Reference customer journey for Eichrecht in EV Roaming

Publication of the S.A.F.E. Roaming Working Group

This document is part of a series of distributions by the SAFE working group “Roaming”. The individual issues of the series cover dedicated topics on the application of the calibration law in EV roaming networks. To understand this document please refer to the other issues available through safe-ev.de.

This document is written for all parties developing roaming solutions in electric mobility.

Scope of this document:

Calibration law (Eichrecht) sets high demands on both the accuracy of measurement and the verifiability of measured values used for billing. In the perspective of charging processes for electric cars, this means that during the charging process, the end user of a calibrated measuring device must be able to review the charging progress, and at the end of the charging process the customer must be able to check the measured value of charging consumption. As the user gets a bill/receipt of their charging session geographically and timewise separated from the charging session itself it is not possible for them to do this verification directly onsite. Therefore it must be ensured that the measured values have not been falsified. The implementation of this requirement is not easy due to the multitude of roles (CPO, roaming, EMP, manufacturer,...) and actors. In the first step, the SAFE initiative developed a proposal for the signing of measured values within the measuring capsule of the charging pole, as well as the Transparenzsoftware for the subsequent verification of these same measured values. This has now been established as a standard in Germany.

In this document, a proposal is made as to how the customer can be accompanied in his charging experience (customer journey) via various market players in compliance with German Eichrecht. It serves as a reference point for identifying necessary changes in the electromobility ecosystem in order to fully establish calibration conformity in the sense of the end user. The customer journey consists of the search for charging options, comparing available tariffs, selection of the charging station, the charging process and the checking of the bill. Related matters such as price information can also have an important influence. All authentication, authorisation and billing methods must comply with Eichrecht.

Bidirectional charging, dynamic pricing/tariffs, balancing group allocation for specific charging sessions and Eichrecht with SMGW are not within the scope of this version of the document.

Based on the results, suggestions are to be made on how POI data must be maintained in the backend systems of the parties involved, and also the requirements for the roaming protocols of all parties involved. This document aims to support the development of standardised implementations of the roaming processes between all stakeholders. The customer journey has been developed by the working group Roaming within SAFE. This document aims to be the basis of further evaluations.

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Terms and definitions

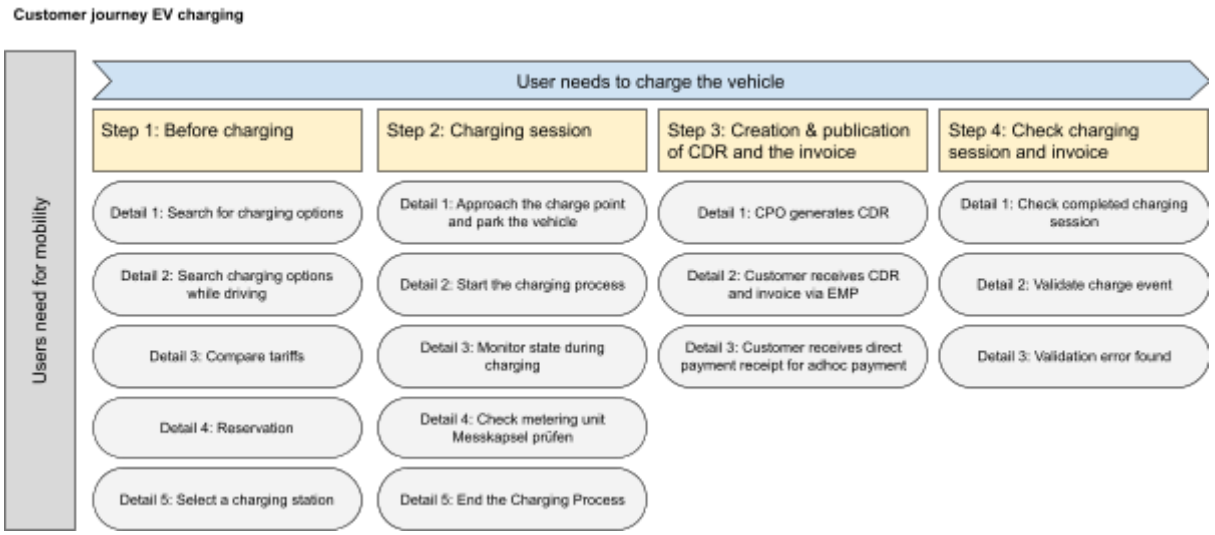
- **Dynamic pricing:** the practice of varying the price for a product or service to reflect changing market conditions, in particular the charging of a higher price at a time of greater demand. With EV Charging the pricing will be dynamic during the day. When charging will be started, the price will be fixed on the prices at the start time of the charging session (more information: Dynamic Pricing for Electric Vehicle Charging—A Literature Review; https://www.mdpi.com/1996-1073/12/18/3574/htm)
- **Charge Detail Record (CDR):** Data records with information on individual charging processes. This includes, for example, the name and address of the charging point, the EMP, the relevant electricity meter number, user identification, start and end timestamp of charging.
- **Backend-only reservation:** reservation is handled in the backend system only and not communicated to a charging infrastructure.
- **Local storage and validation device**: A component of the charging hardware which is able to store and display calibration law relevant charging session data in the charger in a secure way.
- **Payment app:** Payment of a charging transaction via a general payment app (e.g. Apple Pay, Google Pay).
- **Mobile network operator (MNO)**: Offering payment of charging sessions via the mobile phone invoice.

