

DC Fast Charging Information for Consumers

How EPA can do more to educate consumers
and resolve a major hurdle for EV adoption



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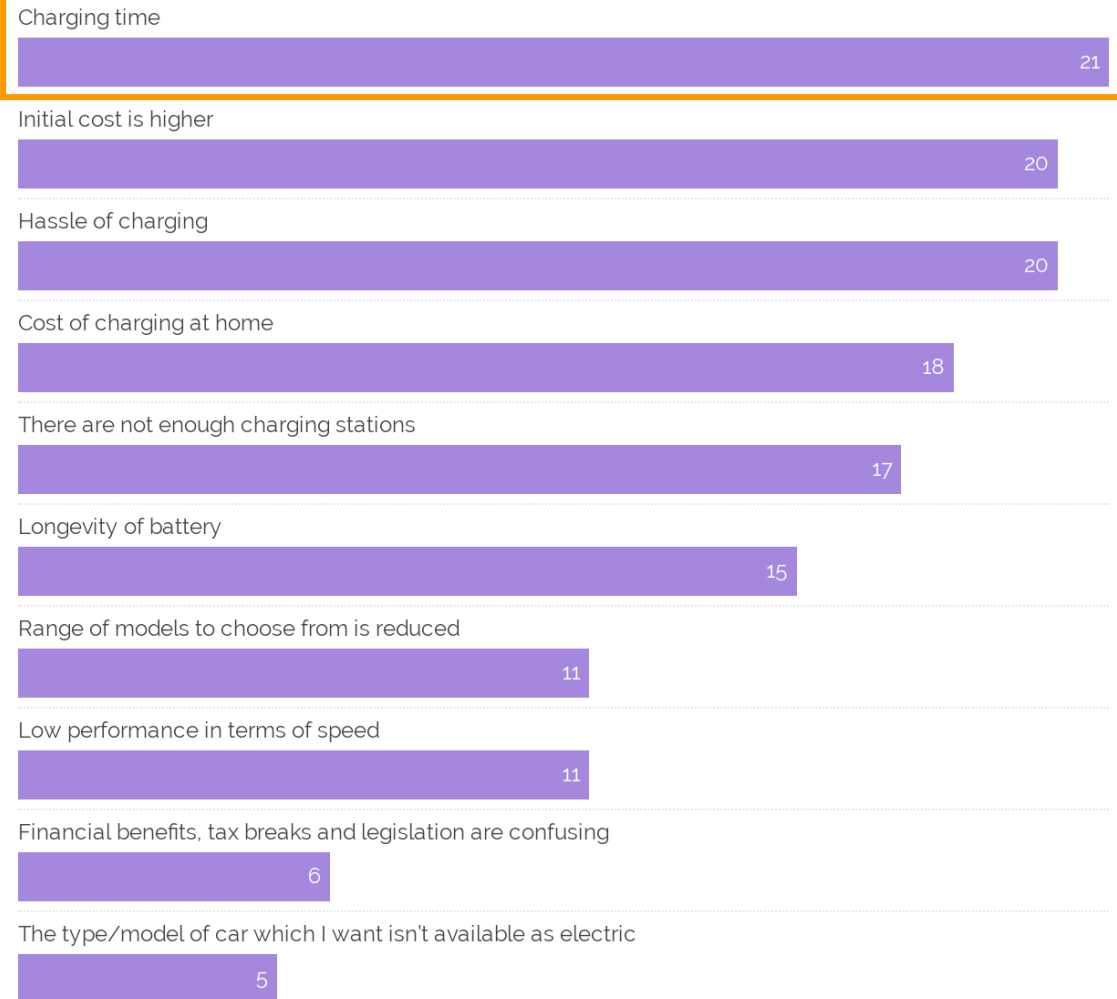
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“Electric cars take too long to charge”

Charging time is the top reason why those in the market for a new car would not consider an electric vehicle

Which, if any, of the following reasons describe why you would not consider purchasing [an electric engine] with your new or second-hand car? Please select all that apply. (% of US adults likely to buy a vehicle in the next 12 months)



- EV charging time remains a key concern for consumers
- A lack of clear information is leaving consumers confused

Tesla Model 3



Charging

Supercharging
Max/Payment Type
250 kW Max; Pay Per
Use

Onboard Charger Max
11.5 kW max (48A)

Charging Speed
Up to 147 miles added
in 15 minutes

- Car companies are advertising their DCFC capabilities in different ways
- Direct comparison of DCFC capabilities across vehicles is not currently accessible for consumers

Hyundai Ioniq 5



800V DC charging

Go from 10 to 80% in 18 minutes.

