



INTEROPERABILITY, CHARGING AND PARKING PLATFORM DEVELOPMENT AND LAB-TESTING

D3.3: INCAR – Interoperability, Charging and Parking Platform
development and lab-testing

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Abstract

The INCAR Platform main objective is solving currently faced challenges in terms of interoperability among the different actors of the electromobility domain, including the automation of the economic compensations among all involved partners and embracing additional actors, such as micro-CPOs and casual EV drivers. This report describes the architecture of the solution that implements all required features to address these objectives, as well as technical details and end user documentation. Component testing phase has been also conducted, results of which are reported in this document. Finally, an overview of the efforts performed so far by the pilot sites in order to make demonstration of the solution feasible are included.

Keywords

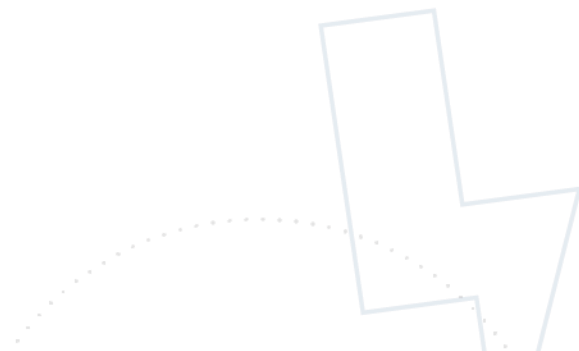
Interoperability, technical, architecture, features, INCAR, development, testing, documentation, end-user, EV driver, payments

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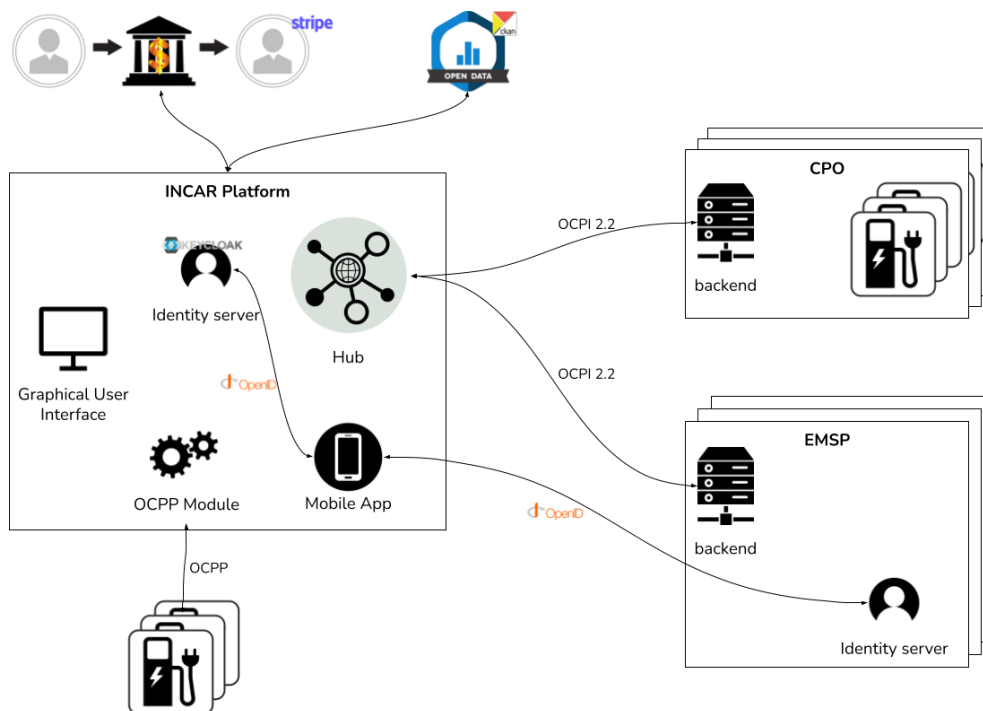


Executive summary

The current deliverable, D3.3 “INCAR – Interoperability, Charging and Parking Platform development and lab-testing”, provides an overview of the work performed in the context of tasks T3.3 “INCAR – Interoperability, Charging and Parking Platform development” and T3.4 “Integration and testing”.

The main objective of the INCAR Platform is to solve currently faced challenges in terms of interoperability among the different actors of the electromobility domain, CPOs and EMSPs. This includes one of the main barriers identified at the moment, which corresponds to the automation of the economic compensations among all involved partners. Additionally, in order to unleash new business models and facilitate the deployment of electromobility, the INCAR Platform embraces additional actors, such as micro-CPOs (small entities that can rely on the INCAR Platform to manage their charge points and offer them to the USER-CHI community of users) and casual EV drivers (drivers with no contractual relationship to any EMSP, willing to make use of the services offered by the parties integrated with the INCAR Platform). Last but not least, the INCAR Platform also allows the publication of relevant data to Open Data portals, thus enabling further use and combination of the managed data by third parties, potentially in combination with data from other sources.

The features already presented are supported by a set of software components that interoperate to enable all the required services. Technical details and end-user documentation of these software components are listed in the content of the deliverable.



In order to formalize the testing phase, a common testing framework has been defined and shared by the teams in charge of testing all software components of the INCAR Platform, thus making it possible to reach consistent and properly documented conclusions. Tests have been formally documented using a common template that compiles relevant information. Motivated by the primary objective at the current stage of the USER-CHI project within WP8, which is the preparation of the upcoming piloting phase, tests performed and compiled in this document have a strong focus on functionality from a perspective close to the end-users experience.

Finally, this document provides some details on the effort taken so far by the pilot sites (Barcelona, Berlin, Budapest, Rome and Turku) with regards to the preparation of the pilots to successfully demonstrate the INCAR Platform in the upcoming months.



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1. Introduction

1.1 Purpose of the document

The purpose of this deliverable is to document the work carried out in tasks T3.3 “INCAR – Interoperability, Charging and Parking Platform development” and T3.4 “Integration and testing”. These tasks take over the work of T3.1 “Design and specification of services” in order to implement the required software solution, following the design guidelines documented in D3.1 “Design and Specification of interoperability and roaming services” [1].

1.2 Scope of the document

This document is aimed to thoroughly describe the implementation of the INCAR Platform. Due to the variety of targeted readers, sufficient details are provided from different perspectives, including overviews of the implemented features, technical details useful to CPOs or EMSPs with interest in integrating their backends with the INCAR Platform, and end-users utilizing the different available INCAR Platform user interfaces to make use of the offered services.

Additionally, the document provides details on the efforts taken so far by the different demo sites of the USER-CHI project in the direction of integrating their systems with the INCAR Platform.

1.3 Structure of the document

This document consists of seven chapters, including chapter 1 for the introduction to the deliverable and chapter 7 for the conclusions drawn during its writing. The core of the deliverable is contained in chapters 2 to 4, which provide the main details of the work performed. Chapter 3 includes an overview of the INCAR Platform features. Chapter 4 provides technical details about the architecture of the solution, of interest to parties willing to integrate their backends. Chapter 5 includes documentation of the INCAR Platform, targeting end-users.

Additionally, chapter 5 provides details on the methodology used to test and validate the correct operation of the provided software implementation, while chapter 6 provides an overview of the efforts taken by the Demo Sites of the USER-CHI project with regard to the integration of their backends in the INCAR Platform.

2. INCAR Platform features overview

2.1 Interoperability

The main objective of the INCAR platform is to enable true interoperability between the various players in the field of electromobility. With this target in mind, the core of the INCAR Platform consists of full implementation of the Open Charge Point Interface (OCPI) 2.2 protocol, and in particular, the implementation of the reference *Platforms via Hub* topology, where the INCAR Platform acts as the central coordinator of the interactions among partners.

Supported partner roles include:

- Charge Point Operators (CPOs), which will take benefit of the INCAR Platform by making their Charge Points accessible to a broad audience of EV drivers
- ElectroMobility Service Providers (EMSPs), which will take benefit of the INCAR Platform by significantly increasing the number of charge points that are accessible to their customers and
- Smart Charge Service Providers (SCSP), which will be able to offer their services to any of the other actors involved

A particular and relevant link exists with the SMAC application designed and developed within WP4, which will be linked to the INCAR Platform in a standardized manner by implementing the SCSP role.

In addition, the INCAR platform adds value by providing space for other players in the field of electromobility, thus supporting the introduction and expansion of charging options by facilitating access to a wider audience for these players as well. These actors include:

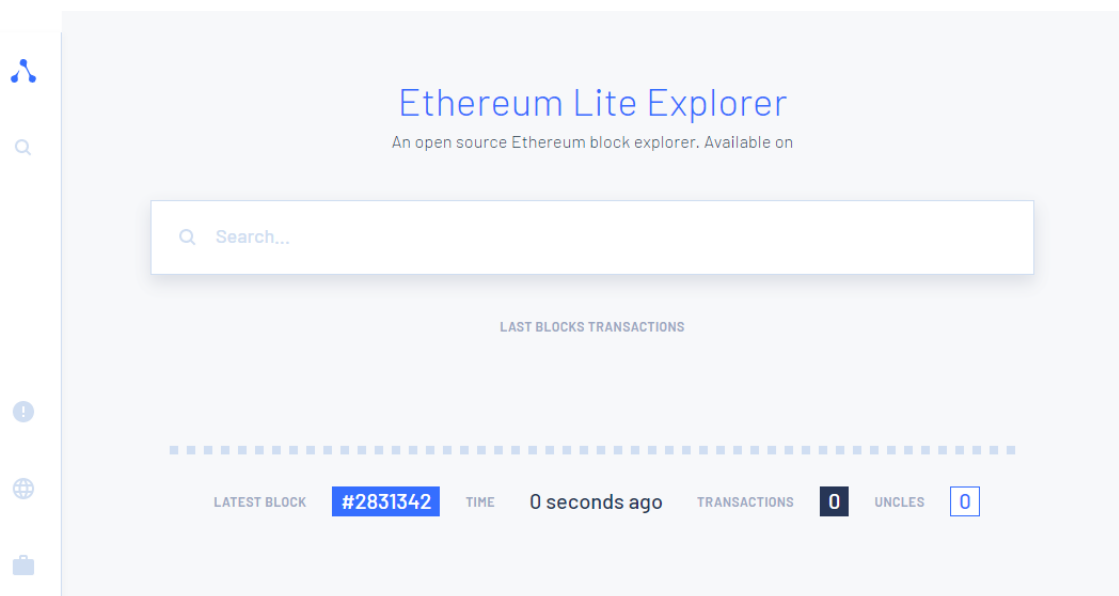
- Micro-CPOs: Entities with interest in installing and offering charge points to potential users, but missing capacity to manage them appropriately (e.g. restaurants, supermarkets, malls...). By joining the INCAR Platform, they will gain visibility and access to detailed configuration and reports about how their charge points are used
- Casual EV drivers: EV drivers that do not have a contractual relationship with any EMSP, or whose EMSP has not joined the INCAR Platform. By using the INCAR Platform mobile app, they will be able to make use of any of the Charge Points available in the INCAR Platform

2.2 Payment management

In order to provide true interoperability and a proper and complete experience to all actors addressed by the INCAR Platform, special attention has been paid to implementing a solution that automates and solves all payments for the services that all actors offer and utilize.

