Charging without any surprises
Customer journey

“I’m on my way to charge at a (semi) public charging station.”

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1. Background of the program "Charging without any surprises"

Electric driving is on the rise. To make it a more pleasant and reliable experience for electric vehicle (EV) drivers, the program "Charging without any surprises" focuses on user-friendliness. To this end, we started by developing a customer journey for public charging, a service benchmark for existing charging stations, a price transparency report, and by mapping out the processes surrounding complaints, reports, monitoring, and compliance. Our goal is that by 2025, (public) charging will be a simple, everyday operation in The Netherlands, just like filling up at a gas station is today. Together, we will boost the confidence of the growing group of (potential) EV drivers and facilitate the transition to electric transport.

From a driver's perspective, the customer journey for public charging will illustrate how drivers currently experience public charging, what works, and what the obstacles are. This will provide a sound basis for jointly determining the ambition, key service indicators, and points for improvement. It will also provide input for the complaints and reporting process, allowing EV drivers to easily report complaints and leave reviews, which can be responded to and used to improve the charging process continually.

The customer journey analysis looked at EV drivers' behaviour and needs from three perspectives: the experts (VER, ANWB, LaadpasTop10)[1], the EV drivers (who depend on the public charging network and pay for their charging costs) and supply chain partners. This service design approach provides a realistic impression of EV drivers' experience, important moments, bottlenecks and needs. The customer journey comprises seven steps. 1. I plan my charging in advance. 2. I drive to the charging station. 3. I arrive at an available charging station. 4. I start the charging process. 5. I wait and watch the progress. 6. I stop charging. 7. I receive my invoice.

The service design bureau in-Novation carried out the project at the request of NKL. This project is being conducted within the framework of the "Nationale Agenda Laadinfrastructuur (NAL)" (National Agenda Charging Infrastructure - NACI).

The 'Charging without surprises'-program consists of the following projects:

- Customer journey public charging (Dutch and English)
- Service Benchmark (Dutch and English)
- Price Transparency Benchmark (Dutch and English)
- Complaints and Reporting process (only in Dutch)
- Compliance and monitoring (only in Dutch)

[1] VER: 'Vereniging Elektrische Rijders' (Association of EV Drivers); ANWB: The Royal Dutch Touring Club; LaadpasTop10: ChargecardTop10

2. Summary

Today's electric vehicle driver

On the positive side, EV drivers have gained confidence in the longer distances they can travel with electric vehicles and in the substantial increase in public charging stations in recent years. Besides the fact that drivers check the availability of a charging station, the price and expected charging speed have also become increasingly important criteria in their choice.

Today's EV driver dedicates a relatively large amount of time to research and find information. They have to do so because there are a lot of variables in the current EV market: various charging stations, various charging cards, various charging rates, various charging speeds and various sources of information. Many EV drivers have a backup plan and often double-check availability, price, or speed because of these variables. This concept of backup plans and double-checking needs to be improved as the growing group of EV drivers is expected to be much less willing to actively prepare for their journey.

Areas for improvement for supply chain partners

The customer journey provides an exciting insight into the current EV driver's experience. With their expertise and knowledge of projects, the supply chain partners have assisted in providing a glimpse into the future. This report refers to the 'current' and the 'preferred' customer journey. The supply chain partners proposed several priorities on how to achieve the preferred situation. Because EV drivers sometimes feel they are paying more and are worried about a price increase in the future, the report states that providing insight into pricing is essential. NKL will investigate this aspect in more detail in the Price Transparency Benchmark. We will also address the choice and transparency of the charging speed. The complexity of the charging speed makes it difficult to provide insight. With the arrival of 'smart charging' technology, this subject will become increasingly important.

At present, there is uncertainty about the information provided. It is a matter of priority to eliminate this uncertainty by making the information clearer and more accurate. The expertise of the helpdesk at municipalities, CPOs (charging point operators) and MSPs (mobility service providers of EV drivers) and at OEMs (Original Equipment Manufacturer) was mentioned as a separate priority. There is also a call for uniformity in the charging stations' instructions (signposting, design, communication, and user manual). With the rise in the number of EV drivers, it is important to have enough parking places for both EV drivers and fuel vehicles. This will prevent fossil fuel cars from being parked at EV charging stations and fully charged EV cars remaining parked at the charging station ("clingers"). Finally, it is advisable to continuously monitor the customer journey experiences of EV drivers.