IONIQ 5 is one of the few electric vehicles that can handle these ultra-fast chargers. ⓘ

400V DC charging

Go from 10 to 80% in 25 minutes (est.)

Most public DC charging stations conveniently use this Level 3 charger. ⓘ

240V AC charging

Go from 10 to 100% in about 7 hours.

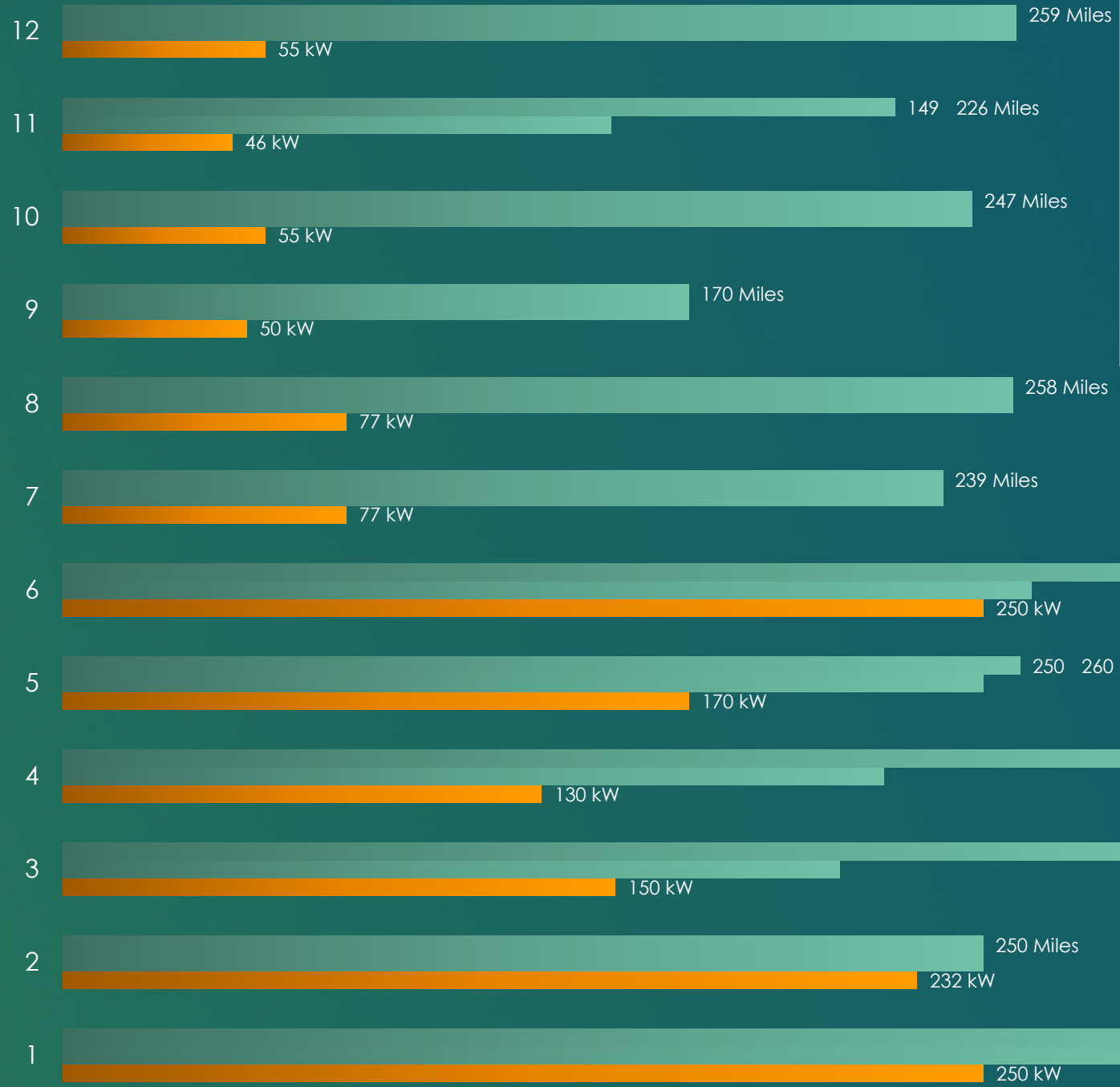
The standard 10.9kW on-board charger uses Level 2 charging to power-up your IONIQ 5 at home. ⓘ

