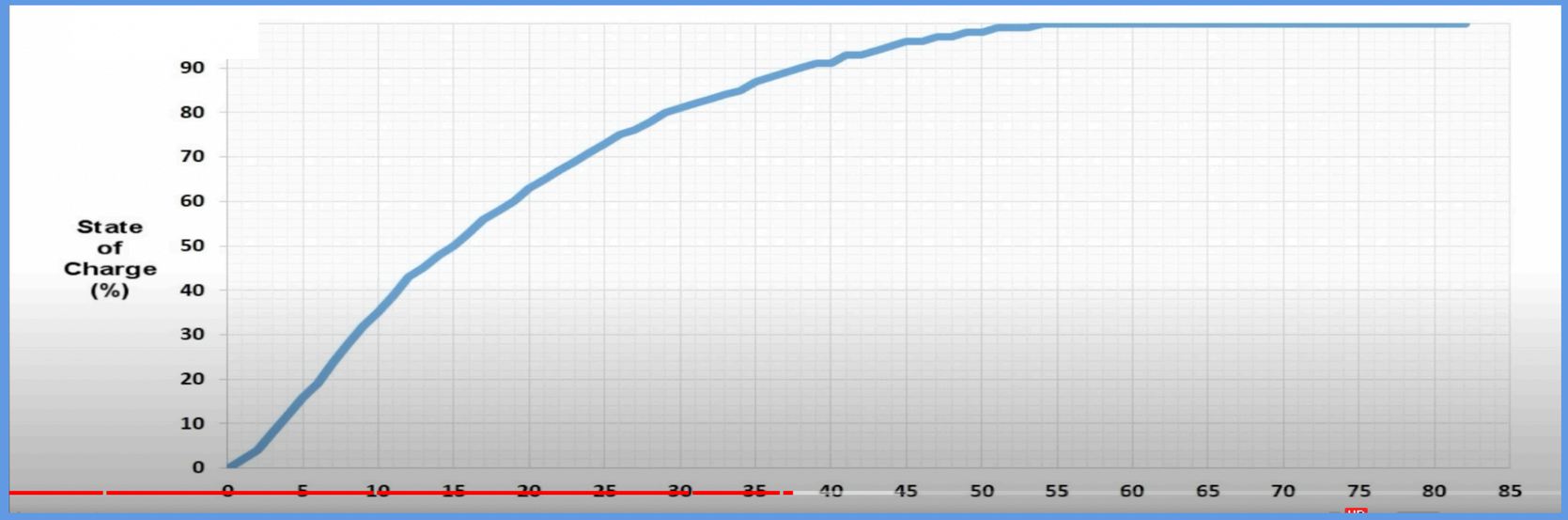
Charging the battery from 5% to 35% at 150 kw or higher would add over 100 miles of range in less than 15 minutes.
But more useful to us is how the percentage of charge changes throughout the time of the charge.



Direct Current Fast Charging Tesla model 3

The Curves

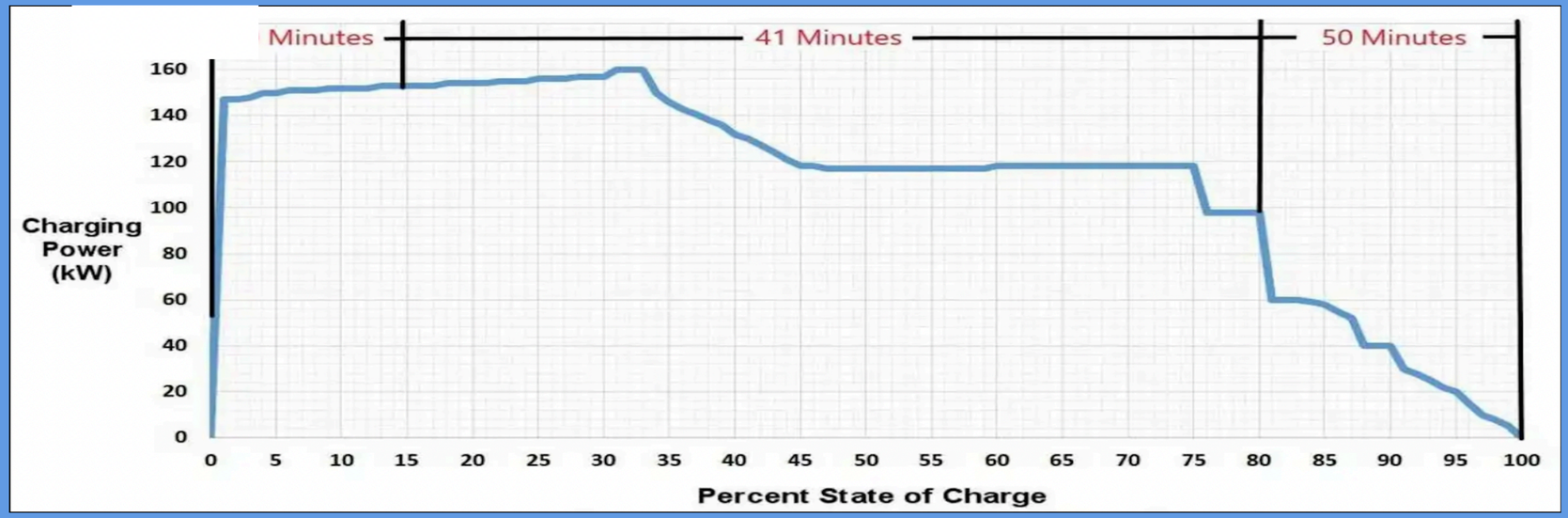
Here is the more useful percentage of charge as it changes during the time of the charge. Notice as the battery fills the slope of the curve flattens – indicating that the battery is filling slower & slower & slower.