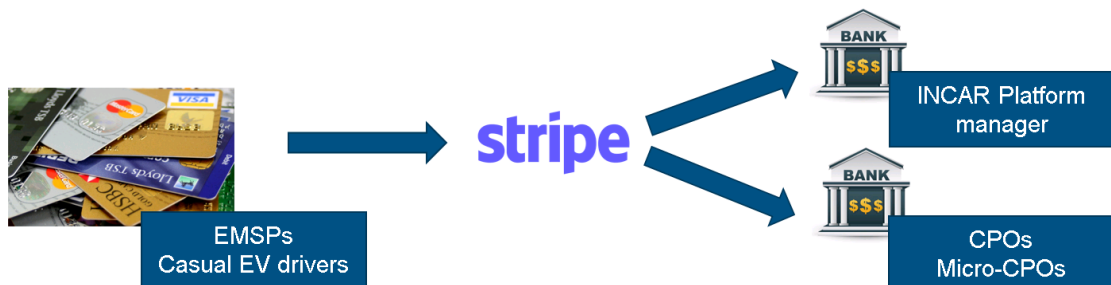
The INCAR platform keeps a record of all interoperability operations that take place between connected partners. Relevant data of the accountability is additionally tracked in a private Blockchain, with the objective of increasing the transparency and trustworthiness of the INCAR Platform.

Figure 1 INCAR Platform Blockchain Explorer



In order to handle the transfers of money among partners, INCAR Platform is integrated with Stripe [2], a well-known online service for payment processing. Money flows managed by the INCAR Platform are depicted in Figure 2.

Figure 2 Money flows managed by INCAR Platform



With the purpose of managing payments among partners, the following information is required to be provided by actors joining the INCAR Platform:

- CPOs and micro-CPOs will register and authorize deposits on their bank accounts, for the services provided (charge sessions taking place in their Charge Points)
- EMSPs will register a credit card that is authorized to be charged, for the usage (of their customers) of third party Charge Points
- Casual drivers will be able to perform pay for use directly from the INCAR mobile app, by providing the information of the credit card to be charged

Additionally, it is foreseen that the entity managing the INCAR Platform gets revenues by charging a fee over each managed transaction that takes place. Payments to the INCAR Platform manager are also managed automatically.

Figure 3 Overview of INCAR Platform payments managed within Stripe

Payments Filter Export + Create payment

AMOUNT	DESCRIPTION	CUSTOMER	DATE
€116.12 Succeeded	pi_3JzIXED1UwhxrHe03at1Dwyo	prueba1@prueba1.com	24 Nov, 11:17 ...
€124.58 Succeeded	pi_3JzIXED1UwhxrHe00Hty0lmZ	prueba2@prueba2.com	24 Nov, 11:17 ...
€3.27 Succeeded	pi_3JwqtkD1UwhxrHe0Qv61Z022	prueba1@prueba1.com	17 Nov, 17:22 ...
€242.70 Succeeded	pi_3JwqtkD1UwhxrHe02vTF4QWY	emsp10@gmail.com	17 Nov, 17:22 ...

Figure 4 Example of an invoice generated by the INCAR Platform

1/1

NombrePrueba1
Tres Forques 147
Phone: 963134082
Email: azambrano.etraid@grupoetra.com

Client
Correo electrónico jross@murray.org

INVOICE

Invoice Reference 2021-0002
Date 14/12/21

Card	Amount
1234	1,00
341	2,00

Payment details
Date 14/12/21
Name Elizabeth Russell

Totals

Subtotal 2,37
VAT 21,00 %
TOTAL 3,00

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2.3 Connection to open data portals

With the aim of enabling further use of the data managed by the INCAR Platform by third parties, including municipalities and other entities, the platform includes the possibility to publish statistically relevant extracts of the managed data on a regular basis to open data portals.

The supported open data portal that has been integrated with INCAR Platform is CKAN [3], which is a popular open-source data management system commonly used by public authorities to support their Open Data Portals.

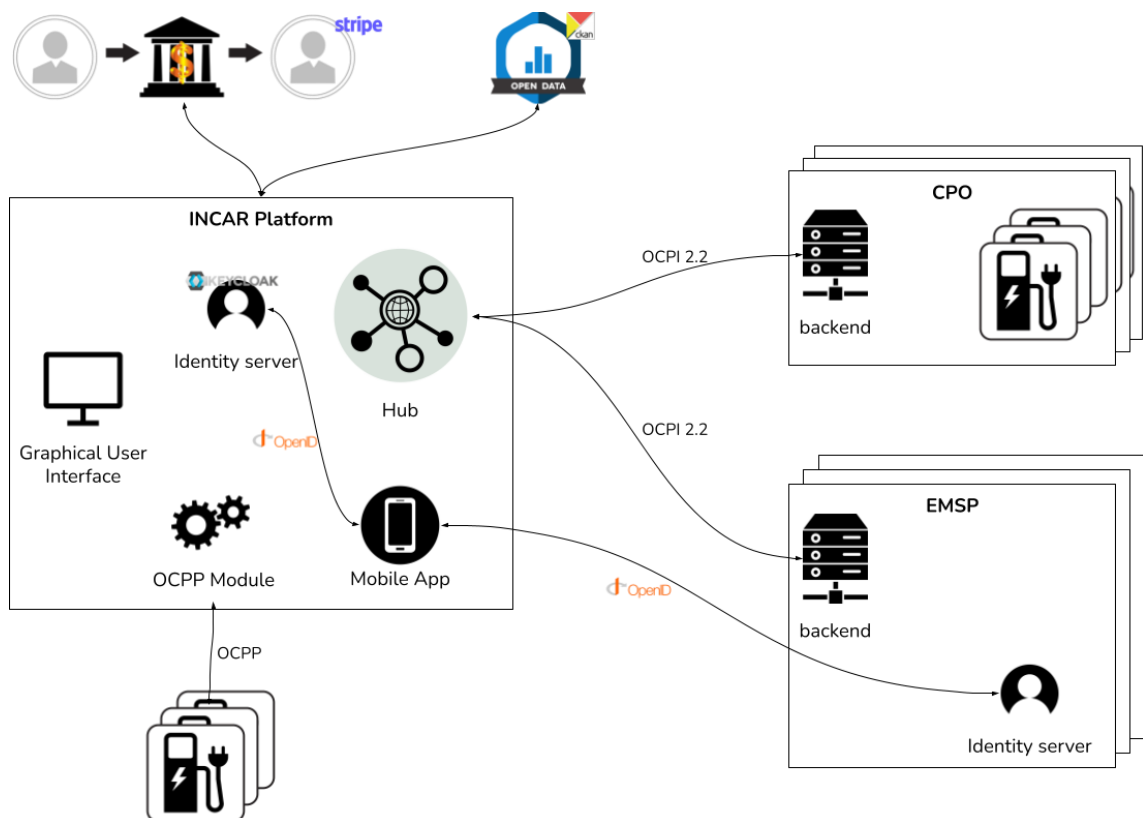
This capacity to connect and publish data to external open data portals unleashes the capacity to make use of the data managed by the INCAR Platform (e.g. statistical usage of the different connected Charge Point) in conjunction with other external data sources, allowing third parties to develop custom services, applications or studies taking advantage of this data (e.g. municipal transport companies could potentially integrate Charge Points managed by INCAR in their own applications, or city planners could develop studies taking density of Charge Point presence in different locations of a city as an input).

3. Architecture overview

3.1 INCAR Platform component overview

In order to implement all features described under section 2, a number of components have been designed and implemented, each specialized for a particular task.

Figure 5 INCAR platform architecture overview



The INCAR Platform is composed by the following components:

- **Hub:** Implements the core functionality that enables interoperability among registered partners
- **Mobile App:** Provides EV drivers access to the INCAR Platform services
- **Graphical User Interface:** Web-based interface allowing partner registration and access to relevant information and dashboards
- **Identity Server:** Component managing user details, including credentials and personal data. INCAR Platform uses this component internally as part of the partner and casual

EV drivers management. This component is supported by Keycloak [4], a widely-used open-source identity management service

- OCPP Module: Component managing communications with the Charge Points of the micro-CPOs, by means of the OCPP protocol in their different available versions

Additionally, some of the features are implemented by means of integration with third-party services, namely:

- Payment management: INCAR Platform integrates with Stripe [2] in order to implement payment automation among all registered partners
- Open data: INCAR Platform is integrated with CKAN [3] to enable the publication of relevant statistical data to the third party open data portals

Integration with electromobility partners (CPOs and EMSPs) takes place by means of the OCPI 2.2 protocol [5]. This protocol defines all required interactions among the partners and the INCAR Platform Hub. Details follow in section 3.2. A relevant remark is that an EMSPs willing to offer the INCAR Mobile App to their users are required to provide access to their customer data by means of the OpenID protocol [6]. This protocol enables the successful transaction of the required end-user data, ensuring that proper permissions are explicitly granted by the end-user (intended usage of their data is properly communicated beforehand) and that any of the INCAR Platform components never get access to the end-user credentials (which are managed by the corresponding EMSP). In order to facilitate the integration of EMSPs willing to use the Mobile App, independent instances of Keycloak as well as offline tools for data synchronization will be offered by the project.

3.2 Interoperability and roaming services: OCPI 2.2

Interoperability and roaming services implementation is based on the open protocol OCPI 2.2. The protocol specification details the different roles which have a relevant paper in the electromobility ecosystem. Usually, CPOs and EMSPs are the most common actors, but the last protocol version introduced a new role called Hub, intended to centralize the communications between the different partners involved in an electromobility platform. Consequently, the INCAR roaming service involves the implementation of the OCPI modules that are related to the Hub role.