Ford F-150 Lightning



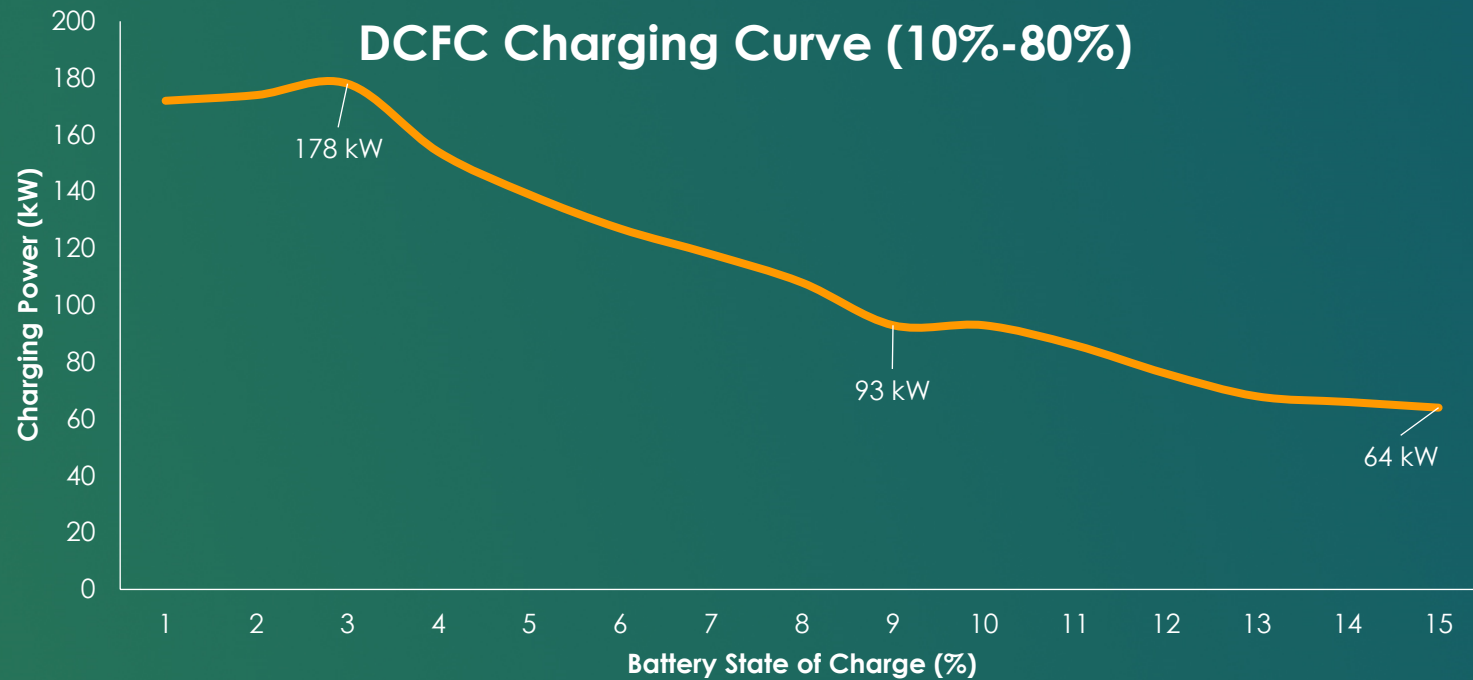
How fast can the Ford F-150® Lightning® charge?

Using a 150kW+ DC fast charger, the standard-range 98kWh pack can charge from 15-80% in 41 minutes.¹⁷⁸ The extended-range 131kWh pack can charge from 15-80% in about 36 minutes.

