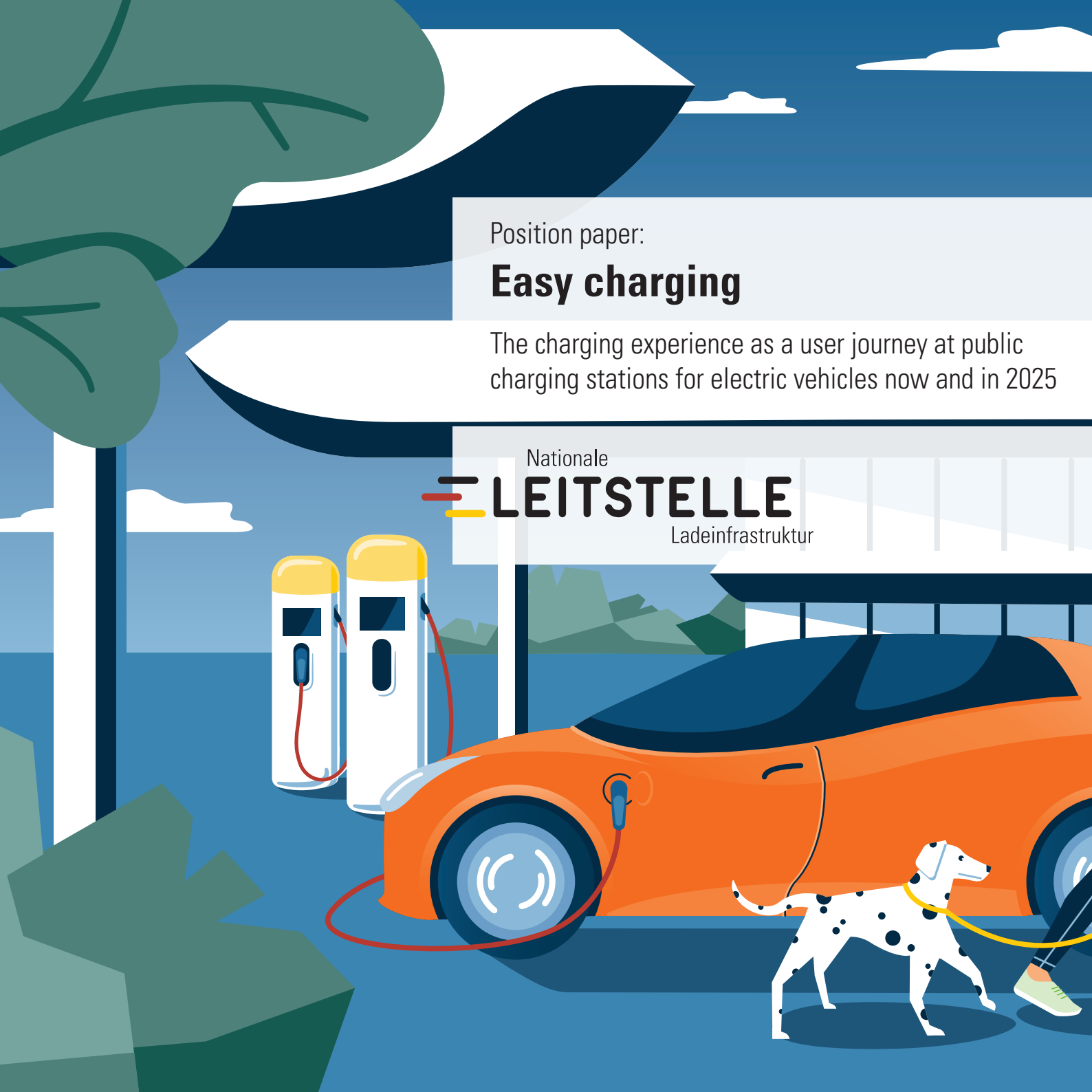
Position paper:

# Easy charging

The charging experience as a user journey at public charging stations for electric vehicles now and in 2025

Nationale
LEITSTELLE
Ladeinfrastruktur



# User journey

# Summary

Charging electric vehicles at public charging stations is a new experience for many users, which differs greatly from the classic refuelling process. There is not yet a uniform picture of a **user journey for charging electric vehicles**. Similarly, there is no universal concept for an ideal charging process available for the immediate future.

This position paper outlines the user journey as an operating sequence for charging electric vehicles in public **now** and **in the near future**. It also describes the current charging process sequence from the users' point of view. Furthermore, it sets out statements for the charging experience in the present and technology trends in the future. Answers given in response to a digital questionnaire have allowed the perspectives and experiences of electric vehicle users to be incorporated.

On behalf of the BMVI, the National Centre for Charging Infrastructure is planning a user-friendly complete public-charging infrastructure system and derives all necessary measures from the user journey described. The paper is aimed equally at federal, state and local authority representatives and at market participants, such as from the energy industry, automotive industry, parking space management and other industry organisations.

The user journey presented here consists of nine steps, which can be divided into four parts: preparation, procedure, support and charging experience. The following **conclusions** can be drawn for the target user journey in 2025:

- In future, users will be able to use **advanced navigation functions** when searching for a charging station. Booking a charging point will become more commonplace.

- By 2025, the charging process from the start through to payment will be further simplified, in particular through advances in **communication between vehicles and charging stations**. This allows for a rapid and convenient charging process – even in bad weather or in the dark. Shopping or entertainment facilities near the charging stations ensure users are occupied while charging their vehicles.

- Support is improving, especially with the wider adoption of **digital remote maintenance**, so that problems are solved in the background before and during charging.

- **User-friendly operation** and **attractive locations** increase the quality of the charging experience at public charging stations. Above all, this can be seen in the **seamless integration** of public charging into users' day-to-day life or route planning.

# About the National Centre for Charging Infrastructure

Within the German Federal Government, the BMVI is responsible for developing the charging infrastructure in Germany. The National Centre for Charging Infrastructure – founded in December 2019 on behalf of the BMVI under the umbrella of NOW GmbH – is coordinating Germany's transition to electromobility. To this end, it is developing requirements for the electric vehicle charging infrastructure in Germany using a system-wide approach that focusses on current and future users.