Some general design decisions to be taken into account are detailed hereby:

- Although OCPI does not define any limitation to broadcast push operations, it has been considered suitable to deny this operation to *cdrs*, *chargingprofiles*, *sessions* and *commands* modules.
- OCPI considers the scenario where *ocpi-to* headers are omitted, which is called open routing request. Since it is not possible to identify the receiver of these requests when this header is not present, these types of operations are not allowed in the INCAR Platform.

3.2.1 Versions

This module is the starting point for any OCPI connection. Via this module, clients can learn which versions of OCPI a server supports, and which modules it supports for each of the versions. It contains the version information endpoint, as well as version details. Both provide the hub version information.

3.2.2 Credentials

This module describes the registration process between two OCPI platforms. This process starts with a POST request, including the token that has been provided after creating the account in the INCAR graphic user interface. This token can only be used once, to perform the OCPI 2.2 registration of the corresponding party in the INCAR Platform.

INCAR Platform will manage payment among partners, and therefore an extra check is added to the process, and partners with invalid payment-related information will be automatically denied participation in the INCAR Platform until valid payment-related information has been provided.

Additionally, once a platform is registered in the INCAR Platform, some data exchanged in the previous step, such as the platform endpoints or the platform members, may be changed. In order to report this new information to other parties, the platform shall perform a PUT request against the *credentials* module. The steps followed by the INCAR Platform in this case are almost the same as during the registration.

Finally, OCPI provides a mechanism to stop the communications between two platforms. This is the *unregistration* process, and it is performed by sending a DELETE request to *credentials* interface. Whenever needed, the INCAR Platform will invalidate the corresponding party information as well as their related information such as the charging points or tokens managed by that party. However, this information will not be removed from the database, it will remain disabled instead.

3.2.3 Locations

There are a *Sender* and a *Receiver* interface for *locations*. *Sender* interface, implemented by EMSPs, is mainly for reporting data related to *locations*.

The PUT operation can be employed for adding information about a *location*, an EVSE or a connector. Once the data is registered in the INCAR Platform, the request is redirected to the appropriate partners. In the case a new EVSE is reported, the steps are similar as in the case of *location*. If a new connector is reported, the same business logic is followed.

GET operation in the receiver interface will request the data stored in the INCAR Platform or the data stored in the corresponding partner backend. These situations can be identified based on the 'ocpi-to-party-id' header present in the client request. Something similar occurs on GET operation in the sender interface, but in this case, GET the information of a particular location/EVSE/connector will not be possible when requesting to INCAR Platform because a *location* cannot be identified just with *object id*, as locations from different CPOs can have the same *id*.

Finally, an additional GET operation outside of the scope of OCPI is implemented. This service is intended to be requested by the INCAR mobile app. In all mobile requests, the authentication will be performed checking the token included in the request against the mobile token configured in the settings of the project (API Token strategy).

3.2.4 Sessions

Implementation of sessions module follows the steps described in the *locations* module. The objects received will be persisted by the INCAR Platform. Sessions are owned by the CPOs, but their information shall be displayed to EMSPs as well, so additional data is managed internally to serve this purpose. In the case of PUT and PATCH (receiver) operations, if the session reported is performed in an EVSE included in an optimization context, the session data will be redirected to SMAC in order to apply smart charging services.

PUT operation in sender interface will report dynamic EV driver inputs for smart charging.

GET operations will respond data stored in INCAR Platform or in partner backend, depending on the request headers, as in the case of *locations*.

INCAR mobile app will be able to request sessions associated with a user. A logged-in user shall be able to request their session data, but not sessions of another user (token). In order to identify this set of sessions, the driver EMSP data shall be reported, as well as its corresponding token. Additionally, the user will be allowed to introduce their charging preferences by means of PUT request which follows the data model described in OCPI.

3.2.5 CDRs

POST request on receiver interface allows a CPO to report a new CDR. CDRs are the only object of OCPI scope that cannot be updated. For this reason, an error response will be thrown in the case there is a CDR with the same id in the hub database. Apart from the hub database, CDRs information hash will be also persisted in a private Blockchain. Once this storage has been completed, the CDR will be reported to the affected partner. Apart from the body content validations, that are performed in all modules, the 'ocpi-to' headers will be checked in order to avoid broadcast push, as the CDR data shall be just reported to the EMSP of the EV driver.

As in the sessions module, the mobile app can request a list of CDRs for an EV driver.

3.2.6 Tariffs

Implementation of *tariff* module has the basic business logic followed in all modules such as validations in request content, storage in INCAR Platform, redirection to partners and mobile app communication.

3.2.7 Tokens

Implementation of tokens module has the basic business logic followed in all modules such as validations in request content, storage in INCAR Platform and redirection to partners. While

designing services between INCAR backend and INCAR app, it was not identified any use case in which the EV driver shall request tokens information.

3.2.8 Commands

Commands receiver interface persists and redirects the command received. One important remark is that the INCAR Platform will replace the callback URL before retransmitting the command to the actual receiver. This is motivated by the need of the INCAR Platform to route the response as well, so necessary information of the response can be tracked. Once the receiver sends the response to the INCAR Platform URL that has replaced the original EMSP URL, the INCAR Platform will redirect the response from the CPO to the EMSP endpoint.

The body of the command can also include an extra parameter called 'operation'. This could be included when sending the command from the INCAR app, and it will be present in the case of reservation with cost, or in the case of starting session commands. This operation represents the id of the retention performed by the payment SDK that will be necessary when reporting a CDR to the Blockchain. Apart from this field, the status of the session related to this command will be persisted in order to be able to easily identify the command and the operation associated with a CDR. The command status will change at the moment the CDR information is received by the hub.

In the sender interface, the hub shall identify the original URL of the EMSP in order to notify the CPO response.

There are different endpoints depending on the specific request that comes from the EMPSs/CPOs and INCAR mobile app. The business logic for both cases does not vary, but the validations in the request are different.

3.2.9 Charging Profiles

PUT operation on receiver interface allows reporting new *charging profiles*. As in the command module, a response URL is included in the request. Following the previous case, the INCAR Platform will replace the response URL, so a response from the CPO to the EMSP can be properly routed.

POST operation in the sender interface is intended to identify the original response URL of the EMSP and report the response from the CPO.

3.2.10 Hub Client Info

INCAR Platform implements the sender interface of the *HubClientInfo* module, which returns the information of connected partners.

Additionally, an endpoint is included in order to report the INCAR mobile app the available EMSPs with their corresponding Identity service information (Keycloak), intended to be used during the EV driver login.

3.2.11 Smart charging optimization

The hub redirects all information related to the smart charging optimizations. The management of this data will be performed by SMAC.

The receiver interface GET and DELETE operations, as well as PUT operation in the sender interface will be supported.



4. INCAR Platform documentation

4.1 INCAR administration and management

With the aim of managing INCAR Platform details, and getting access to the information managed by the platform, a Graphical User Interface (GUI) has been developed as part of the INCAR Platform software package.

The GUI is accessible to target users by means of a public website. The following sections specify all the elements available in this GUI, which vary depending on the role of the operator that connects makes use of it. Four different roles have been considered:

- Charge Point Operators (CPO)
- ElectroMobility Service Providers (EMSP)
- Entities sharing both roles (CPO+EMSP)
- Micro-CPOs (Charge Point owners without the capacity to manage the Charge Points on their own)

4.2 Usage of INCAR by CPOs

4.2.1 Registration

To join the INCAR Platform, CPOs will be able to access the INCAR Platform GUI and proceed with the self-registration, by indicating the following information:

- Email address
- Password
- Role (CPO)
- Country Code
- Party Id

Country Code and Party Id are special fields that will uniquely identify the partner in all interactions with the INCAR Platform. According to OCPI 2.2 [5], “In several standards, an issuing authority is mentioned that will keep a central registry of known Providers and Operators. At this moment, the following countries have an authority that keeps track of the known providers and operators: Netherlands, Belgium, Luxembourg, Germany, Austria and France”. INCAR Platform will check that no other partner sharing the same role, Country Code and Party Id has been previously registered, rejecting the registration otherwise.

Figure 6 INCAR platform GUI - Login site

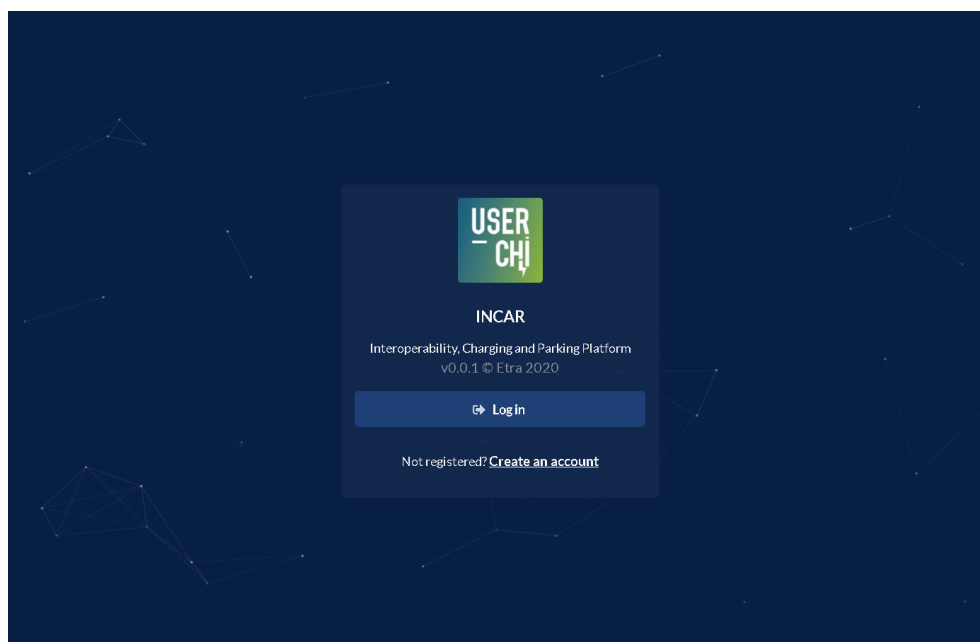
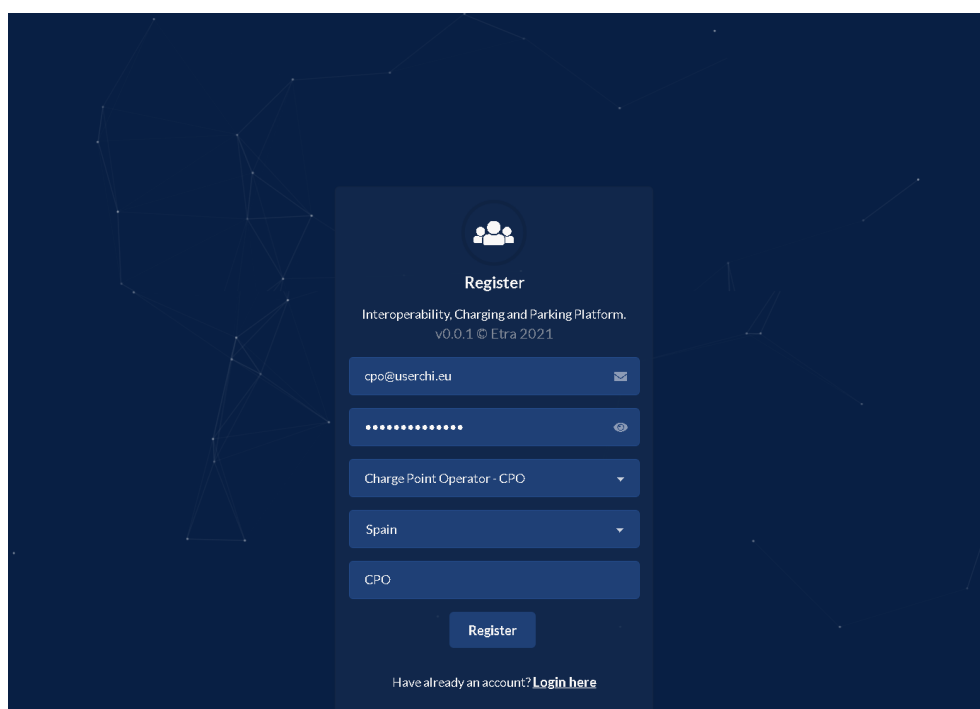