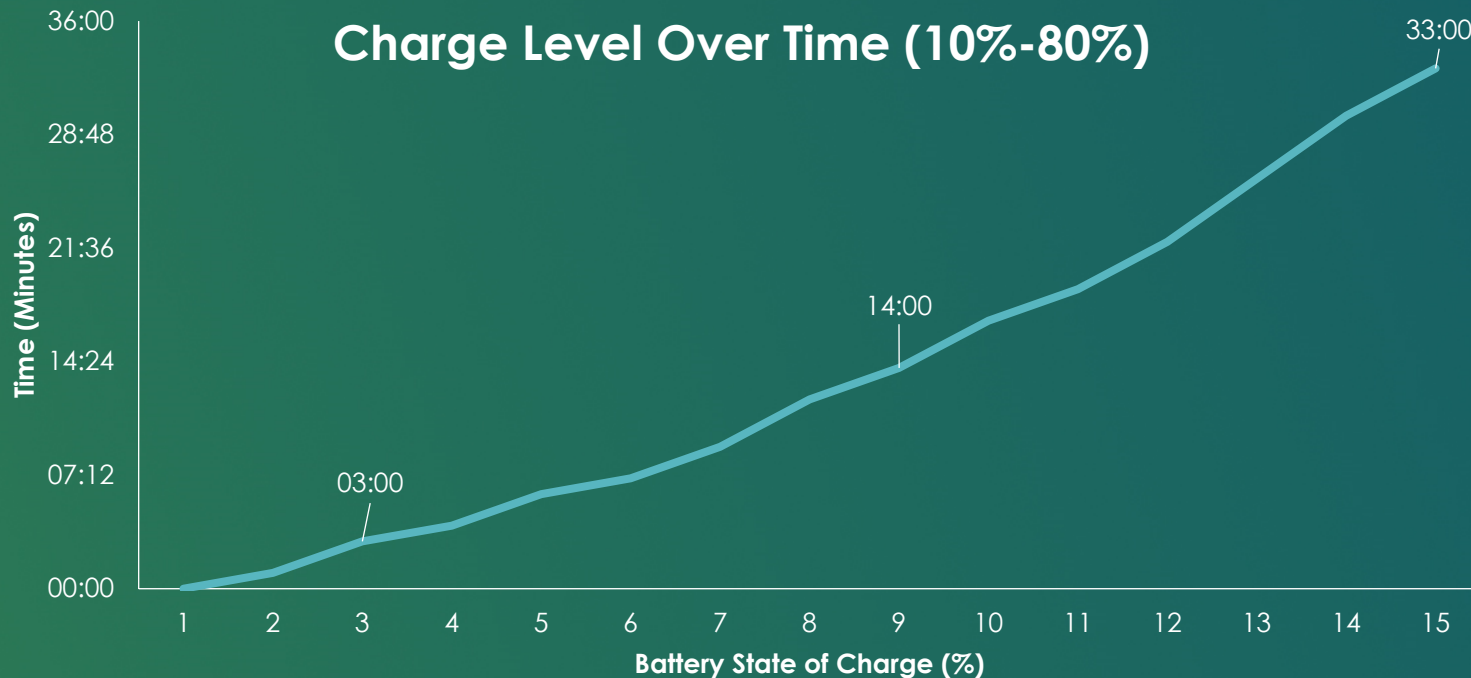


- Here is a partial representation of recent EVs, including their ranges and “peak” charging speeds
- Peak charging is only part of the story

Series 3 Series 1



Volkswagen ID.4 Pro AWD (2023)
 170 kW Peak Charge Rate*
 275 Mile Range
 77 kWh Battery
 3.1 Miles / kWh



- All EVs have nominal (or ideal condition) DCFC curves
- Variations abound but there are consistent trends, such as frontloading faster charging speeds and tapering off as they approach full
- This is an active area of improvement, and many factors are being balanced by the OEMs



A Better Routeplanner



9 h 42 min (860 km)

8 h 17 min ⚡ 1 h 9 min - 3 charges



Epa Headquarters, Constitution Ave NV

5:03 PM

100%

2 h 20 min (223 km)



Sheetz 352 - Bedford, PA [Electrify America]

7:23 PM → 7:37 PM (⚡ 9 min)

36% → 56%

1 h 28 min (160 km)



EVgo Car Charging Station [EVgo]

9:06 PM → 9:34 PM (⚡ 23 min)

10% → 67%

1 h 48 min (194 km)



EVgo Car Charging Station [EVgo]

11:23 PM → 12:05 AM (+1) (⚡ 37 min)

10% → 87%

2 h 39 min (283 km)



Plymouth + Epa Lab, Plymouth Rd, Ann

2:45 AM

10%

+ Add waypoint

+ Amenity



Restart



Share



Save plan



- An easy way to represent the impact of charging curves is through route planning
- Proper route planning for current EVs will tend to charge between low – 80% where charging occurs the fastest and balance with minimizing the number of stops