The activities of the National Centre for Charging Infrastructure are based on the "Charging Infrastructure Master Plan" adopted by the German Federal Cabinet in November 2019. Accordingly, to ensure electric mobility is ramped up successfully, it is crucial that consumers remain at the centre when implementing the necessary measures.

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# Categorisation

This section categorises the position paper within the overall strategy of the National Centre for Charging Infrastructure and within the activities of other national and international bodies.

In a publication written by Working Group 5 of the National Platform Future of Mobility (NPM) in April 2020, a uniform definition for user-friendly charging was developed based on four characteristics: a) simple, b) always possible everywhere, c) transparent and d) safe. The fifth feature is that charging should also be e) convenient. The panel's preliminary work served as a starting point for developing this position paper.

SOURCE:
www.plattform-zukunft-mobilitaet.de/2download/kundenfreundliches-laden-fokus-oeffentliche-ladeinfrastruktur

In a series of workshops in spring 2020, car manufacturers and charging infrastructure operators presented their customer experiences, findings and assumptions for how technology will develop between now and 2025. To further supplement the data used as part of this position paper with real user experiences, it refers in certain sections to a current survey commissioned by NOW GmbH. This took the form of a digital pilot survey with 124 people registered as users of electric vehicles in Germany in spring 2020. They were asked about their experiences and lessons learned when using public charging stations. Even if the findings were primarily gained with regard to the situation in Germany, they should also have far-reaching significance for other European countries, provided that the country-specific regulatory requirements for the use of charging stations are taken into consideration.

# Methodology and editorial notes

A statement-based approach was chosen to provide a universal picture of the current and future operating sequence regarding the use of public charging infrastructure. The process steps are to be seen as the sequence of users' actions, according to which the charging process for an electric vehicle is most often prepared and carried out. The document describes each of the nine steps for users at this point in time (2020) and identifies technology trends for 2025 that are expected to lead to changes in these steps.

Given the complexity of the process, a core question was used for the statements in each section in order to arrive at succinct results: "How should this process step for publicly charging electric vehicles be designed in the interest of users in 2020 and 2025?"



# User journey

The nine sections in this paper individually describe the standard usage and operating sequence for charging electric vehicles at public charging stations. Since these are not "customers" of a specific provider but rather consumers – or in other words "users" – the authors have chosen the term "user journey". The term "public charging station" describes publicly accessible normal, fast and ultra-fast charging facilities.

1. Finding a charging point
2. Booking a charging point
3. Getting to a charging point
4. Finding the charging point upon arrival
5. Starting the charging process
6. The charging process
7. Paying for the charging process
8. Contacting the support service
9. The charging experience

# 1. Finding a charging point

At the beginning of the user journey, it is necessary to search for a suitable charging point: before setting off or during the journey, along the route, having reached the destination or in its vicinity.

**Statement on the status quo**

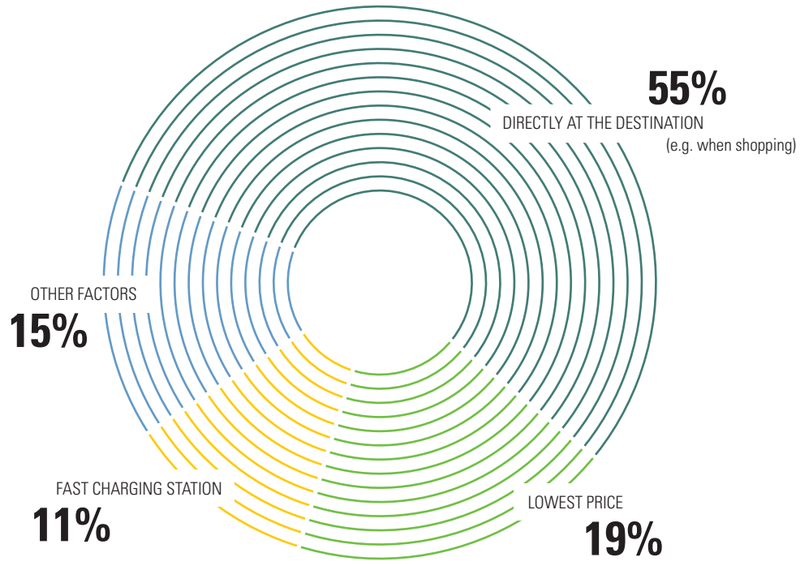
"As an electric vehicle user, I would like to be able to view all accessible charging points, including their location data and current occupancy states (available, in use, out of order), on different media (smartphone, tablet, computer) in order to find the best charging point for me."

**Current situation**

When planning a charging process, both information about the charging station and the location are particularly important to users. Within the current user journey, neither the complete searchability of all accessible charging points using the preferred media nor the uniform availability of information on opening hours, occupancy status or detailed information about the charging price at the desired charging point are guaranteed everywhere and at all times.

Our user survey demonstrated that, currently, the quality of the facilities near the charging location and favourable charging costs are particularly decisive criteria when searching for a charging station.