Our common goal

By jointly working on these improvements, we aim to make (public) charging an everyday activity in 2025, just like filling up at a gas station is today. This would mean that by 2025 EV drivers will not have to go to any extra trouble to make backup plans and to double-check, so that we finally will be able to say, "charging without any surprises" is a fact.

The project was conducted at the request of NKL and took place within the framework of the NACI.

3. Scope: Customer journey public charging

The customer journey for public charging provides insight into EV drivers' current experiences, what they deem important, and the major bottlenecks.

The customer journey forms the basis for a shared ambition and formulating points for improvement, drawing up indicators for the service benchmark and developing the complaints and reporting process. The basic principles for drawing up the customer journey are:

- The customer journey is created from the EV driver's perspective;
- Both the happy and the unhappy flow have been identified, including the reporting of complaints;
- We started with an overview of the current customer journey to get insight into the most important expectations, experiences, highlights, and bottlenecks.

"I'm on my way to charge at a (semi-) public charging station. And I want to charge without any surprises"

Scope: "I'm on my way to charge at a (semi) public charging station."

Definition of public charging: *Public charging includes all charging stations that are accessible to the public: rapid chargers, charging stations in residential areas, at business parks, on car parks, in parking garages and at retail outlets such as Ikea and Lidl.*

Target group: *EV drivers in the Netherlands, who pay themselves, do not have their own driveway and therefore depend on public charging.*

Start of the customer journey: *The customer journey starts with a reason to charge. The charging location can be either along the way or at the destination.*

End of the customer journey: *The customer journey ends when the invoice and payment are accepted.*

4. Approach: Service design approach

Service design means "designing services" from the perspective of the customer or end user, using design thinking techniques. Service design is all about creating the ultimate customer experience. The service design agency in-Novation designed and supervised the process.

The customer journey analysis, service ambitions and points for improvement were generated in four rounds based on an iterative design process in co-creation: 1. consultation with experts 2. Consultation with EV drivers 3. Consultation with supply chain partners 4. review and fine-tuning of service ambition and points for improvement. From EV drivers' perspective, broad market consultation involved repeatedly checking and refining assumptions, analyses, and ideas (triangulation)

Reports consulted:

- Thesen paper: Einfach laden, Nationale Leitstelle Ladeinfrastruktur, NOW.GmbH.de 08/2020, Germany
- Nationale Berijdersonderzoek, VER/RVO, 4-2-2021, the Netherlands

Steps taken

There were four rounds in the iterative design process that in-Novation supervised:

1. *Consultation with experts* (VER, LaadpasTop10, EV drivers who depend on public charging, NKL and EVConsult) during a co-creative workshop, where we charted the expected current customer journey
2. *Consultation with EV drivers* (see text box) who depend on public charging, supplemented by ten interviews with EV drivers and observations during charging sessions.
3. *Consultation with supply chain partners:* VER, OEMs (RAI Association, Jaguar-Landrover), CPOs, MSPs (Allego, Total), NACI regions[2] G4 and East-Netherlands and data owners (Eco-Movement). Based on current projects, the future customer journey and the desired improvements were assessed. Subsequently, these were translated into a service ambition and shared points for improvement
4. Finally, the *service ambition and points for improvement* were reviewed and fine-tuned by the experts involved and during a broad market consultation. The points for improvement that were defined were confirmed and fine-tuned during this process.

Profile of an EV driver

For our meeting with current EV drivers, we selected those who best match the larger group of future drivers who will be depending on the public charging network.

These EV drivers:

- *do not have their own driveway;*
- *depend on the public charging network;*
- *have little affinity with technology.*

They are EV drivers who pay the costs of charging themselves, either privately or via their own business. Their age varies between 25 and 60 years.