Customer journey

The following story map describes the customer journey of the EV driver step by step. It is organized into two activities of which only the first one (title: “User needs to charge the vehicle”) is in the scope of this revision of the document.

The elements of the steps are not to be seen as mandatory and linear.

The customer journey covers the two currently known methods for calibration law validation. The focus is on the description of the procedure with the SAFE transparency software. For completeness of the customer journey and end-to-end compatibility, the second method, a local storage and validation device in the charger is described as well.



Assumptions and the Need For Mobility

For a comprehensive user story, the following assumptions have been defined. The user of a charging station must be equipped with an electric vehicle (BEV or PHEV). In addition, they have access to one or more of the following:

- One or multiple charging card(s) from an EMP/MSP with active tariffs for charging.
- A smartphone (with EMP/MSP Apps and possible price comparison App)
- One or more credit card(s).
- In case of the use of Plug and Charge (ISO15118), the electric vehicle and the charging infrastructure already have the needed certificates and charging tariffs installed.

The user itself has a need for mobility. In connection with his or her electric vehicle, which he or she wants to use, there is a need for charging electrical energy to satisfy the need for mobility. In this user story, only the case is considered where a user actually has to charge because he or she may no longer be able to fully satisfy the mobility needs. Optional charging, where the user does not necessarily have to charge (e.g. due to a full battery or a low mobility need), does not initially play a role in this story.

User needs to charge the vehicle

From the user's need for mobility, the user has a need to charge their car if it is an electric car. This document distinguishes between the need to charge the car from the option to charge if there is no clear need. For the first one it is needed to satisfy the user's need for mobility. The later one is an optional charging, taken gratefully by the user if the option arises but not necessary at the time.

Step 1: Before charging

In the first step of the customer journey the user is considering charging their car. Over the course of this step they look for charging options, compare them and select a suitable charge point or charging location.

Detail 1: Search for charging options

The driver is searching for a charging station which meets the criteria of the driver. To ensure a comfortable charging experience to the driver POI data quality is highly important. It will ensure in all details that their navigation has all needed information to run this journey and to guide them exactly to the right charge point of his demand.

The following criteria are most common for drivers to select a charging station:

Charging power and supported connector types

The driver is looking for available charging power and if the supported connector type used by the vehicle is supported by the the charging station (e.g CCS2 150kW, cable or socket)

Authorisation method/ supported payment solutions

The driver wants to know which authorisation method is supported to start a charging session (eg. ad hoc, Remote start via app, RFID card, Plug-and-Charge)

Total price (including charging fees, parking fees, overstay fees and other service fees)

The driver wants to know in advance the total pricing per session and compare it with other stations and/or other MSP (see also detail 3 “Compare tariffs”). This needs to include session, energy, power, time, reservation, parking and overstay fees (if applicable).

Example: A charging station is located in a parking lot. The energy is paid via the MSP app in Euro per kWh. The parking lot charges an extra fee in Euro per hour though a local vending machine.

Charging port availability (actual and future status)

The driver wants to check if the selected charging station and parking spot is available when the driver arrives to start a charging session and till when the car can be parked and charged.

Example 1: A driver is approaching the charging station on a long distance trip. To plan the charging stop they need to know the availability within the next minutes.

Example 2: A person plans a flight two weeks in the future. They want to travel by car to the airport. The user needs to know if the charger is available when they arrive.

This includes current and future opening hours as well as planned maintenance slots.

Charging location, distance from actual position

The driver wants to filter the most suitable charging locations based on their location or on their planned route.

Additional services

Driver wants to know if any additional services are provided (e.g. free wifi during charging session, reservation).