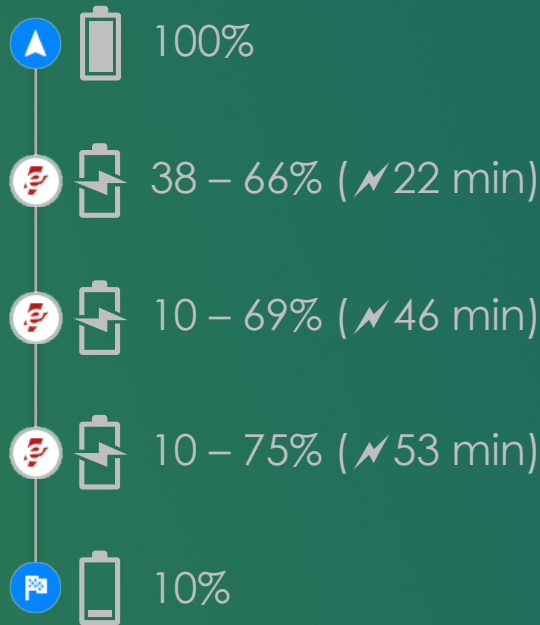


2023 Chevy Bolt



🚗 8 h 10 min

⚡ 2 hr 0 min (3 charges)

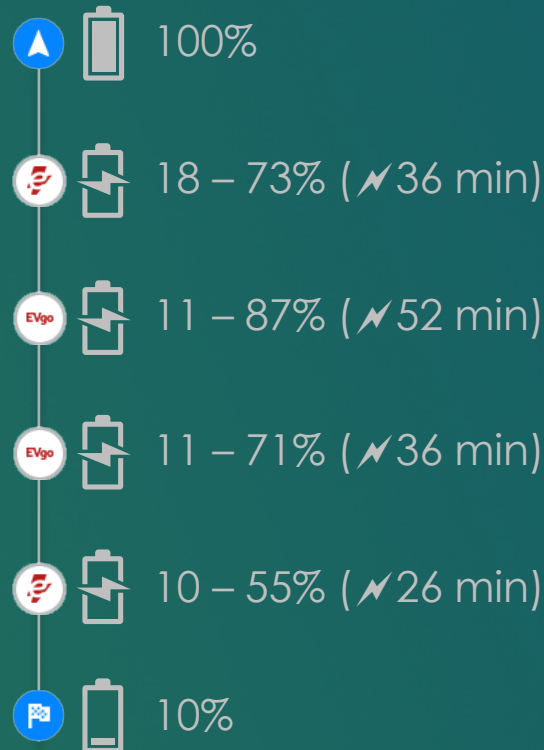


2023 Ford F-150 Lightning (Standard Range)



🚗 8 h 18 min

⚡ 2 hr 30 min (4 charges)

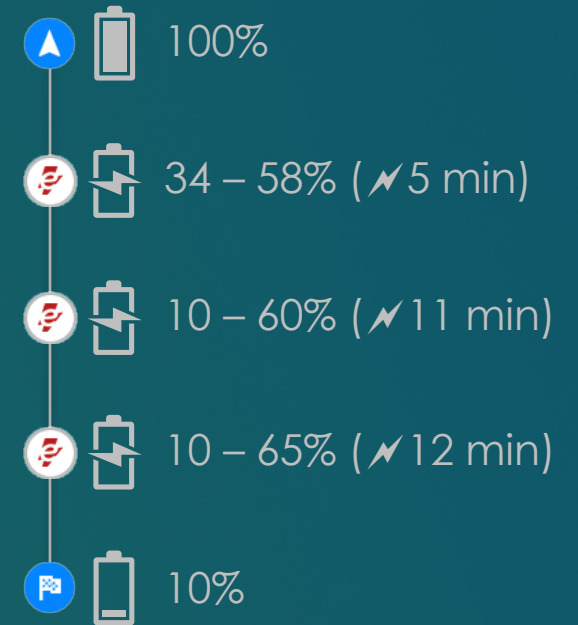


2023 Hyundai Ioniq 6



🚗 8 h 10 min

⚡ 28 min (3 charges)