The charging location or charging behaviour varies from:

- *charging at the destination;*
- *rapid charger along the way;*
- *ABC (always be charging);*
- *charging in the home and work environment.*

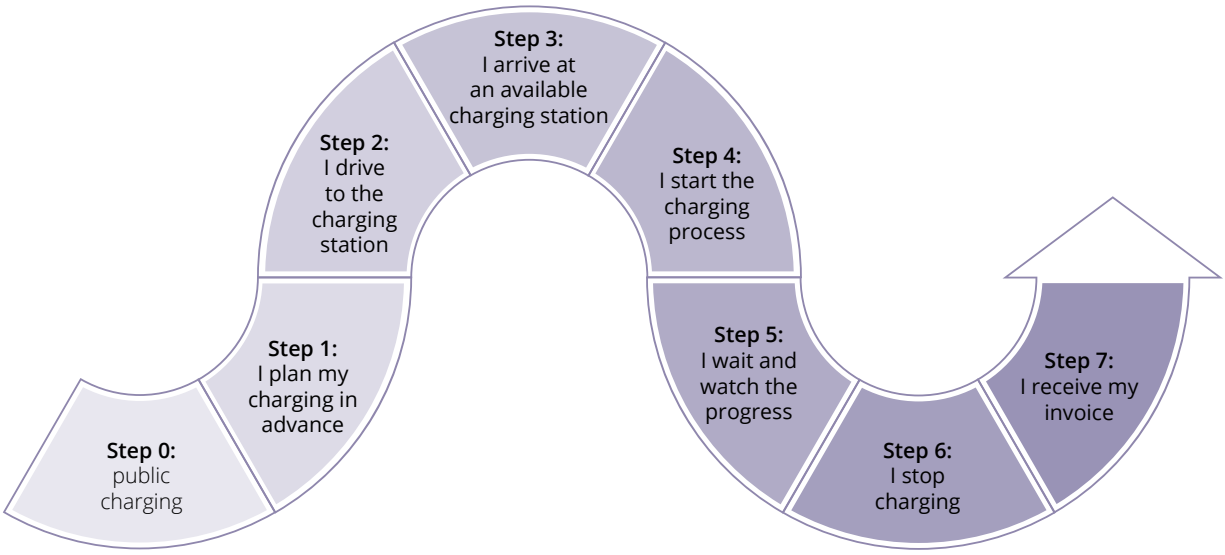
For these EV drivers, cost, speed, and service play a role when selecting a charging station.

5. Results: the definition of the customer journey

The expected customer journey "I'm on my way to charge at a (semi) public charging station" is described by experts based on seven steps. These seven steps are defined based on experts' experiences.

1. I plan my charging in advance.
2. I drive to the charging station.
3. I arrive at an available charging station.
4. I start the charging process.
5. I wait and watch the progress.
6. I stop charging.
7. I receive my invoice.

Attachement 1 describes the various steps of the customer journey in more detail.



6. Results: the current customer journey

Diversity

By talking to EV drivers and (virtually) observing them charging at a public charging station, it became clear that the great diversity of variables influences EV drivers' experience. As a result, the experiences, and choices of EV drivers differ. Due to a lack of consistency in many areas, we noticed that the current EV drivers invest a lot of time in research. This is something that we do not necessarily see the larger group of future EV drivers doing. We expect that this group will want to be unburdened.

Below are the variables that impact the specific situation and the driver's perception:

1. Charging types of EV drivers: at the destination, on the go, at home or at work and ABC charging.
2. Known vs unknown environment. Usually, drivers charge at a charging station, and in an area they know well.
3. Type of car: driving range, navigation, charging technology.
4. Crowds at charging stations/parking spots.
5. Charging station: diversity in design, operation, speed, and technology.
6. Charging card: diversity in price, form, and customer service.
7. Type of navigation: Up-to-dateness, accuracy, data, and options.
8. Apps with information: Up-to-dateness, accuracy, data, and options.