Public / private charging

Driver wants to know if the charging station is for public use or only for customers / employees of a business.

Eichrecht relevance	None identified.

Detail 2: Search charging options while driving

In this detail the user is driving their car and has to charge it in order to reach the destination with the desired amount of energy left over in the battery. While driving the driver is not able to define a detailed search as defined in Detail 1: Search for charging options.

Prerequisite for this detail is that the user has the active trip planned in the car's navigation system. Based on this trip and on current information like battery status, current energy consumption, weather and and other data, the user expects the car to provide the optimal charging option. The filter preferences are the same as in Detail 1: Search for charging options, the UI possibilities in the car to access them however are very limited. This leads to the user not being able to compare the list of charging options manually, e.g. reviewing all details, reading the detailed description or the user reviews.

Eichrecht relevance	None identified.

Regarding tariff/price comparison see detail 3.

Detail 3: Compare tariffs

After searching for charging stations (Detail 1 or 2) the user has multiple charging options at different stations in the target area. Tariffs differ over the stations in question. There are two different types of tariffs:

- Different available MSP tariffs,

- local available Ad-Hoc tariff.

As a user I would like to see and compare the charging station tariffs before the charging to find the most suitable option. Common tariff elements for charging an EV include following parameters:

- Charged energy
- Charging time
- Blocking fee
- Starting fee
- Parking fees

In addition, different EMPs offer different tariffs at the same charging station. There are EV charging tariff comparison services that can be used by EV drivers to know the best tariff of a charger. Informing the customer ahead of the charging session about the price for each component is relevant to Eichrecht compliance.

Price markings are regulated in national law (PAngV in Germany).

Price comparison examples

To demonstrate the price differences and comparison two examples are given.

Example 1: Compare the tariffs to find the cheapest price at a selected charging station

- The user drives KONA Electric 64
- The user arrives at the selected charging station.
- The station offers: CCS DC 100 kW, Type-2 AC 22 kW.
- The Ad-Hoc tariff is 0,45 €/kWh (AC) and 0,55 €/kWh (DC).
- The user has two MSP tariffs:
    - Tariff 1
        - AC: 39 ct/kWh + 1 € per hour after 3 hours
        - DC: 49 ct/kWh + 1 € per hour after 3 hours
    - Tariff 2
        - AC & DC: 49 ct/kWh
- The user wants to charge 20% to 80% SOC = 40 kWh
- The AC charging power limit is 11 kW
- The DC charging power limit is 70 kW

Comparison:

- AdHoc DC: 40 kWh * 0,55 € = 22 € / estimated time: 35 minutes
- AdHoc AC: 40 kWh * 0,45 € = 18 € = 18 € / estimated time: 4 hours
- MSP 1 DC: 19,60 € (energy) + 0,00 € (time) = 19,60 €
- MSP 1 AC: 15,60 € (energy) + 1,00 € (time) = 16,60 €
- MSP 2: AC/DC: 19,60 € (energy) + 0 € (time) = 19,60 €

The user gets the same amount of energy at 4 different prices ranging from 16,60 € to 22 €.

Note: The charging curve of the car was not taken into account.

Example 2**:** Find the cheapest charging option in an area

- The user drives KONA Electric 64
- The user has an important meeting in Berlin, Invalidenstraße
- The meeting lasts 3 hours
- The user needs to charge 30 kWh to drive back home
- The user wants to charge the car as cheap as possible
- The user wants to walk maximum 15 minutes to the meeting location