Figure 7 INCAR platform GUI - CPO registration site



Once the form is completed, the INCAR Platform administrator will need to accept or reject the registration request manually. Further details will be sent via email afterwards, including:

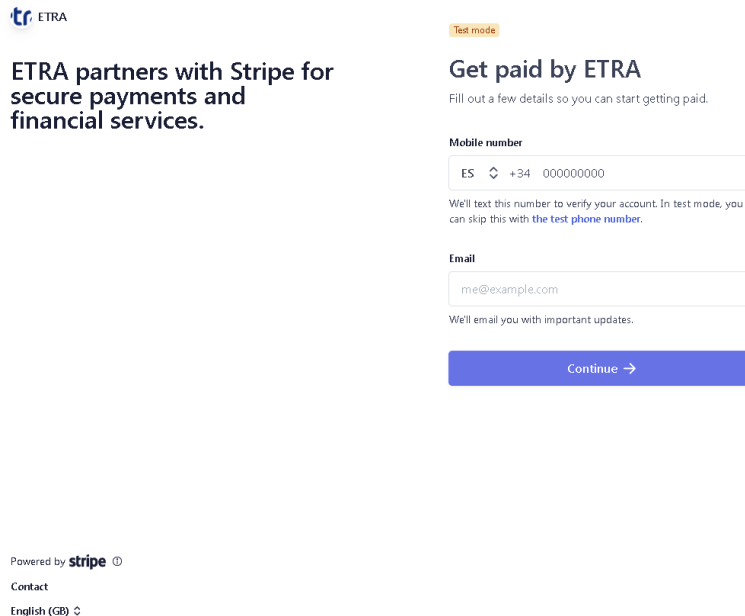
Please confirm registration

- <https://userchi-incar-gui.tec.etra-id.com/confirmation/637ea554-0e0b-4a81->

- URL: <https://userchi-incar.tec.etra-id.com/ocpi/hub/Admin/partner>
- Access token: 637ea554-0e0b-4a81-af15-████████████████████

- Contact information: mobile phone number and email
- Country and type of business
- Company details: name, address, website...
- Bank account details
- Additional documentation for id, address and bank account verification

Figure 9 INCAR platform payment system. Stripe authorization form (i)



ETRA

ETRA partners with Stripe for secure payments and financial services.

Powered by **stripe** ⓘ

Contact

English (GB) ↕

Test mode

Get paid by ETRA

Fill out a few details so you can start getting paid.

Mobile number

ES 📶 +34 000000000

We'll text this number to verify your account. In test mode, you can skip this with the [test phone number](#).

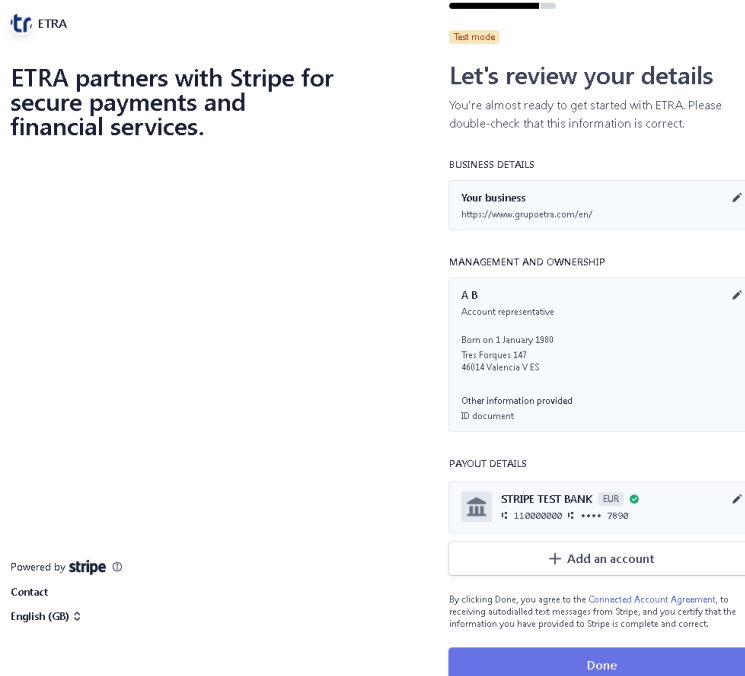
Email

me@example.com

We'll email you with important updates.

[Continue →](#)

Figure 10 INCAR platform payment system. Stripe authorization form (ii)



ETRA

ETRA partners with Stripe for secure payments and financial services.

Powered by **stripe** ⓘ

Contact

English (GB) ↕

Test mode

Let's review your details

You're almost ready to get started with ETRA. Please double-check that this information is correct.

BUSINESS DETAILS

Your business [https://www.grupoetra.com/en/](#) ✎

MANAGEMENT AND OWNERSHIP


A B ✎

Account representative

Born on 1 January 1980
Tres Forques 147
46014 Valencia V ES

Other information provided
ID document

PAYOUT DETAILS

STRIPE TEST BANK EUR  ✎

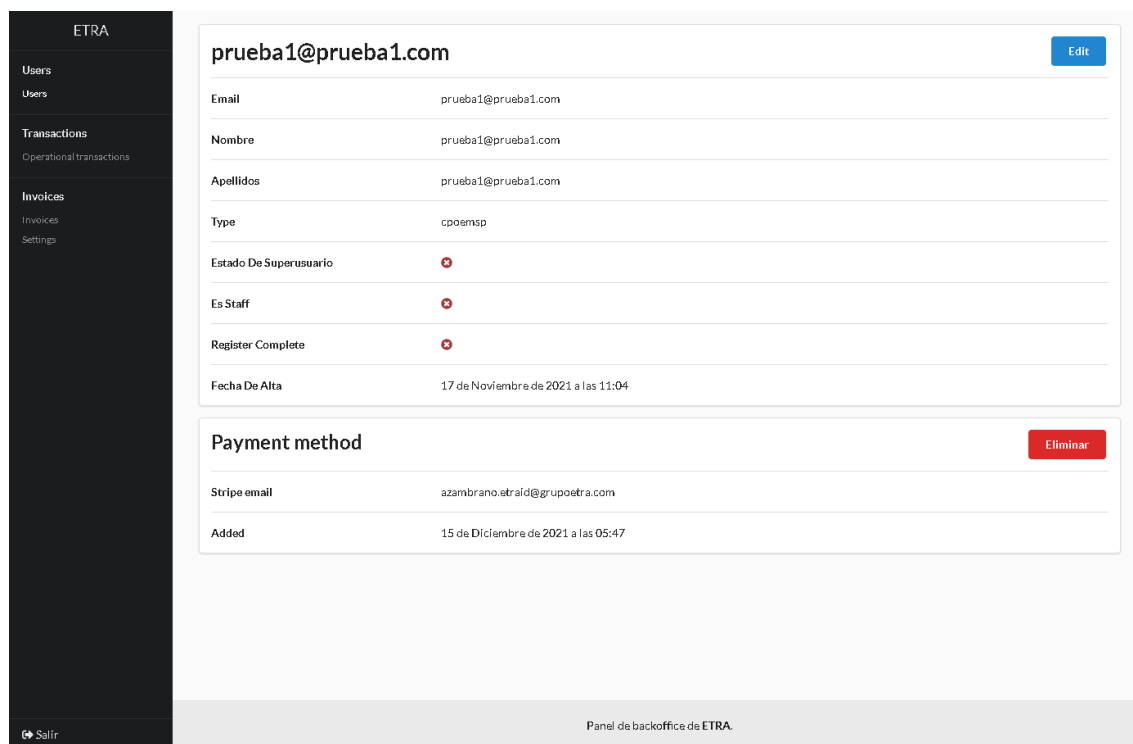
11 00000000 12 3456 7890

[+ Add an account](#)

By clicking Done, you agree to the [Connected Account Agreement](#), to receiving auto-dialled text messages from Stripe, and you certify that the information you have provided to Stripe is complete and correct.

[Done](#)

Figure 11 INCAR backoffice - CPO payment-related details registration



prueba1@prueba1.com		Edit
Email	prueba1@prueba1.com	
Nombre	prueba1@prueba1.com	
Apellidos	prueba1@prueba1.com	
Type	cpoemsp	
Estado De Superusuario		
Es Staff		
Register Complete		
Fecha De Alta	17 de Noviembre de 2021 a las 11:04	

Payment method		Eliminar
Stripe email	azambrano.etruid@grupoetra.com	
Added	15 de Diciembre de 2021 a las 05:47	

Panel de backoffice de ETRA

4.2.2 Login

Once the registration process has been completed, CPO operators will be able to login into the INCAR Platform GUI by using the provided email address and password.