The impact of the charging curve is clear across vehicles

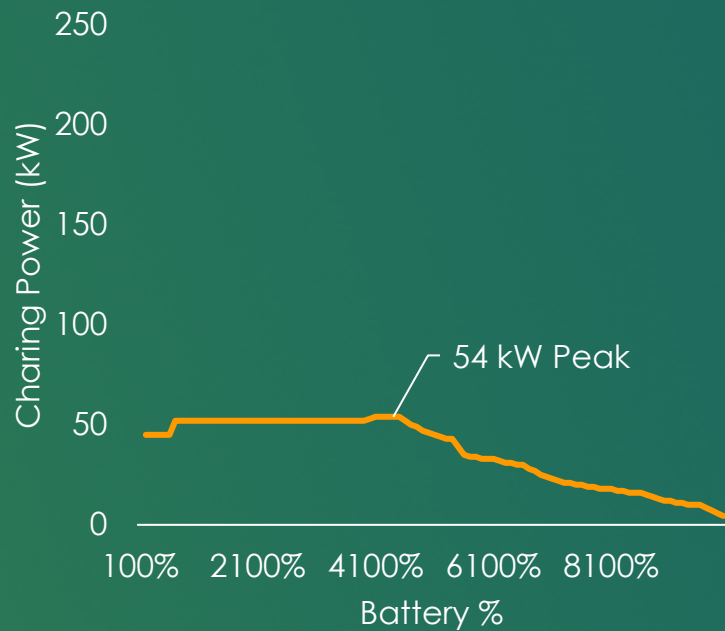
2023 Chevy Bolt



🚗 8 h 10 min

⚡ 2 hr 0 min (3 charges)

🍃 3.6 miles/kWh



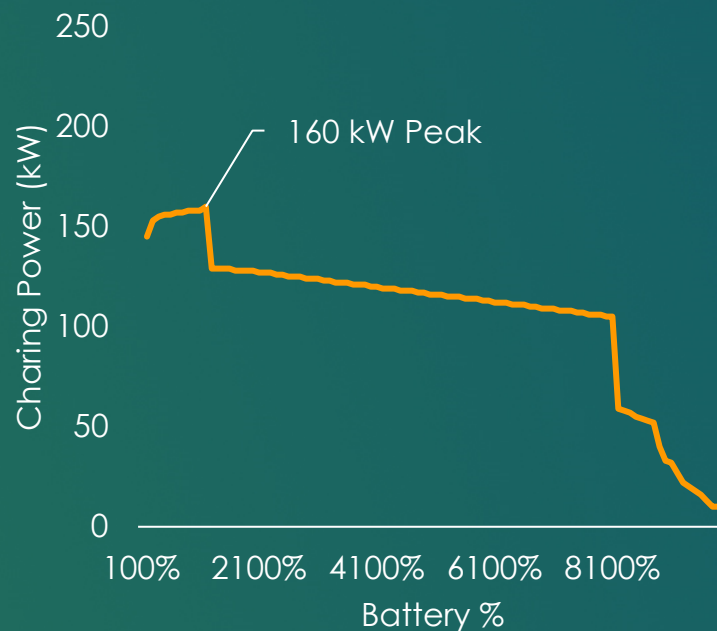
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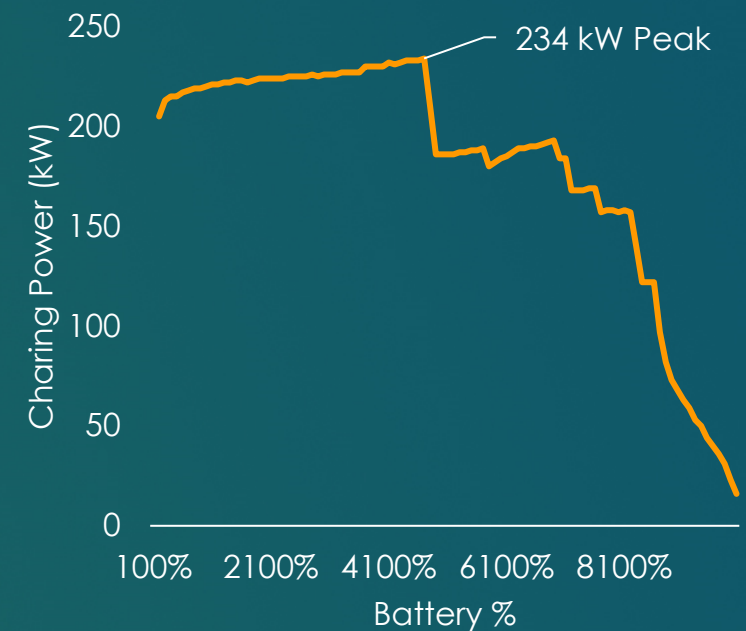
2023 Hyundai Ioniq 6