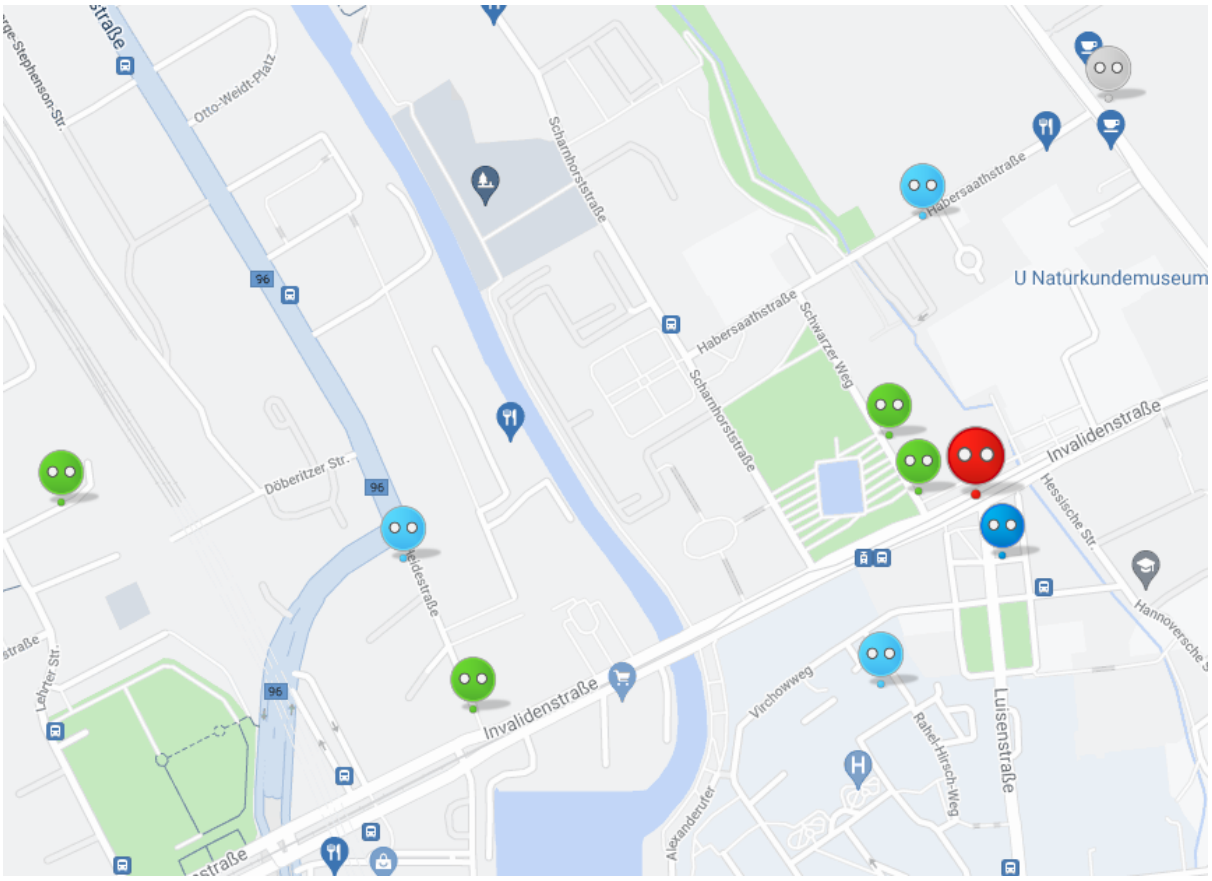
Options for the user to find the best charging station:

- Use the EMP app to compare different stations
- Use comparison app to compare multiple EMPs on multiple stations

Currently, there is no systematic overview of the valid charging tariffs (contract-based or ad-hoc) that enables the user to make comparisons as described in this example.

In order to be able to offer this overview, automatic interfaces are necessary to exchange the following data:

- active EMP on charging point
- ad-hoc-tariff



Screenshot taken from moovility.me

Eichrecht relevance	Tariffs can be displayed informative only. The user needs to check the current tariff when starting the charging session. Dynamic tariffs might contain changing price components.
Eichrecht relevance	Due to the limited UI the comparison of different charging options and tariffs is very limited which can lead to a low price transparency. To offer the optimal charging options the car navigation would need information on the ad-hoc prices as well as the EMP-tariffs the user has subscribed to. The POI data quality must be very high to be able to compare charging options while driving, otherwise the price-based comparison mixes apples with pears.
Other related action points	Solutions to make price options available and easily comparable need to be developed to facilitate this detail. (This would increase the comfort for the driver but is not mandatory.)

Detail 4: Reservation

There are two reservation scenarios:

Reserve Now

Driver wants to charge immediately and looks for a free charging station nearby to reserve a charging point that is only a few minutes away and ensure with the reservation that the charging point is still available for him or her on arrival.

Reservation is only valid for a short period of time and is cancelled when the charging session starts. After reservation, the charging point is shown as not usable or reserved for a short period of time for other customers. If a reservation fee is charged, a settlement is made between CPO and EMP or EMP and customer. If there are delays in the traffic flow, it may be possible to update the reservation for the duration of the delay.

Planned Reservation

Driver wants to charge according to their route planning he or she made hours or days earlier and therefore ensure that the charging point is still available for him or her on arrival.

Reservation is valid for the reserved time slot and until the charging session starts. The charge point cannot be reserved for this time slot by others and is shown as not usable or reserved for the reserved period of time for other customers. If a reservation fee is charged, a settlement is made between CPO and EMP or EMP and customer.