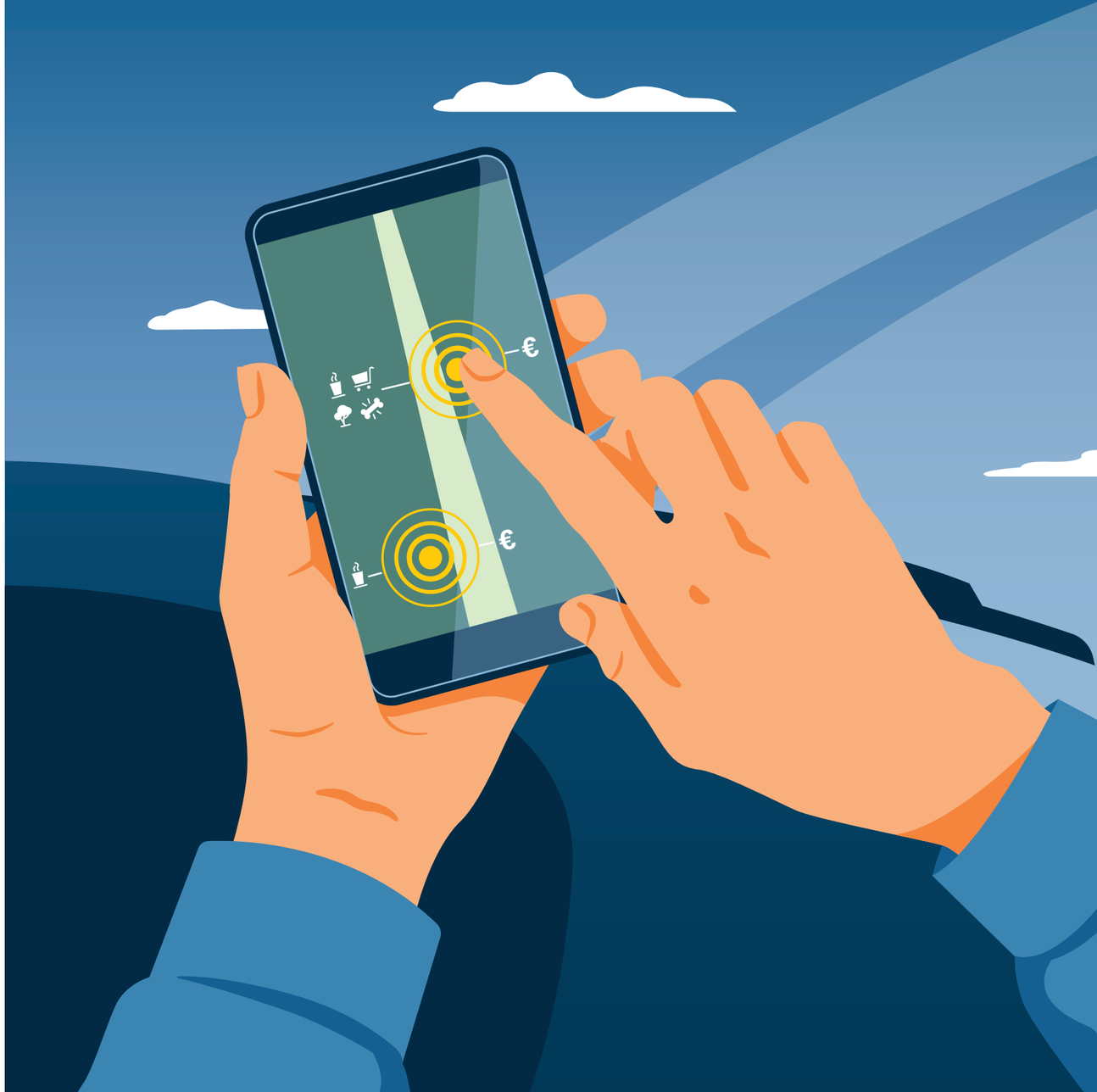
**Generally speaking, what is your main criterion when choosing a public charging station?**



**2025 STATEMENT:** "As an electric vehicle user in 2025, I would like to receive personalised suggestions and advice on the nearest locations for charging in my vehicle or charging app so that I no longer have to actively search for locations and can reach my destination feeling relaxed."

### Technology trends

Experts believe that by 2025, there will be technical solutions that suggest charging points to users based on preselected preferences. Attractiveness around the location will improve, for example through gastronomy and shopping facilities that already exist or are in development. Improved information about the location, charging prices, charging capacity, availability of renewable electricity and other services at the destination is made clear to users before they start their journey. Users receive this information in a uniform manner – both for journeys within Germany and for journeys to other European countries. It could be that this step in the user journey is fully integrated in the step "Getting to a charging point" (cf. 3).



# 2. Booking a charging point

By this, we mean the short-term booking of a single charging point, e.g. using the vehicle's navigation system or an app, and for a specific period of time or at a specific time (we do not mean longer-term booking of a charging point several days or weeks in advance). At present, this function is not yet offered nationwide in Germany. It is currently unclear how the significance of bookings will change in future, but this feature has already established itself at public charging stations in certain European markets.

**Statement on the status quo**

"As an electric vehicle user, I would like to reliably know the status (available, in use, out of order) of a charging station and have working charging stations displayed. The booking of a charging station is not yet established nationwide."

**Current situation**

The booking of a charging point is rarely offered in Germany. The lack of standardised designations makes it difficult to find booked charging points at larger charging facilities. Since the majority of charging points are not currently automatically monitored by parking space sensors or similar, it is only possible to reliably record the availability of charging points to a very limited extent before a booking is made. It is unclear how a reliable booking system for charging points can be implemented without there being consistent punishment for incorrect parking or an overrunning charging process.

**2025 STATEMENT:** "As an electric vehicle user in 2025, I would like to book a charging point in advance or have it booked automatically by means of route planning so I can complete the charging process reliably and in the shortest possible time, and not worry about a charging point being available."

**Technology trends**

By 2025, it is expected that the booking of charging points will become part of route planning. This will also allow accessible charging points to be booked in advance, for example. Booked charging points are shown digitally and on-site in such a way that is understandable to users. Bookings can also be cancelled – in a way that is similar to when it comes to booking car sharing vehicles. It is assumed that there will be fees to pay when making a booking. With the further development of booking technology, the importance of "queueing" – i.e. sorting users based on certain priority criteria – will increase. This can be reflected, for example, in allocated charging periods and varying prices. It is expected that queueing will be established, particularly for busy times at fast charging stations in holiday traffic.

# 3. Getting to a charging point

This step describes how to navigate to the charging point using technical aids, such as by entering the destination in the vehicle's navigation system or in a navigation app.

**Statement on the status quo**

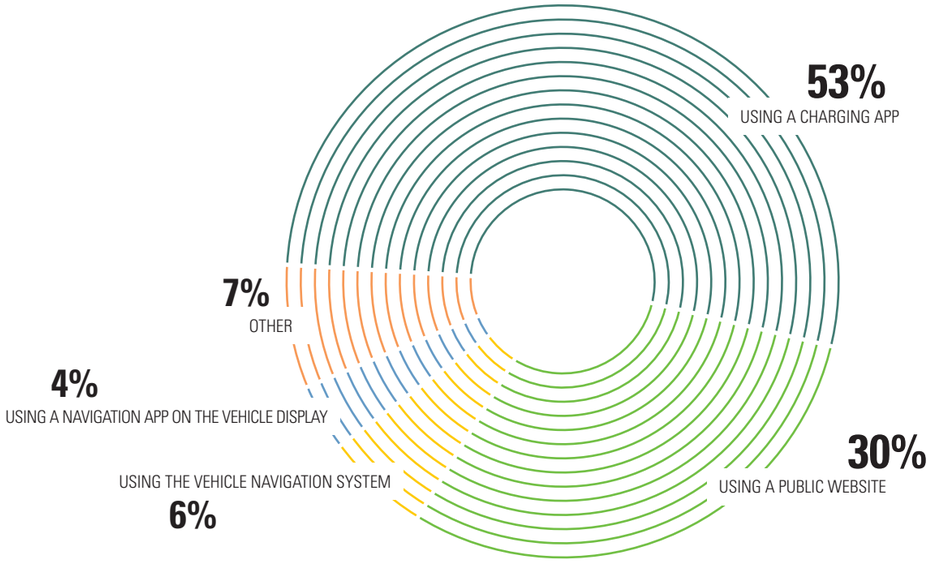
"As an electric vehicle user, I would only like to be shown available charging points based on their coordinates so I can best plan my route. I am not interested in charging points that are out of order."