Direct Current Fast Charging Tesla model 3

The Curves

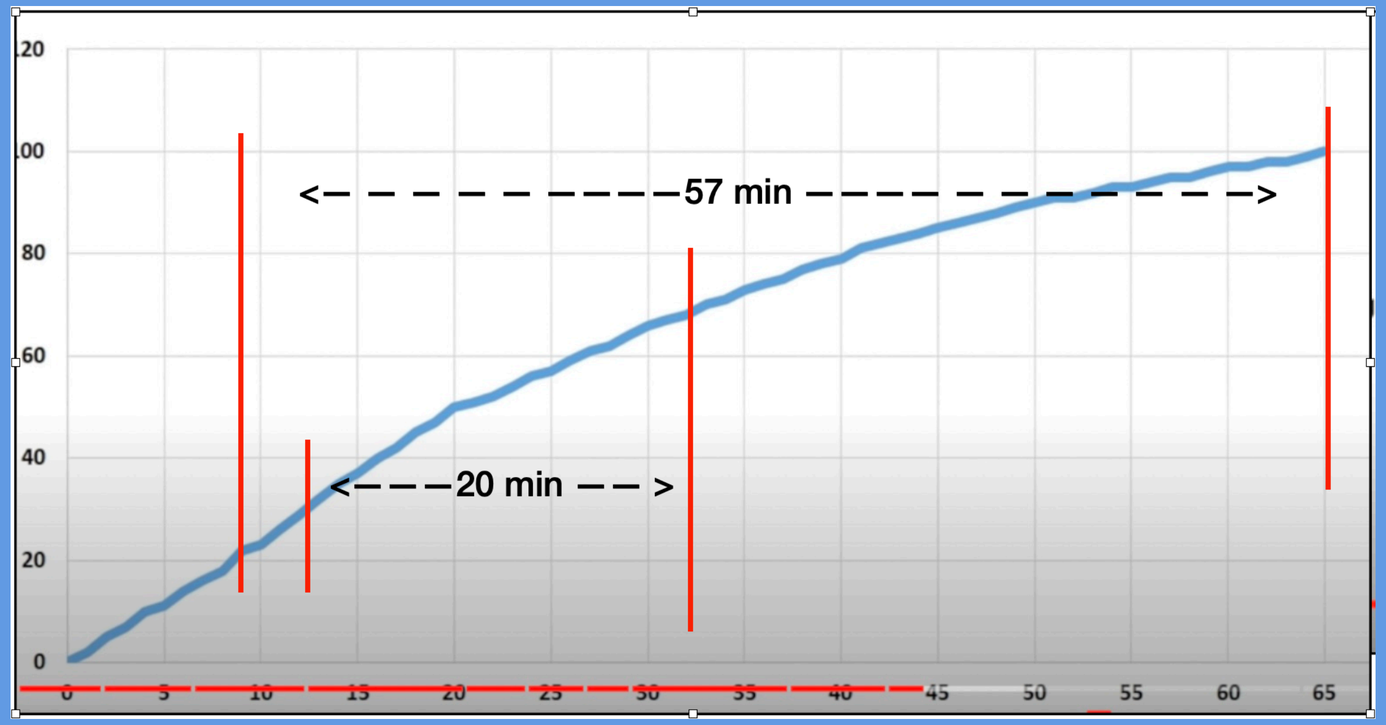
The Ford F-150 Lightning w/ 135kWh battery pack. Going below 15 % is to be avoided (if at all possible). That "sweet spot" of 15 to 80%, which takes 41 minutes to charge. The remaining 20% (from 80 to 100%) takes an additional 50 minutes ! If you are waiting, that 50 minutes is painfully long. That would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



Direct Current Fast Charging Ford Lightning

The Curves

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

Session 2 : Chargers

NEVI

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.

Session 2 : Chargers

NEVI

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 FIFTY PERCENT INCREASE IN INCOME.

NEVI

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.

Session 2 : Chargers

NEVI

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.

Session 2 : Chargers

NEVI

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==>

#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.

Session 2 : Chargers

NEVI

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==>

#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.

Session 2 : Chargers

NEVI

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==>

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

Session 2 : Chargers

NEVI

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==>

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