EV driver's behaviour: back-up plan

High stress moments are rare because EV drivers have a backup plan for potential problems that may occur. Reasons for a backup plan include the wide variety of sources providing various information. Drivers want to be sure they are getting the best deal in terms of price and charging speed. However, the fear of not being able to charge and therefore not being able to meet their planning (the so-called 'range anxiety') is another reason for making a backup plan.

A backup plan includes:

- Spare kilometres to be able to drive to another charging station.
- Having an extra charging card that may be more expensive but that you can use anywhere. The participants in the study had about 3-5 charging cards per person.
- Planning some extra time if you need to get somewhere on time.
- Bringing a cable from home that allows you to charge at your destination or at your home if a charging station does not work.
- Using different apps to help compare things (like price and speed).

Unfamiliar terrain makes drivers insecure

We assume that most EV drivers who charge in familiar terrain are not faced with many surprises. If they incidentally charge on unfamiliar terrain, it feels complex. If they structurally charge on unfamiliar terrain, they will have found a way of dealing with the unknown. Consequently, the surprises are minimised.

Key findings from the current customer journey:

- **Active and conscious drivers:** EV drivers invest a relatively large amount of time going through the information: there are many variables such as charging station operation, charging cards, charging stations, prices, information provision and invoicing. We do not expect this proactive research from future drivers (late majority).
- **Most charging actions take place at known locations:** EV drivers usually charge at a charging station they know; at destinations that they frequent and only occasionally at a charging station they don't know.
- **Confidence:** Drivers feel confident thanks to relatively long driving ranges and many (rapid) charging stations.
- **Important selection criteria:** availability, charging speed and costs.
- **A lot of information:** large diversity in sources of information, data, and accuracy.
- **Backup plan and extra checks:** EV drivers are prepared for the possibility that a card or station doesn't work or is unavailable. They also strive for an optimal situation in terms of price and speed.
- **Reporting problems:** EV drivers report a problem to e.g. MSP/CPO or municipality when they cannot rely on their backup plan.
- **Unreliable:** According to EV drivers, the price for charging is subject to change and therefore unreliable.
- **Concerns:** EV drivers are concerned about possible price increases. They already pay a lot more than someone who has their own charging station

7. Results: Vision, service ambition and points for improvement

We have worked out a vision and service ambition for the preferred future customer journey as well as several points of improvement to realize this together. These have been broadly discussed and developed by (representatives) of supply chain partners, EV drivers, and the NACI Steering Group.

Vision:

- EV as transportation for all.
- 70% of households depend on the public charging network.
- EV drivers are the focus for further expansion and improvement of the public charging network.
- The public charging network needs to be made more user-friendly and intuitive.

Service ambition:

Our ambition is to make public charging a simple everyday act by 2025.

- In 2025, charging will not be a subject of discussion anymore.
- It will just be part of EV drivers' daily routine and life.
- In 2025, EV drivers will not need to go to the extra trouble of double-checking things or having a backup plan.

Areas of improvement:

1. **Price transparency:** EV drivers should know the price before, during and after charging. Price perception: feeling like you are paying more, fear of rising rates results from free-market competition.
2. **Choice and transparency in charging speed:** The charging speed should match EV drivers' planning and expectation. EV drivers currently find it difficult to obtain this information. They should not be negatively surprised by this in the case of smart charging.
3. **Accurate sources of information:** Inaccuracy of information and diversity of sources leads to uncertainty for EV drivers. We must try to provide transparent sources with up to date and complete information.
4. **Behavioural rules around parking:** With the increase in the number of EV drivers, there will need to be enough parking spaces for EV drivers and fuel cars alike to prevent fossil fuel cars from being parked in EV charging spots or a fully charged EV car from remaining parked at one ("clingers").
5. **Skilled and easily accessible help desk:** Currently, not all problems are and can be reported and solved.
6. **Uniformity in charging communication and use:** Make charging at unfamiliar charging locations familiar by providing uniformity in signposting, design, communication, and user manuals.
7. **Measuring and adjusting**: Measure by indicators, reports, and reviews from EV drivers. If necessary, make adju stments to ensure and increase convenience.