This option is not possible to implement right now within Roaming and needs some more design thinking in the emobility market as it has a lot of new requirements to multiple market roles.

There are different aspects for invoicing a reservation:

1. Invoicing per reservation fixed price
2. Invoicing per time period of reservation
3. Handle the reservation as a separate session or combine it with the charging session

Reservation handled in backend only

There is no final clarification regarding the classification of reservation time. Depending on this, the invoicing of reservation time in conjunction with an energy delivery session might be relevant for Eichrecht as well. This might even depend on the way the MSP tariff is designed. If reservation time is considered part of the Eichrecht relevant session, those reservations which are handled by the backend – without actually reserving a single hardware – must be considered separately.

Eichrecht	The reservation time is probably relevant for the Eichrecht. However, there is

relevance	no final legal evaluation existing. A legal clarification is required to introduce reservation services on the market. An exception from the Eichrecht requirements might be a possible solution, comparable to the exceptions for carsharing services. An alternative could be to not invoice reservations or invoice a flat fee per reservation session. See also BDEW-internal document "*Diskussionspapier Reservierung einer Lademöglichkeit an öffentlichen Ladepunkten*"
Other related action points	A solution is to be developed to invoice reservation fees Clarification if reservation time is Eichrecht relevant. If so, a solution for compliant backend-only reservation is to be developed.

Detail 5: Select a charging station

The driver selects one charging station from the search results after comparing different options and tariffs. They enter the address in the navigation system (of the car) by any means, and drives the car to the station.

Tariffs may change until the driver reaches the charging station. Before starting the charging session he or she should/must check the current tariff again. Changes in a MSP tariff will be communicated by the MSP e.g. via email or displayed via a MSP-App.

In this step the user is not starting the charging session itself. Legally the session starts later. At that moment also the tariff is confirmed by the user.

Eichrecht relevance	None identified.
Other related action points	None Identified.

Detail 6: User receives Eichrecht guide

The user should be able to get user documentation about the Eichrecht solution of the selected charging station when selecting a charging station so that he or she can understand the necessary steps to validate the metered values.

User documentation for chargers regarding Eichrecht

There are several options to provide the user documentation to the user:

- Central database of all user manuals for all Eichrecht solutions.
    - Low effort for CPOs and MSPs.
    - One place to go for all Eichrecht solutions.
- Each CPO publishes the user documentation. MSPs reference the documentation at the CPO.
    - CPOs need to reference the documentation for ad-hoc charging
    - MSPs might not want to rely on the CPO (broken links, CPOs shut down etc)
- The MSP offers user documentation in their own websites/FAQs.
    - High maintenance effort for all MSPs.

In all cases the solution can be referenced through the data format proposed in the SAFE publication “General definition of POI and tariff data structures”.

A market wide consistent solution needs to be agreed on. The proposal of SAFE is the implementation of a central database as the most economical and user friendly solution.

The following possible entities are identified for the operation of this central register:

- BNetzA
- BDEW e.V.
- SAFE e.V.
- Bundesanstalt für Straßenwesen (BAST) as operator of the NAP
- Konformitätsbewertungsstellen “conformity assessment bodies”
- NOW GmbH

Eichrecht relevance	The user should be able to get user documentation about the Eichrecht solution of the selected charging station when selecting a charging station so that he or she can understand the necessary steps to validate the metered values.
Other related action points	A market wide consistent solution needs to be agreed on. The proposal of SAFE is the implementation of a central database as the most economical and user friendly solution.

Step 2: Charging session

This step begins at the point where the driver leaves the usual traffic and turns in direction of the charging station and ends when the EV is leaving the charging station spot.

Detail 1: Approach the charge point and park the vehicle

The user's goal in this detail is to drive their car to the right (e.g. previously chosen) charge point. The detail ends when the user stops their vehicle in front of the charge point.

Actions to be taken by the user:

- Find the local route to the charge point.
    - Find the available charge points within a bigger charging station.
    - Find the charge points on a large site e.g. company parking or multi-storey car park.
    - Find the right direction to the charge point on a highway resting area.
- Identify the desired charge point at the station by the following parameters:
    - power: Locate a charge point with the charging power the user was looking for in the search, including the currently available charging power due to load management.
    - plug type: Locate a charge point with the plug type fitting to the users car and matching the desired charging tariff.
    - reservation: If the user has reserved a charge point in the search, they have to locate the one
    - availability: If charge points are reserved for others or out of order or blocked by other vehicles the user has to identify them as unavailable if possible.
    - operator: If multiple operators charge points are at an approximate location the user has to identify the desired operator.
- [optional] Remove the access barrier: If the charge point has been reserved for the user, the access barrier has to be removed.
- [optional] If the charge point is within a parking garage, the user might need to pay at the gate or receive an access ticket for later payment.