Figure 12 INCAR platform GUI - Login form



Sign in to your account

Username or email

Password

Sign In

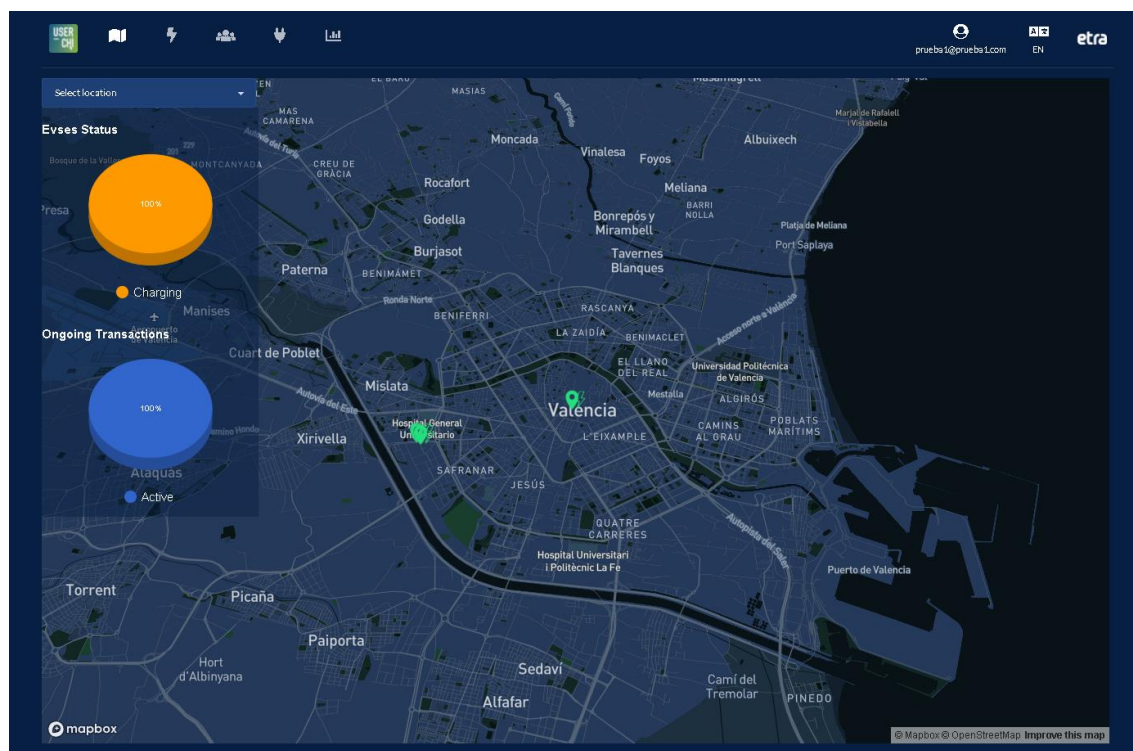
4.2.3 Information provided

CPOs will gain access to all the relevant details about the interoperability operations managed by the INCAR Platform and concerning their charge points. All details are distributed along the following sections.

4.2.3.1 Map

A map displays the location of all charge points managed by the CPO. Additional details are provided upon the selection of one of the markers. An overlay is additionally presented displaying the current status of all charging points (percentage of currently available Charge Points).

Figure 13 INCAR platform GUI - Map



4.2.3.2 Dashboard

The dashboard gives access to all relevant statistical data related to the CPO transactions as they are registered by the INCAR Platform. Upon selection of a month, following information is provided:

- Total amount of transactions registered in CPOs Charge Points
- Total energy delivered in these transactions
- Total invoice amount

- Average values per transaction for the above indicators
- Daily distribution of above indicators along the month
- Distribution of above indicators per hour of the day
- Total transaction share per EVSE
- Total energy supply share per EVSE
- Total income share per EVSE

Figure 14 INCAR platform GUI - CPO operation dashboard



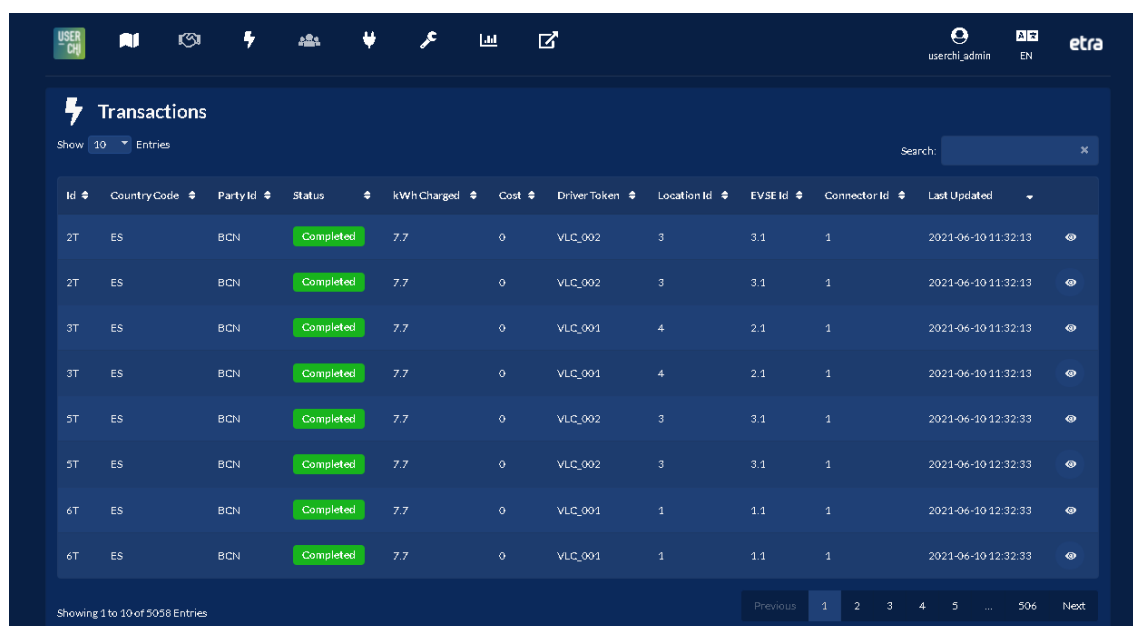
4.2.3.3 Transactions

The Transactions section provides access to the information of all transactions performed by any EV driver in any of the Charge Points managed by the CPO. Information presented includes:

- Transaction id

- Country code and Party id of corresponding CPO
- Status: the status of the charge session (ACTIVE, COMPLETED, INVALID, PENDING, RESERVATION)
- Total energy supplied
- Total cost
- Driver token
- Charge point details, including location id, EVSE id and connector id.
- Last time session data was updated

Figure 15 INCAR platform GUI - Transactions



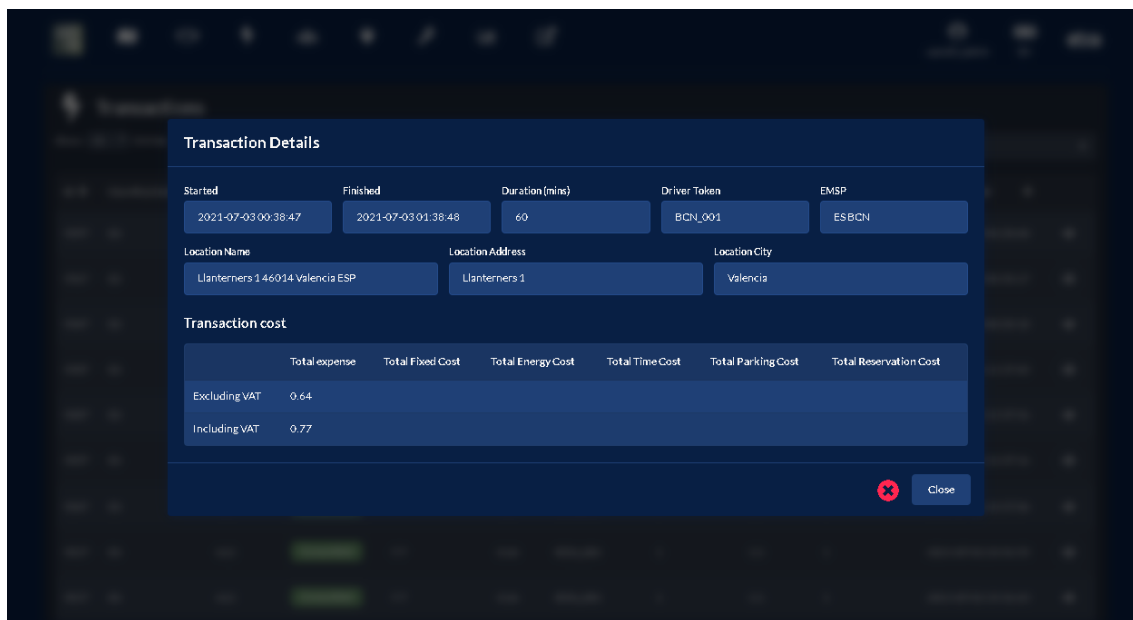
The screenshot shows the 'Transactions' page in the INCAR platform GUI. The page has a dark blue header with the USER-CHi logo and navigation icons. The main content area displays a table of transactions. The table has columns for Id, CountryCode, PartyId, Status, kWhCharged, Cost, DriverToken, LocationId, EVSEId, ConnectorId, and LastUpdated. The Status column shows 'Completed' for all entries. The table is paginated, showing 1 to 10 of 5058 entries. A search bar is located at the top right of the table area.