Appendices

Appendix 1: Customer journey in detail per step
Appendix 2: EV drivers' behaviour in reporting problems
Appendix 3: Response from supply chain partners

Appendix 1: Customer journey in detail per step

Customer journey: I'm going to charge at a (semi) public charging station
The customer journey is broken down into seven steps.

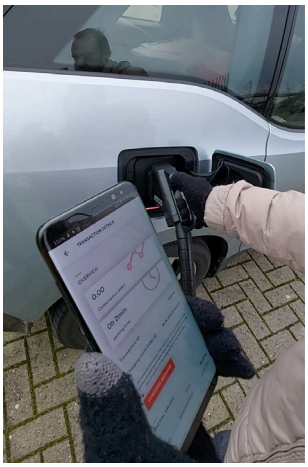
Step 0. Public charging.
Step 1. I plan charging in advance.
Step 2. I drive to the charging station.
Step 3. I arrive at an available charging station.
Step 4. I start the charging process.
Step 5. I wait and watch the progress.
Step 6. I stop charging.
Step 7. I receive my invoice.

Step 0: Public charging

Current customer journey:
Drivers generally recharge if their schedule depends on it, or if the battery level is below 50%. They usually charge spontaneously if their preferred charging station (in front of the house, next to the house) is free. Once the car is fully charged, it is usually left connected to the charger, because the driver may not be able to move it.

Expectation or wishes for 2025:

- The process should be smooth and effortless for drivers.
- If the batteries are larger, there is going to be a greater distinction between rapid charging (on the go) and charging during other activities.
- Expectations need to be managed better. By providing an estimate of any expected extra time for charging and the costs involved.



Step 1: I plan charging in advance

Current customer journey:
I plan where I'll charge and how much time it'll take. I want to know if the charging station is available. I also check which card I can use to charge and what the best price is. Also, I need to know which charging station is suitable for my car. To do so, I use various tools like apps and navigation systems. That's a hassle.

Not everyone plans their charging process in advance; it often depends on whether someone is familiar or unfamiliar with the area.

Bottlenecks:

- It is hard to choose because not all information can be found in one place, and it isn't always accurate.
- There is a lack of overview and significant differences in rates at different charging stations and cards.
- Apps and information are not always accurate and reliable.
- EV drivers often have a backup plan ready, especially when their schedule is tight.

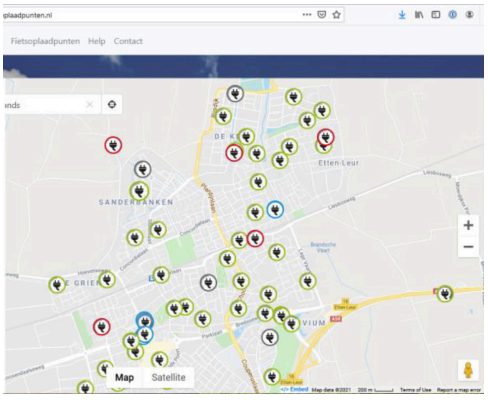
Expectation for 2025:

Improvements:

- My car will plan my journey and charging sessions based on the meetings I have scheduled in my calendar, time of arrival, traffic, charging time.
- The coverage ratio of charging stations will ensure better availability and scheduling.
- In the future, it'll be possible to book a reservation.

Bottlenecks:

- There will continue to be a large number of apps and information sources, or their number will even increase.
- The reliability of the information will remain challenging for each situation.
- More uncertainty and complexity due to smart charging and other business models.



Step 2. I drive to the charging station

Current customer journey:
When the battery drops below 40-50%, I become more cautious, and want to start charging. If the driving range decreases faster than expected, that might even lead to some sense of insecurity. As a result, my planning can be thrown into disarray because I'll have to find time to charge somewhere in between. I adjust my speed and/or route according to my car's consumption. Sometimes my car's navigation system is helpful in this respect.
Most of the time, I'm familiar with the area and drive straight to a charging station. If I'm not familiar with the area, I use the car's navigation system or an app to find a charging station. Having a co-driver's help when you need to find a charging station when you're on the go is helpful. Most of all, I want to know if the charging station is available and how busy it is.