**Current situation**

Navigation to the desired charging point is currently characterised by the fact that only a certain number of charging points are displayed in navigation systems and charging apps, that these systems and apps do not display any or varying real-time information regarding the availability of charging points, and that the quality of the information provided about the charging locations and their surroundings varies from provider to provider.

According to our 2020 user survey, e-mobility providers and charging apps are currently the main tools used when searching for a charging station location. Digital online map services or specific charging point directories are also more commonly used by users today than the vehicle's own navigation system or navigation apps on the vehicle display.

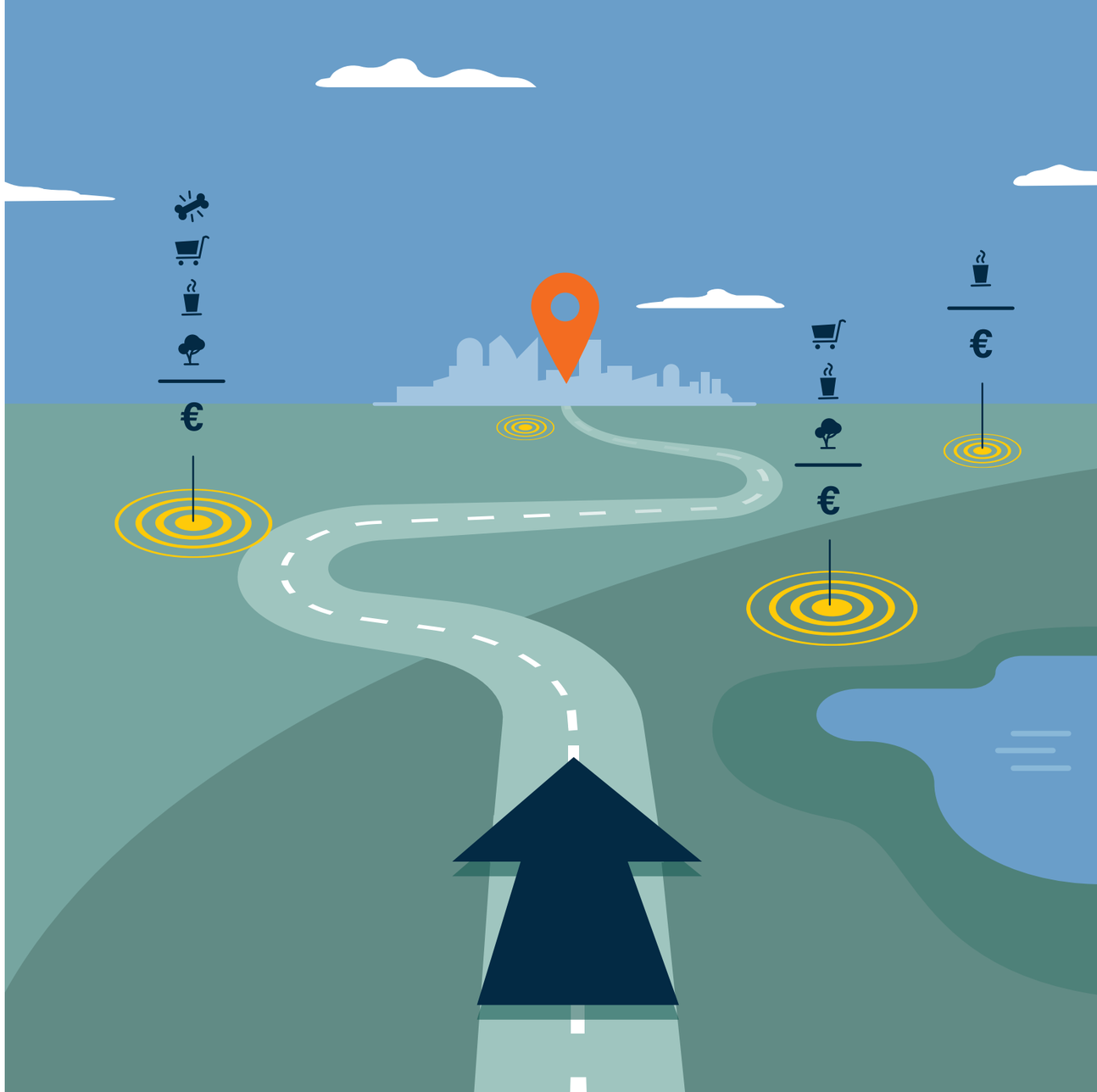
**How do you normally search for and find the location of a public charging station?**



**2025 STATEMENT:** “As an electric vehicle user in 2025, I would like my vehicle or app to assume responsibility for navigating to available charging locations on my route so that I no longer have to plan routes with possible charging locations myself and reach my destination in a more relaxed manner. With the help of time- or cost-optimised routes, charging stops and breaks are automatically determined in the background so I can always reach my destination in the best possible way.”

### Technology trends

For user journeys in 2025, it is expected that vehicles will navigate using high-quality data in real time and manually searching for charging locations will be a thing of the past.



# 4. Finding the charging point upon arrival

In this step, we mean finding the selected charging point at its location. This location may be a rest area, a larger car park or a multi-storey car park.

**Statement on the status quo**

"As an electric vehicle user, I would like to have the actual location of a charging point displayed on my app or navigation system, and be directed to the desired charging point on-site by standardised signs to find it as quickly and easily as possible."