Eichrecht relevance	Approaching the charging location has no invoicing implication and is therefore **NOT** Eichrecht applicable.

Detail 2: Start the charging process

Starting the charging sessions represents the beginning of the registration of metered values. As soon as the EV is parked at the charging station the charging process can start. The following sequence is an example and must not happen exactly like described.

1. The driver authenticates for starting a charging session by
    a. swiping their chosen charge card
    b. using their chosen MSP App
    c. Plug & Charge
    d. applicable Ad-hoc payment method

2. The price for charging is shown to the driver. The price display can differ depending on the authentication method the driver chooses. The customer expects to get the tariff which was displayed during “Compare tariffs” (step 1, detail 3) before.
3. The drivers charging process gets authorized. That means the various applicable backend systems validate the drivers contract and therefore ensure that an invoicing recipient is applicable.
4. The driver physically connects the EV via a charging cable with the charging station. Charging station and EV do safety checks to ensure both are technically ready to start a charging session. If successful the charging station will change its status to “Not Available”
5. *Optional:* It is possible to charge an EV without authentication and authorisation. But then invoicing is not possible. As this would not be relevant for Eichrecht it is not further reviewed here.
6. Charging station and EV physically start transferring energy. The charging station reports this start to the CPO backend with an energy meter value and a timestamp.

In the case of a contract based charging, the user chooses the contract they want to charge with. Each contract has a payment method included. For ad-hoc charging the customer can choose one of the payment methods offered by the CPO.

Eichrecht relevance	Relevant for Eichrecht the charging station stores the start time, and the start meter value and the authentication id. In general it reports it to the CPO backend system at this point. The authentication means is used to assign the Eichrecht relevant data to the contracting party. The tariff is implicitly selected by the selection of the authentication method. Local storage and validation device: at the charger the information display of the local storage and validation device is accessible and visible to the driver. This module is part of the Eichrecht certified system in the charger and it will show to them the metered values of their started charging session. So the driver can check the values of their charging session at a trustable source.
Other related action points	Clarify in which way the displayed price is relevant for Eichrecht.

Detail 3: Monitor charging state

During charging, the user wants to monitor the state of the charger and the charging process itself. Therefore, the user has different options to do so:l

- Meter window and display at the charger
- Metering values in (web-)app of the MSP

- Charging process and additional information (e.g. SOC) within the OEM-App of their car

Local storage and validation device: at the charger the information display of the local storage and validation device is accessible and visible to the driver. This module is part of the Eichrecht certified system in the charger and it will show to them the metered values of their started charging session. So the driver can check the values of their charging session at a trustable source.

Detail 5: End the Charging Process

Ending the charging session represents the end of the measured and reported values by the charging station. The end of the charging sessions can be caused by multiple reasons. The following sequence is an example and must not happen exactly like described.

1. Driver arrives back at their EV and wants to end the charging of theirEV.
2. It is possible that the charging session has already ended due to several possible failures. These failures will not be described here.
3. The driver stops the charging session by e.g.
    a. unlocking the cable at the EV
    b. choosing STOP at the charger
    c. choosing STOP SESSION in their App
    d. swiping their RFID card at the charger
4. The charger stops the charging session as it interpretes the energy transfer as ended.
5. The charging station will send an updated connector status “Available” to the CPO backend which will also broadcast this new dynamic status update into roaming interfaces.
6. The charging station sends a StopTransaction message to the CPO backend which contains the final stop time of the session and the final meter value of the energy meter.

Eichrecht relevance	The charging session values of stop time and final energy meter value are relevant for Eichrecht. Even if the charging session was ended by a failure metered, values of stop time and final meter value are relevant for Eichrecht if these values were recorded. Local storage and validation device: at the charger the information display of the Local storage and validation device is accessible and visible to the driver. This module is part of the Eichrecht certified system in the charger and it will show to them the metered values of their started charging session. So the driver can check the values of their charging session at a trustable source. At the end of a charging session the module shows a summarized data set of all relevant data. The CPO will send the relevant data (tbd) to the MSP.
	It is to be evaluated under which conditions can the charger stop the charging session (e.g. if energy flow drops below a threshold).

Detail 6: Erroneous end the Charging Process

In case of an error of the charger during the session, the metering values might not be available at the end.

Eichrecht relevance	Charging sessions with (partly) missing metering data must not be invoiced to the customer.
	For transparency reasons, the charging sessions should be displayed to the customer in any case.