Highlights:
- • You're more relaxed because you take your time for the drive.

Bottlenecks:
- Unexpected, more rapid decline in the range I can reach can cause a sense of insecurity.
- It can be challenging to look for a charging station while you're on the go if you are unfamiliar with the area.

Expectations for 2025:
Improvements:
- Along the way, you will be assisted by one navigation system that advises you based on location and all the variables you want. A larger battery will increase your driving range and virtually eliminate the need to charge while you're on the go.
- A higher coverage ratio of charging stations will lead to better availability.
- The signposting on the road will be better.
- It'll be possible to make a reservation for a charging station.

Step 3. I arrive at an available charging station

Current customer journey:
I check the availability of the charging station that I've selected on the way. I drive there but always have a backup plan in case I can't find it, or it turns out to be broken or occupied. Sometimes I can't find or reach the charging station because it's not in sight, or I can't get to it (because of a barrier or something).
Usually, I have a backup plan: sufficient spare range/km; I build spare time into my schedule or bring a home charger with me that I can use when I get to my destination.
At rapid charging stations, it's not a big deal if you have to wait a while. Usually, there are several chargers in one place. Normally it doesn't take long. I often look for the fastest charger there. Sometimes, I don't really need to charge, but I park at a charging station because there is no free parking space. In that case, the added bonus is my car is heated/cooled.

Highlights:
- Less parking stress because there's usually a spot available.
- My backup plans

Bottlenecks:
- Can't find a charging station, can't reach it, or it's occupied.

Expectation 2025:

Improvements:

- Bottlenecks resolved due to denser and more accessible charging infrastructure with various speeds.
- Better signposting, services, and facilities at a charging station.
- Good charging behaviour is rewarded.

Bottlenecks:

- New: Parking pressure problems still exist, and the number of "clingers" will increase.
- Future drivers may not be so patient.

Step 4. I start the charging process

Current customer journey:

I look for the cheapest card for this station and may check the price in my app again. Which one was it again?
I plug the cable into my car and into the charging station and start charging with a charging card, token, or app. There are several ways to start charging. I check whether charging has started by looking at the charger and checking my car. There are several ways to check whether the charging process has started: for example, on the dashboard, outside of the car, on the charger by lights or sound. If the charger or card doesn't work, I have a backup plan: spare kilometres so that I can drive to another station, a home charger to charge when I get to my destination and an extra charging card that works at all the stations. If I have to pay for parking, I use a separate parking app

Highlights:

- It's a relief when you see that charging has started.
- Backup plan for when it doesn't work.

Bottlenecks:

- Which card is the cheapest again?
- Various ways to check whether charging has started.
- Parking is started and paid for separately from charging.

Expectation 2025:

Improvements:

- Fewer failures because the charging station and car are more in tune with each other.
- Simple reports: 'green' if everything is going well and a report (red) if something is wrong.
- Improvement of the customer service possibilities.
- Not only "uptime" is important in SLA, the number of charging attempts vs percentage of success are equally important.

Bottlenecks:

- Discussions about the rate and expected charging speed have become increasingly complicated since the inception of smart charging.

Step 5. I wait and watch the progress

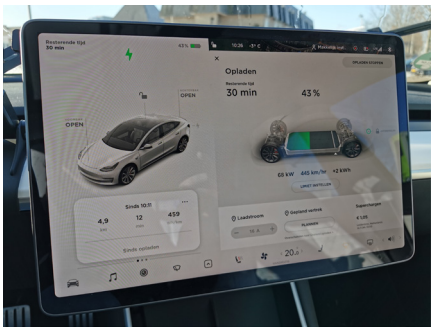
Current customer journey:
I only charge enough to get home, get to my next destination or until I have finished my activity. I don't find the wait annoying; I'm prepared for it. I don't experience the waiting time at a rapid charging station as a waste of time; I plan a break, have lunch, or work for a while. Sometimes while I'm waiting, I'll check to see how the charging process is going. You need to focus on the charging speed, what percentage is charged, and whether the charging process has unexpectedly stopped. I can either check this in an app, in the car or at the charging station.