Id	CountryCode	PartyId	Status	kWhCharged	Cost	DriverToken	LocationId	EVSEId	ConnectorId	LastUpdated
2T	ES	BCN	Completed	7.7	0	VLC_002	3	3.1	1	2021-06-10 11:32:13
2T	ES	BCN	Completed	7.7	0	VLC_002	3	3.1	1	2021-06-10 11:32:13
3T	ES	BCN	Completed	7.7	0	VLC_001	4	2.1	1	2021-06-10 11:32:13
3T	ES	BCN	Completed	7.7	0	VLC_001	4	2.1	1	2021-06-10 11:32:13
5T	ES	BCN	Completed	7.7	0	VLC_002	3	3.1	1	2021-06-10 12:32:33
5T	ES	BCN	Completed	7.7	0	VLC_002	3	3.1	1	2021-06-10 12:32:33
6T	ES	BCN	Completed	7.7	0	VLC_001	1	1.1	1	2021-06-10 12:32:33
6T	ES	BCN	Completed	7.7	0	VLC_001	1	1.1	1	2021-06-10 12:32:33

Further details can be accessed by clicking on the corresponding Transaction Details button:

- Start and stop times, and duration of the session
- Driver token and EMSP
- EVSE address
- Detailed associated costs (energy, time, parking and reservation costs, including taxes details)
- Validation with blockchain, ensuring data has not been modified since it was registered by the INCAR Platform

Figure 16 INCAR platform GUI - Transaction details



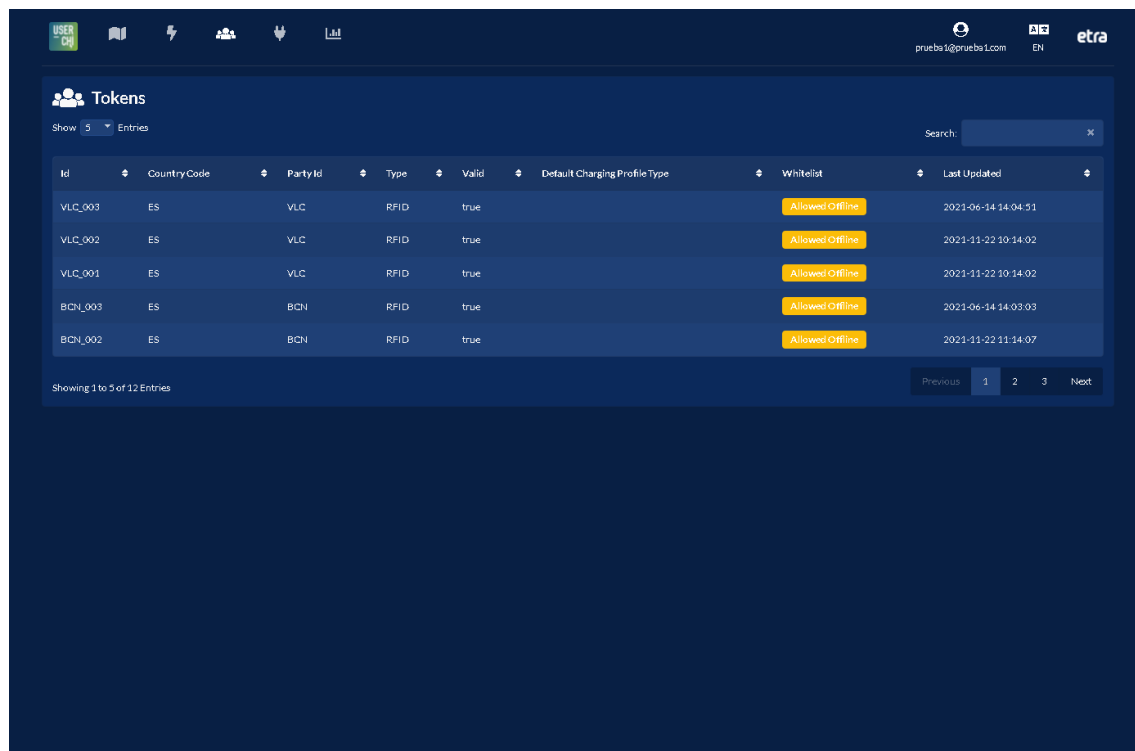
Transaction Details						
Started	Finished	Duration (mins)	Driver Token	EMSP		
2021-07-03 00:38:47	2021-07-03 01:38:48	60	BCN_001	ESBCN		
Location Name	Location Address	Location City				
Llanterners 146014 Valencia ESP	Llanterners 1	Valencia				
Transaction cost						
	Total expense	Total Fixed Cost	Total Energy Cost	Total Time Cost	Total Parking Cost	Total Reservation Cost
Excluding VAT	0.64					
Including VAT	0.77					

4.2.3.4 Tokens

The Tokens section provides access to the information of all EV driver tokens that have been registered in the INCAR Platform (and are therefore potential customers of the CPO). Information presented includes:

- Identifier
- Country code and Party id of corresponding EMSP
- Type: AD_HOC_USER (one-time token), APP_USER, RFID or OTHER
- Validity
- Whitelist-allowed
- Last time token data was updated

Figure 17 INCAR Platform GUI - Tokens



Id	Country Code	Party Id	Type	Valid	Default Charging Profile Type	Whitelist	Last Updated
VLC_003	ES	VLC	RFID	true		Allowed Offline	2021-06-14 14:04:51
VLC_002	ES	VLC	RFID	true		Allowed Offline	2021-11-22 10:14:02
VLC_001	ES	VLC	RFID	true		Allowed Offline	2021-11-22 10:14:02
BCN_003	ES	BCN	RFID	true		Allowed Offline	2021-06-14 14:03:03
BCN_002	ES	BCN	RFID	true		Allowed Offline	2021-11-22 11:14:07

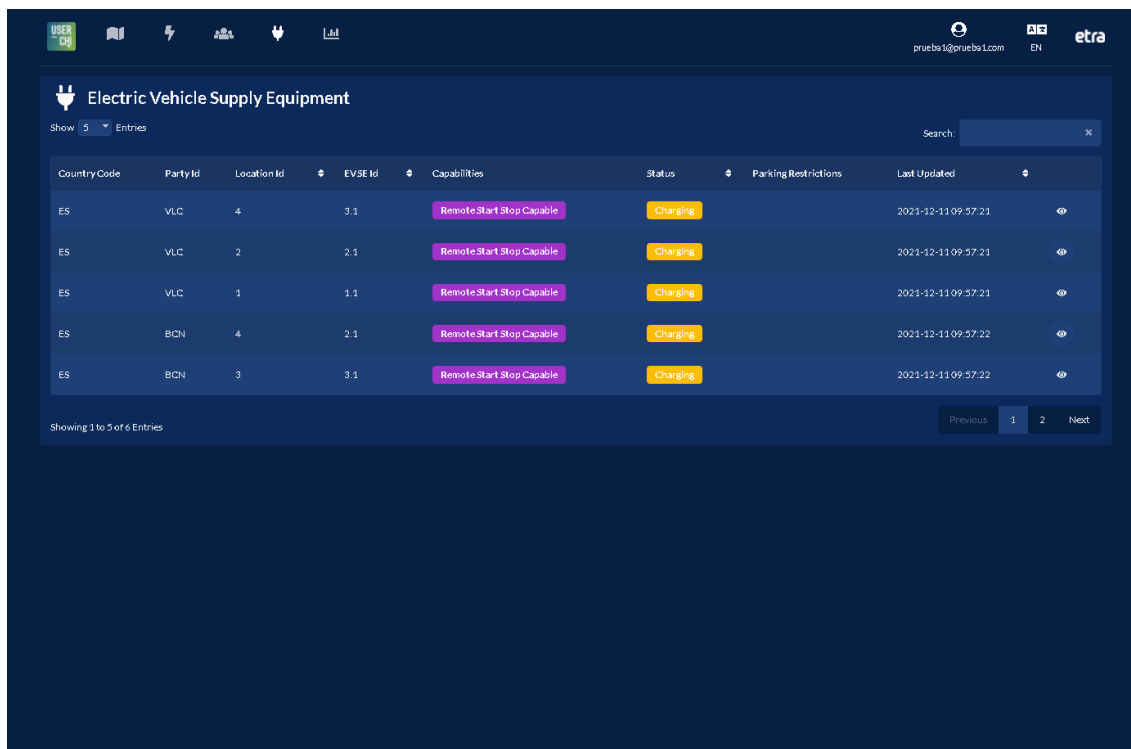
Showing 1 to 5 of 12 Entries

4.2.3.5 Electric Vehicle Supply Equipment

The EVSE section provides access to the information registered by the INCAR Platform about all EVSEs (Charge Points) managed by the CPO. This information includes:

- Country code and Party id of corresponding CPO
- EVSE and location identifiers
- Capabilities: list of functionalities the EVSE is capable of (CHARGING_PROFILE_CAPABLE, CHARGING_PREFERENCES_CAPABLE, CHIP_CARD_SUPPORT, CONTACTLESS_CARD_SUPPORT, CREDIT_CARD_PAYABLE, DEBIT_CARD_PAYABLE, PED_TERMINAL, REMOTE_START_STOP_CAPABLE, RESERVABLE, RFID_READER, TOKEN_GROUP_CAPABLE, UNLOCK_CAPABLE)
- Status: latest known status of the EVSE (AVAILABLE, BLOCKED, CHARGING, INOPERATIVE, OUTOFORDER, PLANNED, REMOVED, RESERVED, UNKNOWN)
- Parking restrictions: the restrictions that apply to the parking spot (EV_ONLY, PLUGGED, DISABLED, CUSTOMERS, MOTORCYCLES)
- Last time EVSE data was updated