**Current situation**

After arriving at the charging location, you have to find the specific charging point. The lack of nationwide standardised markers or signs at destinations means that currently, charging points are not always easy to find on-site and are rarely discovered in passing. Moreover, the direction of parking is not the same at all charging points, which may mean that it is not convenient to connect the cable. Depending on the cable length and the parking space itself, it may be necessary to park elsewhere.

**2025 STATEMENT:** "As an electric vehicle user in 2025, I would like to be able to navigate via my app or in-car (e.g. using the navigation system) to a previously booked charging point and be guided to it on-site by standardised signs. I will be guided directly to the specific charging point by pictures in the navigation system or in the app, for example. I will already know en route whether restaurants or shopping facilities are available at the charging point."

**Technology trends**

Improved navigation and route planning will make it easier to find local charging points in future. It is anticipated that booked charging points will be able to be accessed more precisely thanks to higher-quality data and more precise vehicle navigation, and that the recommended parking direction will be shared before the charging process.

# 5. Starting the charging process

In this step, we describe how to start a charging process at a charging point, including authentication and identification, cable routing and plugging in and securing the charging cable. The sequence of these process steps varies depending on the provider and operator.

**Statement on the status quo**

"As an electric vehicle user, I want the charging process to start as quickly and transparently as possible through intuitive operation, simple menu navigation and complete price information relating to the charging process. The charging point configuration at the car park and an accessible charging infrastructure enable all users to start charging conveniently, even in bad weather or in the dark."

**Current situation**

Nowadays, there are two common ways of starting the charging process via authentication and identification at the charging point. Firstly, there is ad-hoc charging, which has already been harmonised by the legislator with the first regulation amending the 2017 Charging Point Regulation. Secondly, there is contract-based charging, where users have concluded a contractual relationship with an e-mobility provider (EMP) and usually use an app or a card/chip for automatic and contactless identification before starting the charging process. However, there is a lack of standardised, intuitive handling, particularly for ad-hoc charging. As a result of complex operating concepts, it sometimes takes users a few minutes to start the process. With contract-based charging, not every e-mobility provider is accepted for every charging process.

What's more, it is only possible to see whether a contract is recognised at the charging station by digital means (e.g. app, website or display). The locations of charging points in the car park (e.g. due to structural conditions) can also result in less convenience when starting the charging process – due to complicated cable handling, for example. There is still no roofing or lighting at most charging points, which is a disadvantage compared to a petrol station when it is raining or dark.

**2025 STATEMENT:** "As an electric vehicle user in 2025, I would like to see the charging process be standardised and start automatically thanks to communication between the vehicle and the charging station, so that the charging process can be carried out quickly and conveniently, even in bad weather and in the dark."

## Technology trends

Charging processes starting automatically will be an important trend by 2025. Plug & Charge technology as per ISO standard 15118 will make it possible to conveniently start the charging process from the vehicle. Moreover, users are shown information on prices, the calculated charging time and other data on the vehicle display even before starting. To do so, certificates stored in the vehicle are used for the charging process. As far as convenience outside the vehicle is concerned, in addition to improved positioning of charging stations in parking areas, a roof over the charging stations together with lighting will make the charging process more pleasant in bad weather and in the dark. Experts even believe it will be possible for charging to start fully automatically, e.g. managed by robots at the charging station.

# 6. The charging process

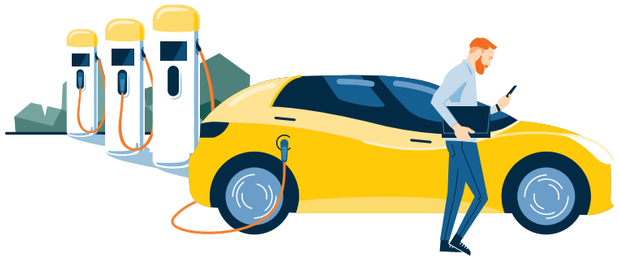
In this step, we look at the time taken for the charging process to be completed.

**Statement on the status quo**

"As an electric vehicle user, I would like to receive as much information as possible about the charging process via the charging station, my vehicle or my app, such as the expected charging time or charging costs, so I can plan the time during the charging process."

**Current situation**

Today, during the charging process, there may be malfunctions, interruptions and compatibility issues between the vehicle and the charging point. There is a lack of reliable information on charge interruptions, expected charging duration, charging capacity and the amount of energy emitted before and during the charging process, as well as a lack of standardised documentation and assessment of the quality of the charging process once it has finished.



**2025 STATEMENT:** "As an electric vehicle user in 2025, I would like my vehicle or app to guarantee an automated charging process and to provide me with a reliable forecast of the charging time, charging performance and charging process costs in line with my planned break, so that I can bridge the time during the charging process and continue driving in a timely manner."

**Technology trends**

For 2025, it is expected that users will receive significantly more real-time information so that they can digitally observe the charging process and charging curve away from the vehicle. Interruptions are recognised by the operator and communicated immediately via digital means. The time during the charging process can also be bridged in a much more enjoyable way, for example through better shopping or entertainment facilities near the charging location.

# 7. Paying for the charging process

In this step, we consider paying for the charging process once it has started. Nowadays, digital payment options are well known, such as via an app or on a website, or credit card payment by reading the card on the charging station card terminal.