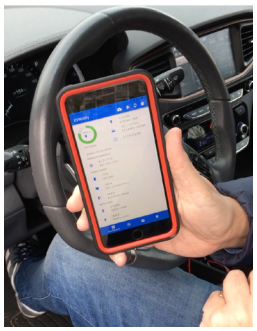
Highlights:
- Waiting also has a social component, and rapid charging feels good.

Bottlenecks:
- Uncertainties such as varying speeds and the stopping of the charging process.
- You can't always check the exact charging speed.

Expectation 2025:
Improvements:
- Charging speed and rate, and so on, can be read and selected at the station.
- Insight into kilometres that are charged.
- More facilities will be available during charging, such as checking tire pressure, vacuuming, cleaning, emptying trash.

Bottlenecks:
- More demand for electricity may come at the expense of charging speed due to distribution at peak times.





Step 6. I stop charging

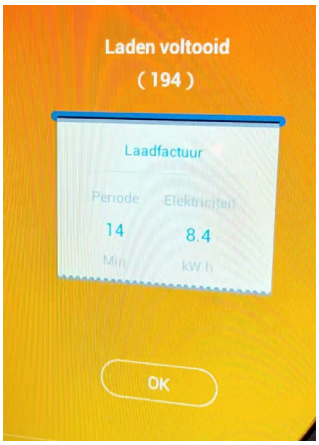
Current customer journey:
I can see that my battery is sufficiently charged. I stop charging and put the cable away. I look (in vain) for information about the speed and costs incurred and possibly for a receipt. I find it annoying when I have to move the car late at night after it's fully charged. Consequently, I don't always do so.

Highlights:
- My car is sufficiently charged; I can continue my trip.

Bottlenecks:
- It isn't unequivocally visible everywhere whether the charging process is finished.
- Uncertainty about the actual costs. Also, this is communicated in various ways.

Expectation 2025:
Improvements:
- Apps for charging speed or to see whether the battery is fully charged work well.
- You can immediately see the number of kWh and the corresponding amount you have to pay at any time during the transaction.
- You can specify how many kWh you want to charge or how many euros you want to pay.
- If I experience problems, they are solved immediately (remotely).
- Payment via in-car apps (Parkmobile, etc.).

Bottlenecks:
- Helpdesk capacity will need to be expanded due to the increase in drivers who have little affinity with technology and the number of charging stations.
- Fines for those who cling to the charging station

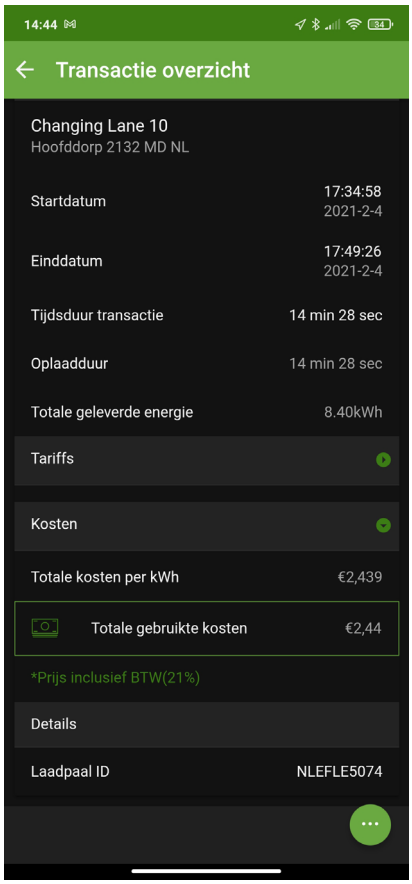


Step 7. I receive my invoice

Current customer journey:
I receive the invoice, sometimes very quickly and sometimes not until three months later. It depends on the card I've used. Then I check to see that there aren't any unexpected costs, like a price increase, additional or double-charged costs. If something isn't right, I report it to my charging card provider. Sometimes, when I get home, I double heck the different charge card providers to find out which one is the cheapest now; this can change over time.