Figure 18 INCAR platform GUI - Electric Vehicle Supply Equipment



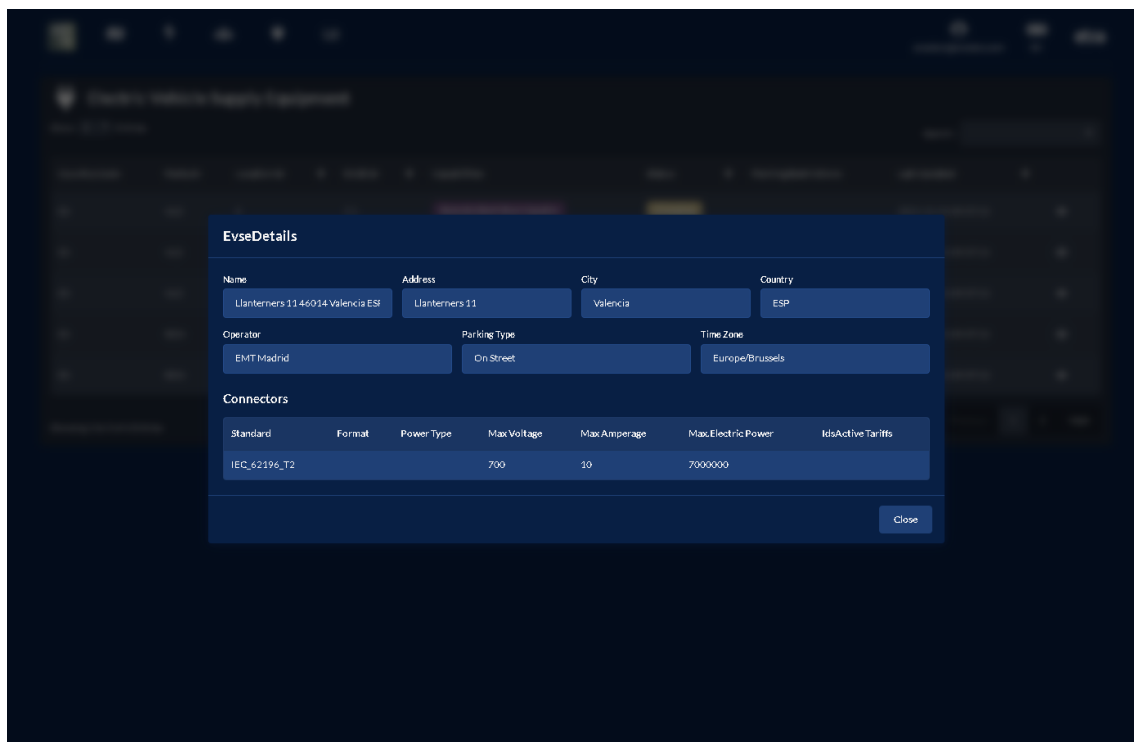
The screenshot displays the 'Electric Vehicle Supply Equipment' section of the INCAR platform GUI. It features a table with 5 entries, each representing a charging station. The table columns are: Country Code, Party Id, Location Id, EVSE Id, Capabilities, Status, Parking Restrictions, and Last Updated. Each entry includes a 'Remote Start Stop Capable' button and a 'Charging' status indicator. The table is paginated, showing 1 to 5 of 6 entries.

Country Code	Party Id	Location Id	EVSE Id	Capabilities	Status	Parking Restrictions	Last Updated
ES	VLC	4	3.1	Remote Start Stop Capable	Charging		2021-12-11 09:37:21
ES	VLC	2	2.1	Remote Start Stop Capable	Charging		2021-12-11 09:37:21
ES	VLC	1	1.1	Remote Start Stop Capable	Charging		2021-12-11 09:37:21
ES	BCN	4	2.1	Remote Start Stop Capable	Charging		2021-12-11 09:37:22
ES	BCN	3	3.1	Remote Start Stop Capable	Charging		2021-12-11 09:37:22

Further details can be accessed by clicking on the corresponding EVSE Details button:

- Name and address of the Charge Point
- Operator details
- Connectors list and details, including type and power/ampereage

Figure 19 INCAR platform GUI - Electric Vehicle Supply Equipment details



Name	Address	City	Country
Llanterners 11 46014 Valencia ES	Llanterners 11	Valencia	ESP

Operator	Parking Type	Time Zone
EMT Madrid	On Street	Europe/Brussels

Connectors						
Standard	Format	Power Type	Max Voltage	Max Amperage	Max Electric Power	Is Active Tariffs
IEC_62196_T2			700	10	7000000	

Close

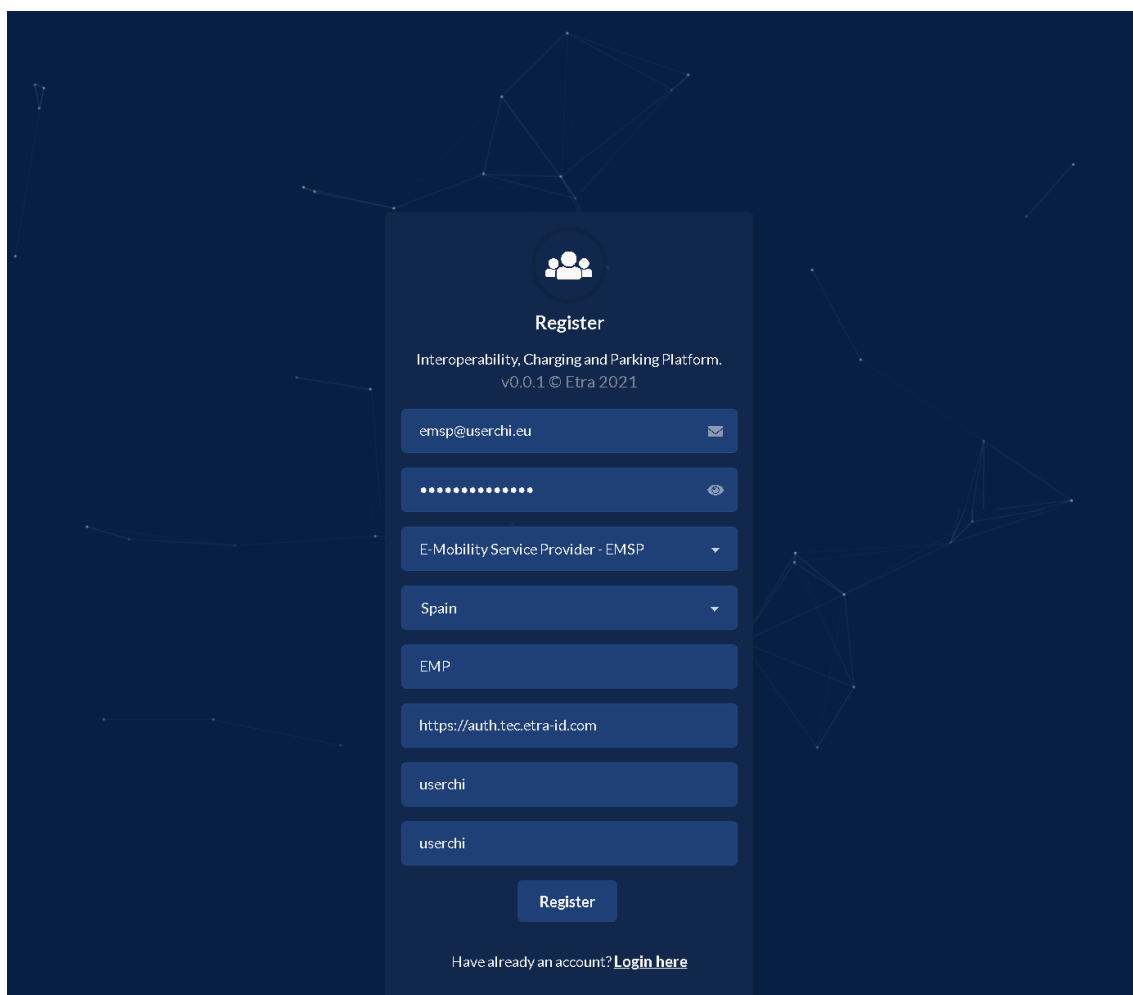
4.3 Usage of INCAR by EMSPs

4.3.1 Registration

Registration of EMSPs in the platform takes place in a similar manner as described in section 4.2.1. Differences are documented hereby:

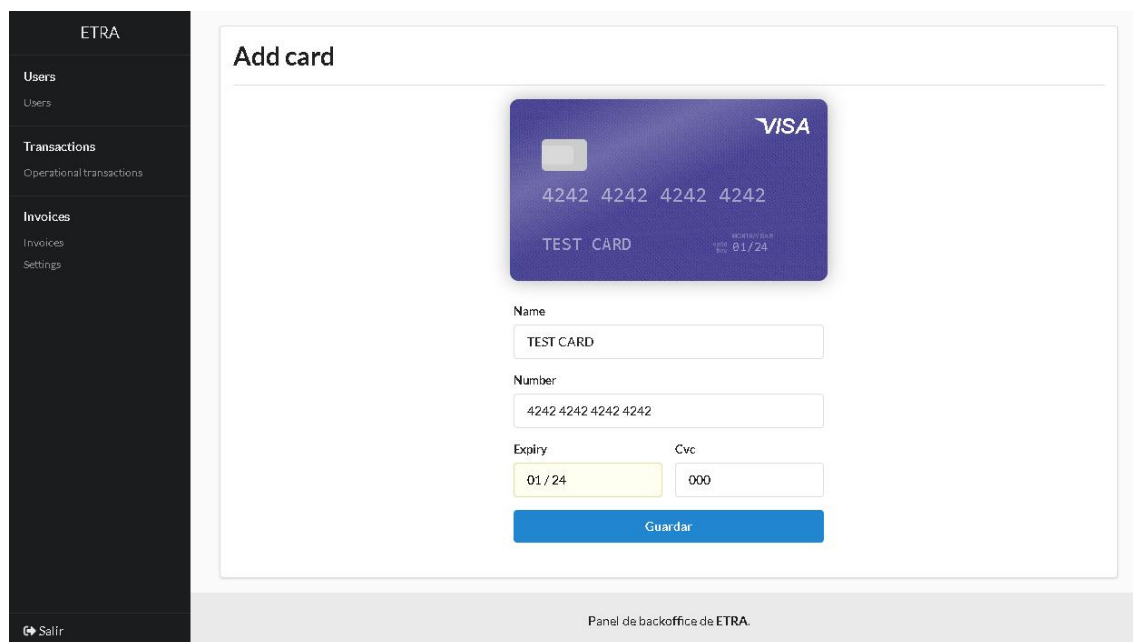
- The role to be selected in the registration form is *EMSP*
- Access data to the corresponding EMSP Identity Service Provider needs to be given in order to allow customers to make use of the INCAR Mobile App. This information includes:
 - URL of the Identity Service Provider
 - ClientId and secret (so INCAR Mobile App can authorize itself in the corresponding Identity Service Provider)

Figure 20 INCAR platform GUI - EMSP registration site

The image shows a registration form for the INCAR platform. The form is titled "Register" and includes the text "Interoperability, Charging and Parking Platform. v0.0.1 © Etra 2021". The form fields are: email (emp@userchi.eu), password (represented by dots), E-Mobility Service Provider - EMSP (dropdown menu), Country (Spain), EMP (text field), URL (https://auth.tec.etra-id.com), Username (userchi), and Password (userchi). A "Register" button is at the bottom, and a link "Have already an account? Login here" is at the bottom right.

- With regard to the payment-related information, credit card details need to be provided. INCAR Platform will charge on a monthly basis the accounted totals on the provided card.