**Statement on the status quo**

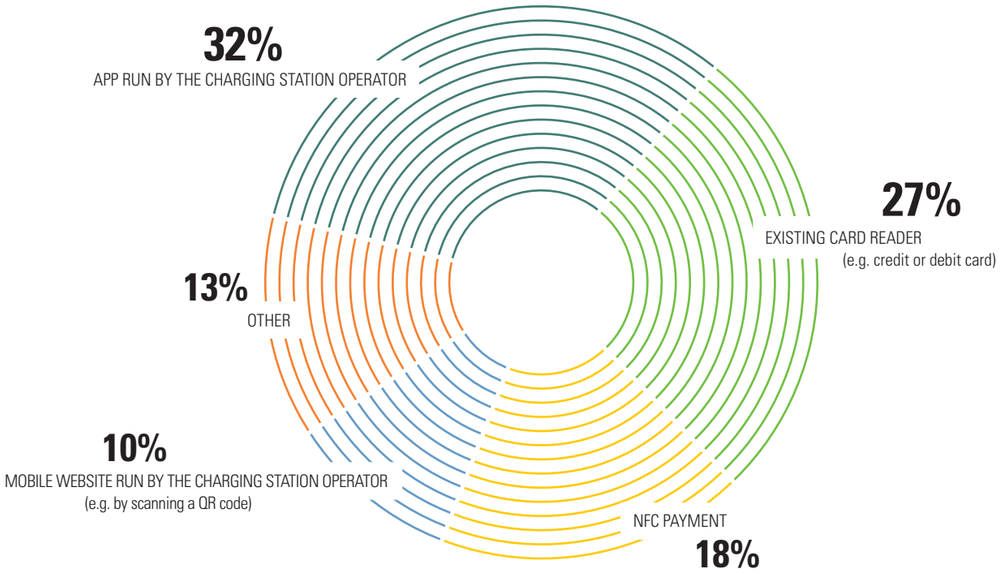
"As an electric vehicle user, I would either like to pay with the most common payment media possible (ad hoc) without first creating a user account, or on a contract basis with the payment medium agreed with my e-mobility provider. I would like to see the final price on the display or in the app so that charging process costs are transparent."

**Current situation**

The current payment process at a charging station depends on the types of user contracts (ad hoc or contract-based) described in section 5. Currently in Germany, it is sometimes necessary to create a digital user account before an ad-hoc charging process, which significantly limits the convenience of direct payment. Furthermore, the charge price is often not apparent in advance, which means that users lack important information, as the price at a charging point can vary considerably depending on the type of contract and e-mobility provider.

According to our 2020 user survey, the most common direct payment options today are apps from charging station providers, card readers at the charging stations, NFC payment options and mobile websites from charging station operators.

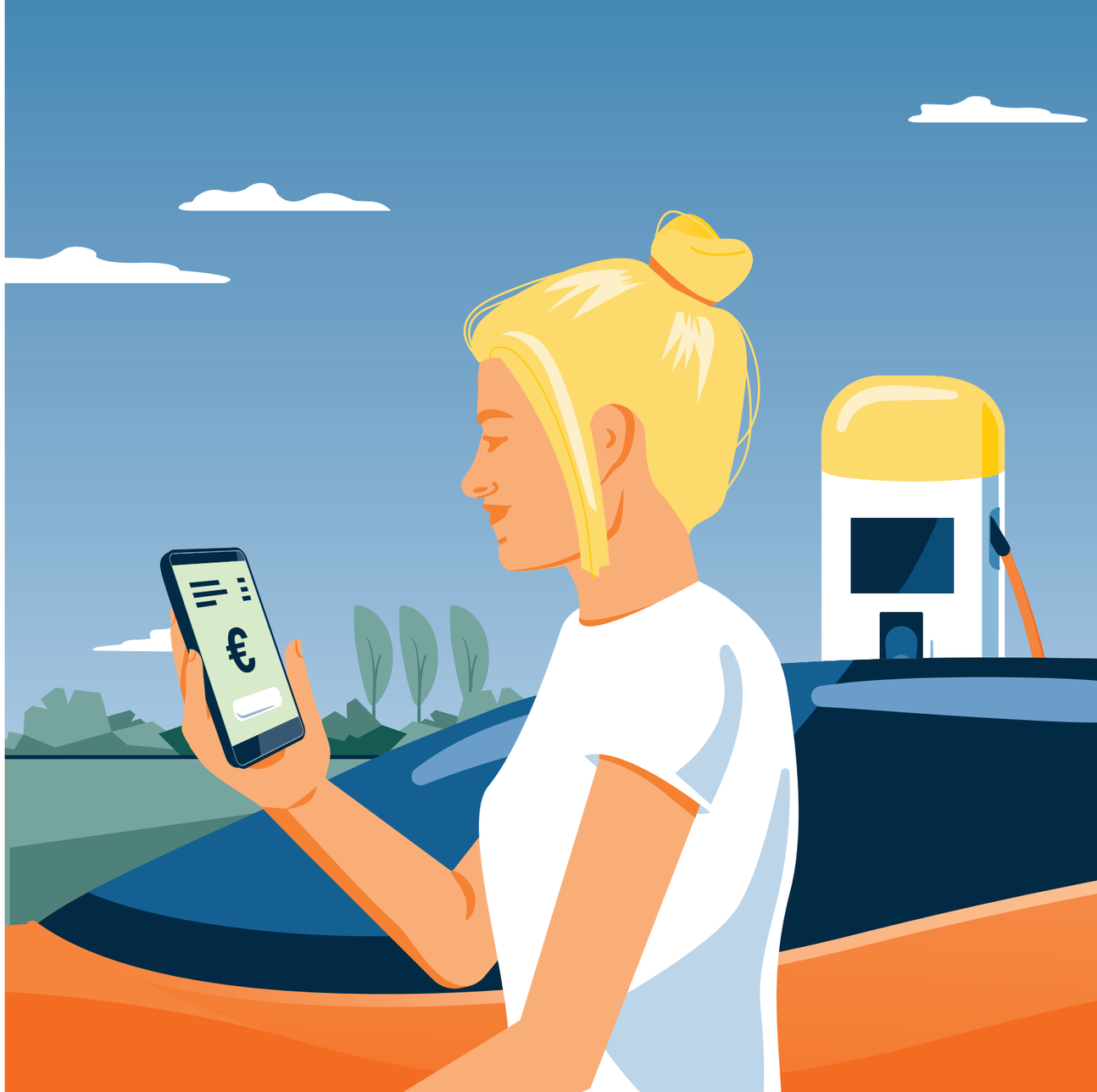
**I prefer to pay directly at public charging stations using:**



**2025 STATEMENT:** "As an electric vehicle user in 2025, I want a transparent payment process so that I can charge at a price known in advance."

### Technology trends

As far as payment for charging is concerned, it is expected that by 2025, the payment process will be simpler and more transparent, particularly thanks to Plug & Charge charging. The further development of roaming technology, networks and platforms will mean that users will be able to charge using their existing contracts at almost any public charging station. For example, NFC technology will make payment for ad-hoc charging (without a contract) more convenient.



# 8. Contacting the support service

Questions may arise before, during or after the charging process. This is why contacting support is an important step in the user journey when charging at public charging points.

