Fast charging

In general, fast charging means waiting, but the wait is getting shorter and shorter. Below you can see the differences in charging time. What used to take half an hour will now be just over three minutes! But beware: as chargers get ever faster, batteries often cannot match the speed of the fast charger.

Power	Speed*	100 km*
3.7 kW	18.5 km/h	324 min
11 kW	55 km/h	220 min
50 kW	250 km/h	24 min
100 kW	500 km/h	12 min
350 kW	1750 km/h	3.5 min

*Assuming the car uses 0.2 kWh/km

Research shows that experienced EV drivers (even the Tesla drivers with fast chargers and big batteries) still want chargers at home. This could change with increase in battery size and charging becoming even faster, but most people really like it that they can charge at home.

Fast charging

The Netherlands were the first country to offer interoperability: with your card or app you can unlock all public chargers. But to do that, multiple things are needed:

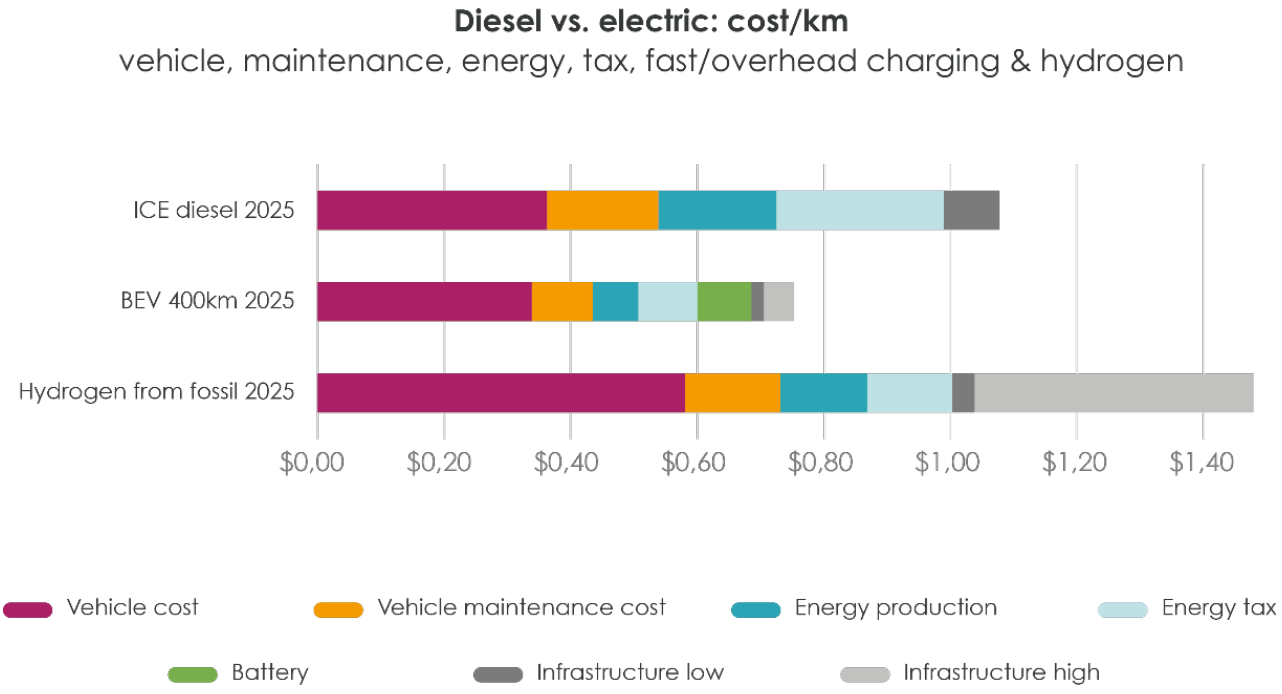
- There must be players that have contracts with all the people who own charge points. The former is called e-mobility service providers, the latter is called charge point operators.
- There must also be computer protocols that make the communication automatic. The only way to include everyone is with an open protocol that is accessible and interesting to everyone.
- Finally, there needs to be a way to clear the payments. The conventional method would be to use a centralized clearinghouse. A newer option would be to use distributed ledger technology. Since blockchain is very energy intensive, IOTA is currently being experimented with.

Charging buses

Buses are quickly being electrified. Shenzhen has electrified all its electric buses last year. To compare: they have more buses than the five largest US bus fleets together. But, they have pretty sizable batteries that take a lot of time to charge. One can do that by giving every bus a 50 kW charger at night. One could also give them a smaller battery or travel even further using super-fast opportunity charging.

Charging trucks

Trucks are a relatively new area that should get more attention, especially big long-haul trucks that make up by far the biggest part of road freight and they emit almost half as much as all passenger vehicles combined. The common thought used to be that they could not become battery electric (only hydrogen or biofuel), but plummeting battery prices and weights change everything. You can see figures from a business case below:



An electric truck could have 25-dollarcents per km advantage, but the charging infrastructure needed is impressive, ten times as fast as the fastest charger right now. Read this blog for more detailed information.

An intriguing option is to charge while driving using overhead wires. Overhead wires in itself are a proven technology. The dynamic pantograph is still new, but it's not rocket science. And the business case for roads with a lot of trucks (and they often use the same corridors) is extremely good.

Inductive highways are probably the most futuristic option out there. They look great and can also charge normal vehicles. Small pilot plots at lower power are already working. A lot more research and standardization are needed for this to become a standard option. But it is an interesting perspective, roads that invisibly charge your car while it's driving!