🚗 8 h 10 min

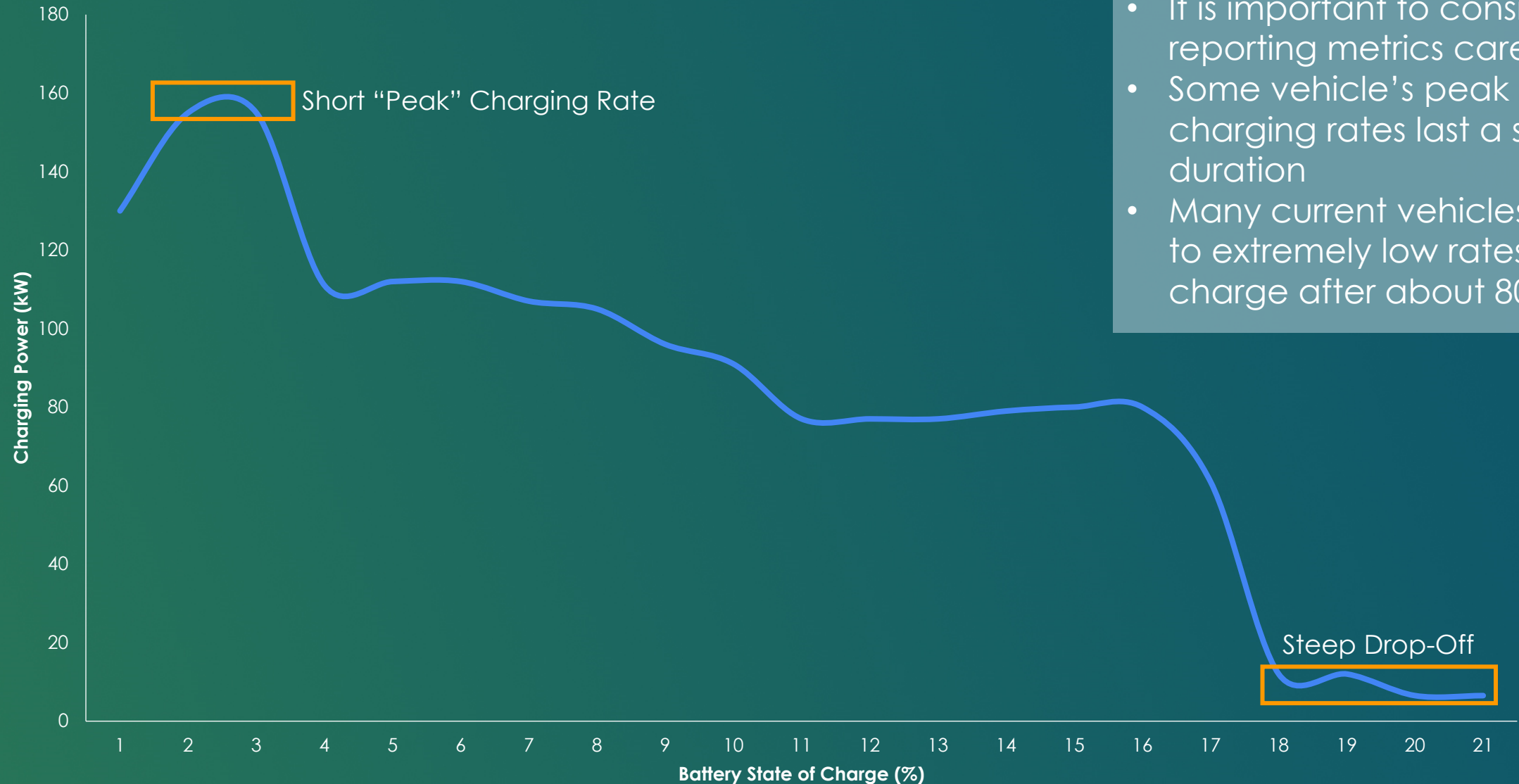
⚡ 28 min (3 charges)

🍃 3.6 miles/kWh



Vehicle efficiency and battery size also play a role in travel time

DCFC Charging Curve (10%-80%)



- It is important to consider reporting metrics carefully
- Some vehicle's peak charging rates last a short duration
- Many current vehicles drop to extremely low rates of charge after about 80%



Temperature Impacts & Battery Pre-Conditioning



State of Charge (SoC) Impacts



Battery Management System (BMS) Software Updates

A few final topics to consider how to communicate/measure:

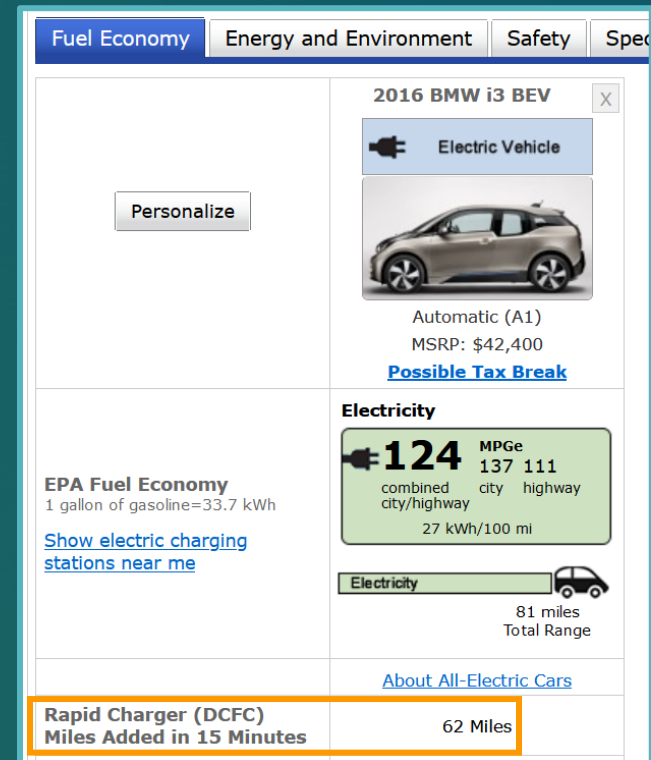
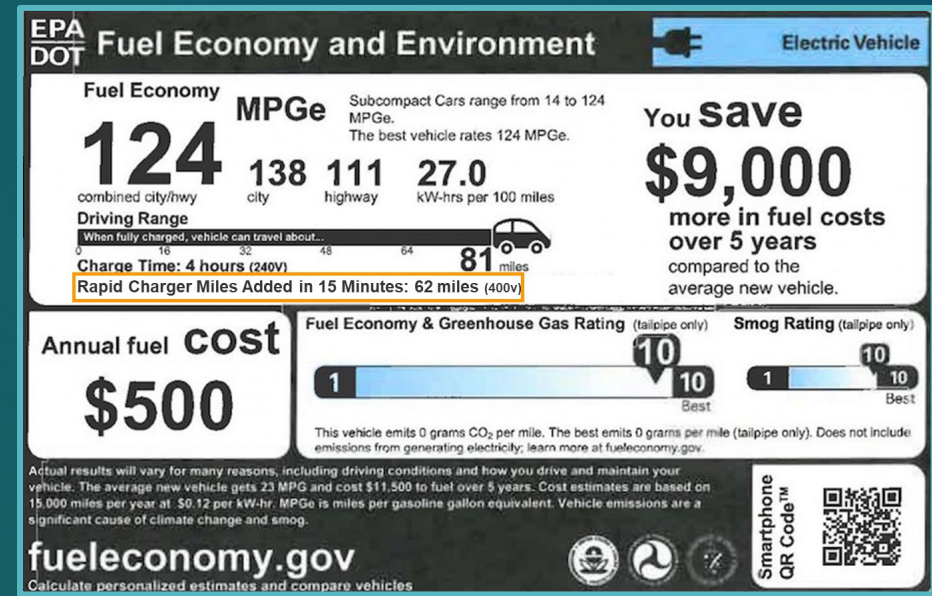
- **Battery pre-conditioning** in hot or cold weather uses additional energy but can allow for ideal charging speeds
- The **State of Charge (SoC)**, or how full the battery already is will often impact where you are along the charging curve (exceptions apply)
- **Software updates** can change many of these factors after the vehicles are on the road

Considerations

Standardize fast-charging test procedures that EPA and OEMs can use to commonly measure DCFC curves

Select common metric(s) for communicating fast charging speeds to consumers

Provide information to consumers so they can compare fast charging speeds and understand what they mean on the road using fuel economy labels, EPA's green vehicle guide, and fueleconomy.gov



Example Possibilities for Conveying Charging
DCFC to Consumers

Average Charging Speed (Between 10 – 80%)	Peak DC Fast Charging Speed	Time to Charge from 10 – 80%	Miles Per 15-Minutes of Charging	Numeric or Color-Coded Indication of Speed
120 kW	175 kW	23 Minutes	Up to 157 miles	8

We need not be constrained by how information has been conveyed in the past, but familiarity might help consumers



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