**Statement on the status quo**

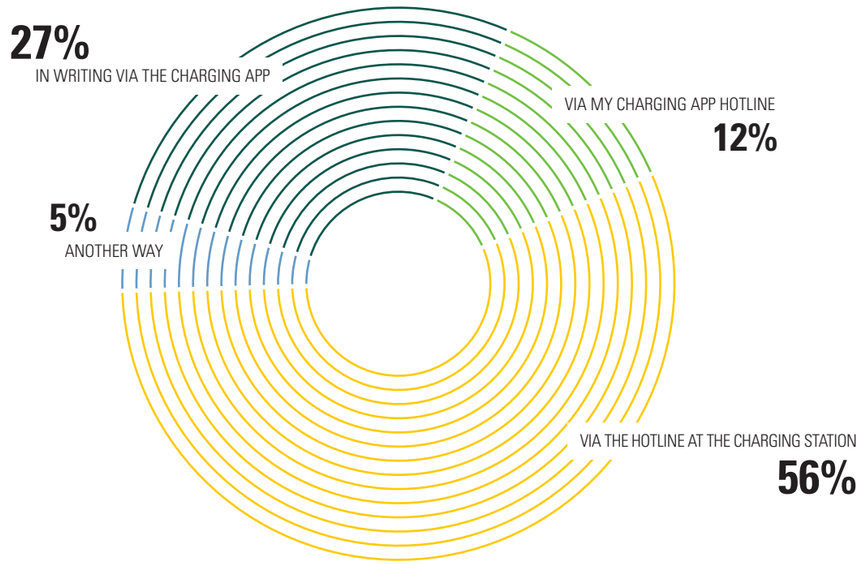
"As an electric vehicle user, I would like to be able to reach a competent, friendly hotline as quickly as possible, 24/7, in order to receive support at a charging point or for a charging process in the event of a service case."

**Current situation**

Due to the distribution of roles between users' e-mobility providers and charging station operators, it is not always currently clear who is the right contact person for a service case before, during or after the charging process. As a further result of this distribution of roles, it is not always currently obvious to the service centres what has caused the service case.

According to our 2020 user survey, 56 per cent of those surveyed now report service cases at the charging station using the charging station operator's hotline, followed by the app and the e-mobility provider's hotline.

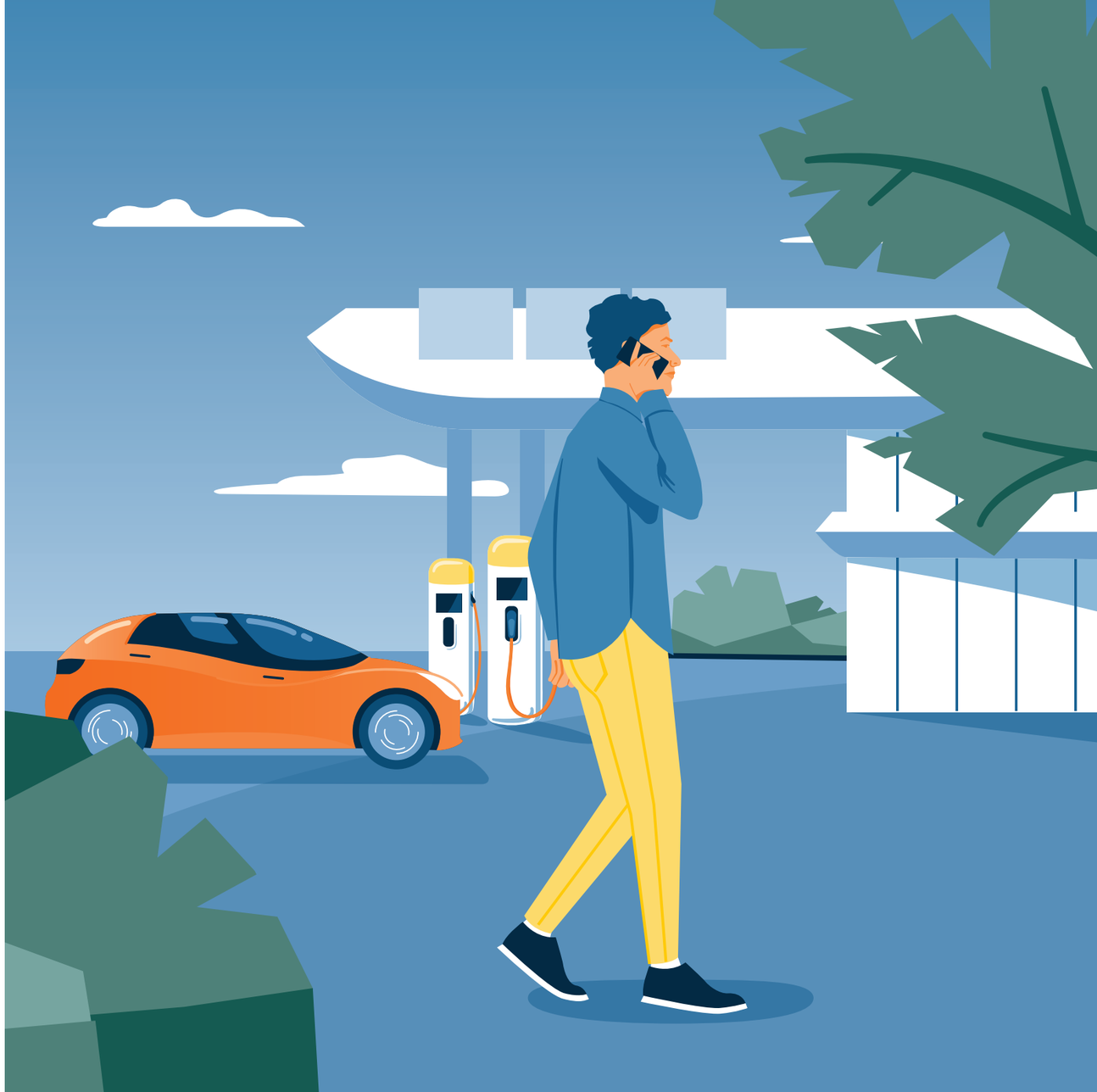
**How do you prefer to report a problem with a charging station?**



**2025 STATEMENT:** “As an electric vehicle user in 2025, I would like to be able to use a reliable, multilingual hotline that is available at all times should I need to make a service call in relation to the charging process. This hotline can answer any questions and is able to solve the service case in the background.”