Step 3: Creation & publication of CDR and the invoice

Detail 1: CPO generates CDR and provides it to EMP

When a charging session has ended, the CPO has to create the CDR that will be the base for the invoice. The CDR will summarize the charging session and will contain all relevant information to inform the EV driver correctly.

There are two possible routes how this information can be provided to the EV driver. This is depending on the type of payment the EV driver has chosen at the start of the charging process, via an **EMP contract** or via **adhoc payment**.

The CPO backend will create a CDR, based on the information from the charging session. This includes the start and stop metervalues, the intermediate meter values and other Eichrecht relevant data.

The CPO will calculate the session end price based on the tariff to the applicable EMP. In case of ad-hoc charging the in step 2 detail 2 presented tariff will be used. The session end price will be added to the CDR.

The CPO provides the CDR via roaming interfaces to the EMP in near real time to inform the EMP about the charging session and costs that have taken place.

There are CPOs and roaming hubs which queue the CDRs over a period of time before sending them to the EMP. Therefore the EMP can not display the rated CDR to the customer in a short time after the charging session.

Eichrecht relevance	The CDR must contain the start/stop meter values including the Eichrecht relevant data.

	The CDRs currently only contain the B2B prices set by the CPO and accepted by the EMP via the roaming contract. Therefore only static B2B tariffs are possible in the current framework. In the future dynamic tariffs will be necessary to intensive customer decisions for grid-friendly charging, optimisation for green energy use and infrastructure utilization. Requirements towards the CDR resulting from these dynamic tarifs need to be evaluated and are probably not yet fulfilled. Local storage and validation device: The CPO provides additional data to the CDR which are needed for the driver to review their charging session at the charger together with the CDR via roaming interface. This relevant data is to be defined.
	The driver is expecting to see all charging sessions. Therefore CPO should communicate all sessions to the EMP in near real-time. The EMP should display all charging sessions to the customer.

Detail 2: Customer receives CDR and invoice via EMP

When the customer uses their charging contract (provided by the EMP) to charge their EV, he wants to receive the cost specification of its charging session as soon as possible. Preferably directly after they have ended the charging session and they are still at the charging station. This gives them the possibility to verify the received information together with any information shown on the charging station.

To achieve this, the following steps must be taken:

1. The EMP will receive and validate the CDR from the CPO. And when needed, the EMP will recalculate the costs, based on the conditions and agreements of the contract he has made with the EV driver.
2. The EMP will present the CDR to the EV driver via the communication channel he has agreed upon with the EV driver
3. The EMP will, on a regular frequency (mostly monthly), invoice the CDRs to the EV driver

CDR validation by the EMP

EMPs validate incoming CDRs to ensure their accuracy and legal certainty for invoicing the customer:

- EMP validates the provided Eichrecht relevant data for presence and integrity.
- If the CPO calculated a session price the EMP validates its conformity to the agreed tariff.

- The data in the CDR is checked for completeness according to the legal necessaries.
- A overall consistency check – also against external data – is performed (e.g. validity and blocking state of the authorization means)

Eichrecht relevance	The CDR must contain the start/stop metervalues including the Eichrecht relevant data. When invoicing is done via the EMP contract, the CPO must provide this information to the EMP via the interface, so that the EMP can present this information correctly to the EV driver. When invoicing is done adhoc, the CPO must provide this information via the invoice that is sent directly to the EV driver.
Other related action points	The CDRs currently only contain the B2B prices set by the CPO. There is no harmonized definition and process on how to exchange tariffs, process sessions and calculate B2C costs to add end-customer prices to the CDR. There are CPOs which queue the CDRs over a period of time before sending them to the EMP. This way the EMP can not display the rated CDR (TODO)

Detail 3: Customer receives direct payment receipt for adhoc payment

For this section only ad-hoc charging with card terminals, web-based payment or MNO (mobile network operator) payment (e.g. via SMS) is in scope.

The customer wants to use the “adhoc” payment option that is offered by the CPO at the charging station. When the customer has approved the use of their adhoc payment option, they expects to be directly informed, at the end of the charging session, about the costs via a direct payment receipt.

To achieve this the following steps need to be taken:

1. When the charging session has ended, the CPO will calculate the costs of the charging session, based on the tariffs that are defined for the adhoc payment service and are presented to the customer at the start of the charging session.
2. The CPO will collect/capture the calculated costs of the charging session from the payment provider that is attached to the adhoc payment method used by the customer. (e.g. credit card company)
3. The CPO must create a direct payment receipt for the charging session, based on the charging session information, for the customer and provide this to the customer. The receipt must contain the charging session information and the Eichrecht information in such a way that the customer can perform a validation of the information.