Highlights:
- Sometimes you're lucky because you get something for free.

Bottlenecks:
- Public charging is more expensive than home charging.
- It can take a long time before you receive the invoice.
- If you have multiple cards, you also have different invoices; there is no uniformity.
- Unexpected costs.



Expectation 2025:
Improvements:
- Having a three-month wait for your invoice will be solved by having insight online and fixed payment times, which makes it easier to check things.
- The early and late majority won't want to have that many charging cards and invoices.
- • We might see more ad-hoc payments at the charging station.
- Increased customer service capacity and improved quality and knowledge.
- Linked to a phone package or as part of your energy bill.

Bottlenecks:
- Charging in public spaces must be more transparent; depending on your subscription, the rate should just be displayed on the charger.

Appendix 2: EV drivers' behaviour in reporting problems

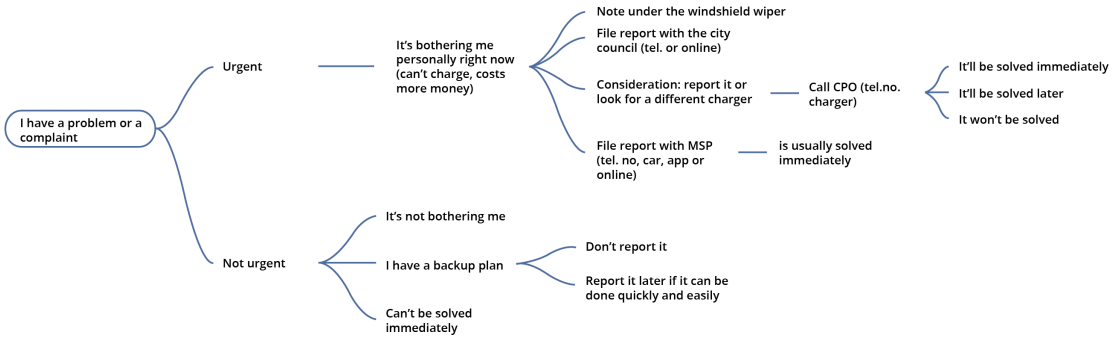
What do you do if it doesn't work?

We noticed that not many EV drivers report it if the chosen charging station is unavailable, or if charging can't be started or stops unexpectedly. Instead, they'll resort to their previously described backup plan first. But if someone does file a report, it'll often be directed to the CPO, except if it concerns the invoice or a wrongly parked car.

During this reporting process, we came across the following bottlenecks:

- Being referred back and forth between CPO - MSP;
- When referred to the MSP, it's unclear why and how you can reach them;
- Sometimes, an EV driver has more relevant knowledge than the call centre employee.

The activities EV drivers carry out when they are faced with a problem or have a complaint.



Appendix 3: Response from supply chain partners

During the workshops, we asked supply chain partners to respond to the conclusions drawn from the interviews with EV drivers. This is further elaborated below.

In general, supply chain partners pointed out that they saw a shift in the EV drivers' focus from the driving range and the number of available charging stations to price and rapid charging.

Some favourable aspects that supply chain partners observed:

- No more issues with 'range anxiety' (anxiety about the driving range).
- No reports of coming to a (near) standstill.
- Not a single complaint about too few charging stations.
- EV drivers are price conscious.
- Most charging sessions take place at known locations, so there are not as many surprises.
- Charging speed will become important; drivers perceive rapid charging as convenient because it's quick.

What are the concerns that supply chain partners have?

- Drivers still need to have a backup plan, like an extra charging card.
- The importance EV drivers attach to the speed of charging and the risk of unexpected negative surprises that smart charging might cause.
- Too much or inaccurate information (availability, charging speed, rate) as soon as they rely on various sources of information from providers.
- Lack of transparency, due to growing diversity in charging cards and/or business models.
- Irritation about slow freight traffic and wrongly parked vehicles.
- Fear of increasing and unannounced rate adjustments.
- The complexity caused by all the variables that vary from situation to situation.
- Often ill-informed helpdesk employee.
- There are no service desks for specific problems.