### Technology trends

Experts believe that it is likely that by 2025, the service quality for charging processes will increase significantly and there will be a 24/7 hotline in the most important languages at the charging point. In addition, better remote maintenance possibilities, solutions by the operator running in the background of the charging process and presenting users with alternative proposals can be expected.



# 9. The charging experience

In this step, we look at users' perceptions and experiences across all steps of the charging process. These include, for example, convenience, quality of facilities and a feeling of security.

## Statement on the status quo

"As an electric vehicle user, I would like the network of public charging infrastructure to enable me to charge intuitively, conveniently and everywhere."

## Current situation

Today, there are still some negative charging experiences. This can be caused, for example, by charging stations that are complicated to operate or a lack of roofing or lighting at the charging station. Furthermore, sufficient entertainment facilities to occupy the charging time is not yet available everywhere, which also has an influence on the overall charging experience.

To better classify preferences, our 2020 user survey provides an overview of the key decision-making criteria for users of electric vehicles at public charging stations. The availability of quick-charging options, certain payment options or connector types is one of the most important criteria from the users' point of view today. This is followed particularly by service offers to increase convenience in all aspects of charging, such as nearby facilities, roofing, lighting and Wi-Fi at the charging point.

**The surveyed users ranked what was most important 1 to least important 9 at a public charging station:**

1. FAST CHARGING
2. CERTAIN PAYMENT METHODS AVAILABLE
3. CERTAIN CONNECTORS AVAILABLE AT THE CHARGING POINT
4. POTENTIAL TO ACCESS FOOD AND DRINK, AS WELL AS PUBLIC TOILETS NEARBY
5. POSSIBLE PASTIME IN THE AREA
6. CHARGING STATION LIGHTING
7. CONNECTED CABLE AVAILABLE
8. ROOF ABOVE THE CHARGING STATION
9. POSSIBILITY TO USE WI-FI

The 2020 user survey also investigated what causes negative charging experiences today. Spaces being occupied by vehicles not charging, technical problems at the start of charging and the charging station being incorrectly shown as available top the list in this instance.

**Users have already had a negative experience when charging because… (multiple answers possible: often 1, rarely 8)**

1. THE PARKING SPACE WAS OCCUPIED BY ANOTHER CAR THAT WAS NOT BEING CHARGED
2. THE CHARGING PROCESS COULD NOT BE STARTED
3. THE CHARGING STATION WAS SHOWN AS AVAILABLE IN THE APP BUT DID NOT WORK
4. THE CHARGING PROCESS WAS INTERRUPTED
5. THE HOTLINE WAS UNAVAILABLE
6. THE PROMISED PERFORMANCE OF THE CHARGING STATION WAS NOT MET
7. THE CONNECTED CHARGING CABLE WAS TOO SHORT
8. THERE WAS NO CHARGING CABLE AT THE CHARGING STATION AND THEY DID NOT HAVE ONE WITH THEM



**2025 STATEMENT:** "As an electric vehicle user in 2025, I would like to go through all the process steps described above intuitively, conveniently and via a single app. I want to integrate charging processes seamlessly into my everyday life or route planning, and be protected from bad weather at properly lit charging stations. I would like to consider charging an electric vehicle to be more convenient than refuelling a conventional vehicle."

### Technology trends

There is the prospect that standardising the process steps for public charging will lead to more intuitive operation. Increased convenience thanks to weather protection and lighting, as well as new services in the vicinity of the charging points, will make the overall experience much more pleasant for users.

# Conclusion and outlook

The nine process steps described here illustrate the different nature of public charging procedures compared to conventional refuelling at a petrol station. When searching for and finding charging points, the situation will certainly change for the better with the growing number of public charging stations in cities or on motorways. The starting and handling of charging processes is very different today due to the diverse provider landscape. Therefore, it is currently insufficient to learn a single process sequence, since it cannot be applied universally everywhere.

From the pilot survey, it became clear that users are still currently sympathetic or can even be regarded as enthusiastic and, as early adopters, sometimes accept complex technology, a lack of information and little convenience. This is also reflected in the statements on the status quo.

The statements for the year 2025 show that experts assume a more intuitive user journey and in some cases, even believe certain process steps will be eliminated, such as by improving information or integrating the charging process into route planning. The vehicle, the charging station or the app will therefore perform considerably more actions automatically than is the case today. Users in 2025 will therefore presumably have significantly higher demands on the use and operation of charging infrastructure.

The interaction between public charging stations and vehicles, navigation systems and apps from manufacturers and suppliers on the market will improve by 2025, and data communication via the various interfaces will be continuously optimised. The charging infrastructure can be operated by different stakeholders, while users of vehicle and app providers experience a standardised, harmonised, intuitive and convenient user journey.

In conclusion, we assume that the economic efficiency of public charging points can also be increased if providers improve the above-mentioned process steps. In addition to a higher utilisation of charging points due to more electric vehicles on the roads, easier searchability, improved weather protection or the ability to book charging points at short notice will increase the acceptance of public charging stations and thus increase utilisation in the interest of the operator.

As the coordinating body for the German Federal Ministry of Transport, the National Centre for Charging Infrastructure will thoroughly support and help shape these activities. It will draw on the knowledge available here to develop a user-friendly charging infrastructure for electric vehicles.

# Definition of specialist terms

| | |
|---|---|
| **Ad-hoc charging** | Charging without an e-mobility provider contract |
| **Electric mobility provider** | Allows access to charging stations via a contract. Also known as e-mobility service provider (EMSP) |
| **Roaming** | Also known as “e-roaming” in the electric mobility sector. Roaming offers the possibility of obtaining e-mobility provider at all charging stations – no matter with which operator a user has a contract. The user’s usual contractual partner handles the invoicing |
| **Contract-based charging** | Charging with e-mobility provider |
| **Plug & Charge** | Certificate-based charging of electric vehicles as per ISO 15118 |

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The National Centre for Charging Infrastructure was founded on behalf of the German Federal Ministry of Transport and Digital Infrastructure (BMVI) and under the umbrella of NOW GmbH.