NOTE: When the adhoc payment session has been started via a card reader at the charging station, the CPO has a challenge to send the receipt to the customer. Due to privacy regulation, the

CPO only gets tokenized information from the payment provider regarding the used adhoc payment method. And therefore cannot send anything to the customer because he has no contact information.
When the adhoc payment session has been started via an app, the same app can be used to present the receipt to the customer.

The receipt is provided to the customer in different ways:

- Optional collection of contact information after payment in case of web-based payment and sending the receipt via e.g. email.
- Download the receipt via a web-portal in case of card based payment.
- Send the user additional information via SMS (in case of MNO payment)

Eichrecht relevance	The receipt must contain the start/stop meter values including the Eichrecht relevant data. The CPO must provide this information via the receipt that is provided to the customer. The invoicing of ad-hoc charging sessions must be verifiable for all use cases and scenarios. If the charging is started via a swiped payment card or payment app (e.g. Apple Pay, Google Pay) there must be a way of providinginformation to the customer via the payment card reference not displayed on the banking overview. Maybe a shortlink to a webportal etc. Each CPO must harmonize this process with all payment providers and all credit/debit card providers. From a customer perspective a harmonization over all CPOs would be beneficial.
Other related action points	● Clarification of the legal obligation to provide a receipt. (Belegpflicht) ● If the customer does not get a receipt document or invoice document automatically, do they have the right to request one? ● In the case of MNO-payment, how is the relevant data and receipt provided to the customer?

Step 4: Check charging session and invoice

Detail 1: Check completed charging session

When a (roaming) charging session has ended, the user expects to see the charging event in an app, even before it is invoiced. The user should be able to validate that the details of the finished charging session corresponds with the actual charging session.

As a user I want to check the consumed energy and charging duration of the completed charge event when the charge event will be invoiced from the EMP. This can be done directly on the charger, in the usage history of the mobile app or through an email or text notification.

In addition to the latest charge event it is common that as a user I can see the history of charging events of my account.

To check the total cost of the latest charge event the user has to see the energy consumption, the address or EVSE-ID of the charger, start and stop time of the charge event and the price.

As a user I expect that the same amount displayed after the end of the charge event is displayed on the invoice and invoiced from my payment method. The data can be validated through the transparency software.

Eichrecht relevance	To allow the customer to verify the charging session directly after it has ended, the CPO should send the CDR as soon as possible to the MSP. The display of completed charging sessions (esp. with session costs) should be based on signed metering data only. When displaying completed charging sessions on the basis of unsigned data it should be marked as such. Relevant data in session report for transparency software validation. Short time to display session in report
Other related action points	Legal clarification on the requirements of displayed transactions in the EMP app (esp. if session price is displayed).

Detail 2: Verify charge event

Once the user has received the invoice or receipt of the charge event, verification of the charge event regarding Eichrecht compliance must be possible.

Given the EMP of the user charges a consumption based tariff, the user must be able to verify that the amount of kWh invoiced for the charge event, matches the amount of energy registered by the charge point meter.

Given the EMP of the user charges a time based tariff component, the user has to be able to validate that the amount of minutes invoiced for the charge event match the actual duration of the charge event.

As a user I must receive verification instructions by my EMP. Different validation mechanisms (SAFE & Local storage and validation device) are explained in SAFE publication “General definition of CDR data structures”.

Eichrecht relevance	The EMP of the EV Driver is responsible for providing verification instructions to the user. Verification instructions, verification tools and Eichrecht relevant data must be available when the charge event is invoiced from the EV Driver. The invoice needs to display all information that is needed for the verification of the charge event. All information for using the transparency software should be provided digitally (email or pdf). Furthermore all “Verwenderauflagen" of the Baumusterprüfbescheinigung need be considered. (See SAFE document “General definition of POI and tariff data structures”)

Detail 3: Verification error found

The user finds an error on the invoice or within the provided metering data. Possible errors are:

1. Validation error detected by the transparency software
2. Charging sessions accounted unjustified
3. Calculation error on the invoice itself
4. Wrong tariff used

In any of the four possible errors, the EMP is responsible to resolve the issue with the customer. In case of ad-hoc charging the CPO is responsible directly.

In case of errors 1) and 2) the session must be credited as there is no base for the claim. In case of errors 3) and 4) the EMP can adjust the invoice based on the existing Eichrecht relevant and signed data.