Figure 21 INCAR platform payment system - EMSP payment-related details registration



4.3.2 Login

Login of EMSPs in the platform takes place in a similar manner as described in section 4.2.2.

4.3.3 Information provided

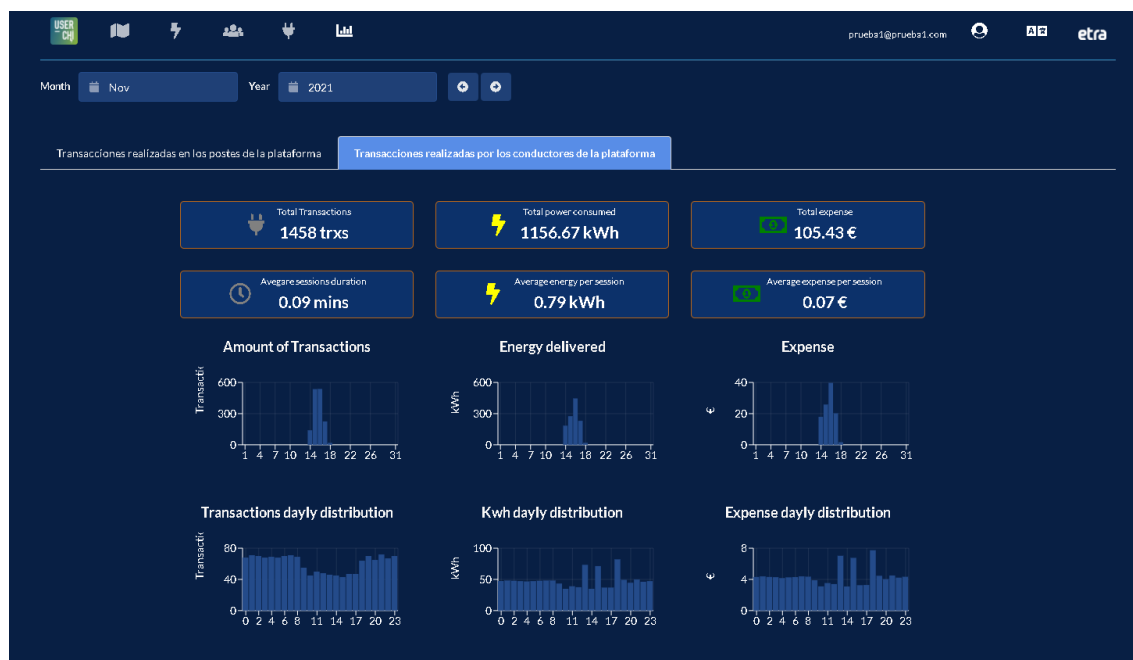
EMSPs will gain access to all the relevant details about the interoperability operations managed by the INCAR Platform and concerning their customers. All details are distributed along the following sections.

4.3.3.1 Dashboard

The dashboard gives access to all relevant statistical data related to the EMSP transactions as they are registered by the INCAR Platform. Upon selection of a month, following information is provided:

- Total amount of transactions registered involving EMSPs customers
- Total energy delivered in these transactions
- Total expenses
- Average values per transaction for the above indicators
- Daily distribution of above indicators along the month
- Distribution of above indicators per hour of the day

Figure 22 INCAR platform GUI - EMSP operation dashboard



4.3.3.2 Transactions

The Transactions section provides access to the information of all transactions performed by any EV driver customer of the EMSP in any of the Charge Points registered in the INCAR Platform. Details can be found in the section 4.2.3.3

4.3.3.3 Tokens

The Tokens section provides access to the information of all EV driver tokens that have been registered by the EMSP in the INCAR Platform (and are therefore able to charge in any of the registered Charge Points). Details can be found in the section 4.2.3.4.

4.3.3.4 Electric Vehicle Supply Equipment

The EVSE section provides access to the information registered by the INCAR Platform about all EVSEs (Charge Points) registered in the INCAR Platform. Details can be found in the section 4.2.3.5.

4.4 Usage of INCAR by entities with EMSP and CPO role

INCAR Platform considers the possibility that a single entity have simultaneously the CPO and EMSP roles. In this case, all details provided under sections 4.2 and 4.3 apply.

With regard to the payment management, specific remarks need to be made for this case:

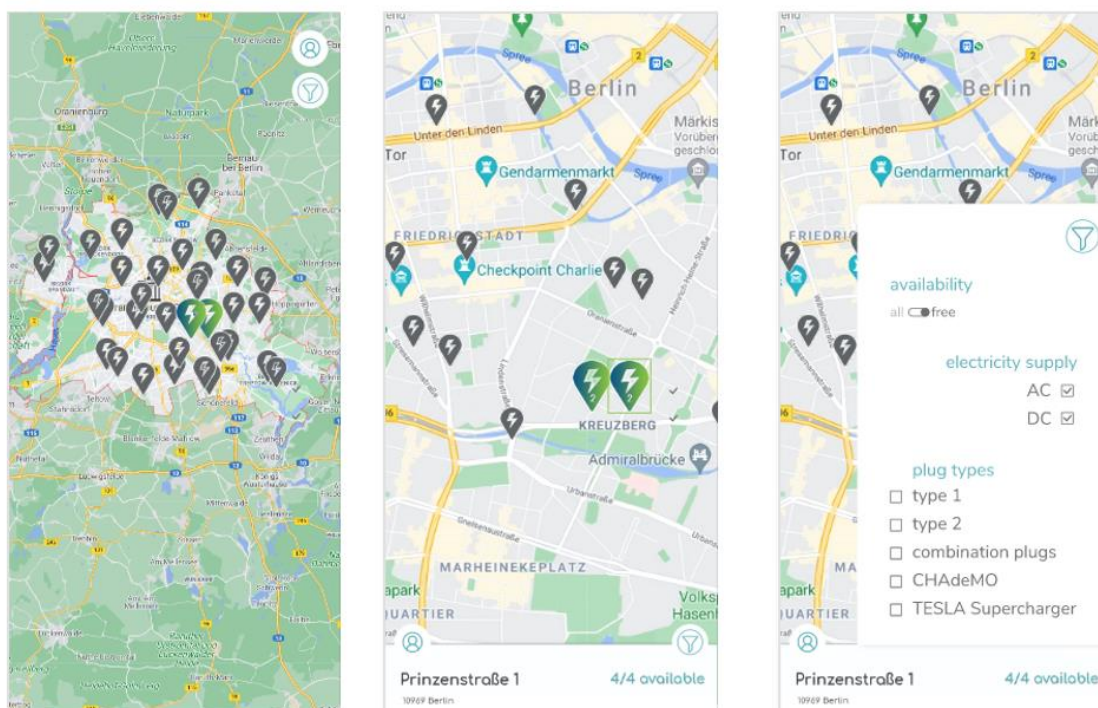
- Entities sharing CPO and EMSP roles will be required to register both a bank account (to receive deposits from third parties) and a credit card (to perform payments to third parties)
- The INCAR platform manages this particular combination of roles in a special way, so that no invoices are generated for the charging operations of the company's customers, which is responsible for its own charging points.

4.5 Usage of INCAR by EV drivers with contractual relationship with registered EMSPs

The INCAR app distinguishes between two end-user groups: EV drivers with a contractual relationship with registered EMSPs and casual EV drivers without such contract. This difference is represented by different app-screens and different authentication processes.

There are some parts of the app that can be used without even being logged in such as an overview of integrated charge points in a map, their real-time availability or routing to selected charge points.

Figure 23 INCAR App features that can be used by everyone without login

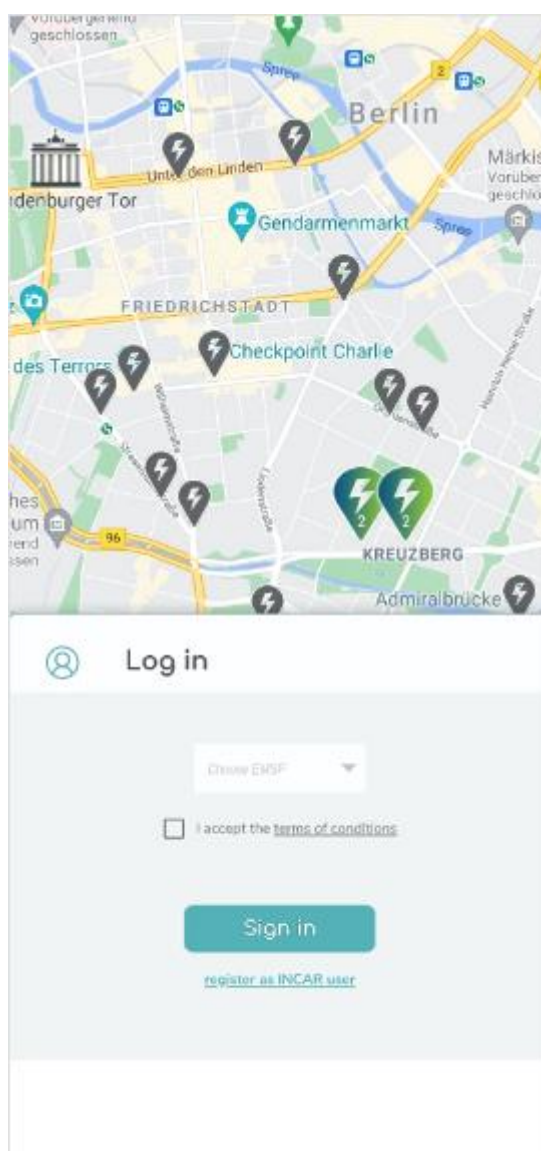


As soon as an EV driver with a contractual relationship with registered EMSPs wants to use advanced INCAR features such as reservation or start of a charging process, he or she needs to be authenticated via login.

To login the user needs to select his/her EMSP from a list of integrated EMSPs in INCAR. The app requests the list of integrated EMSPs from the INCAR platform. After selecting the EMSP, the user clicks on login and is redirected to the login page of the specific EMSP Keycloak instance.

If the login is successful the app receives the information about this user such as his/her OCPI token for further operations such as reservation etc.

Figure 24: INCAR app - Selection of EMSP and Login



4.6 Usage of INCAR by micro-CPOs

4.6.1 Registration

Registration of micro-CPOs in the platform takes place in a similar manner as described in section 4.2.1.

4.6.2 Login

Login of micro-CPOs in the platform takes place in a similar manner as described in section 4.2.2.

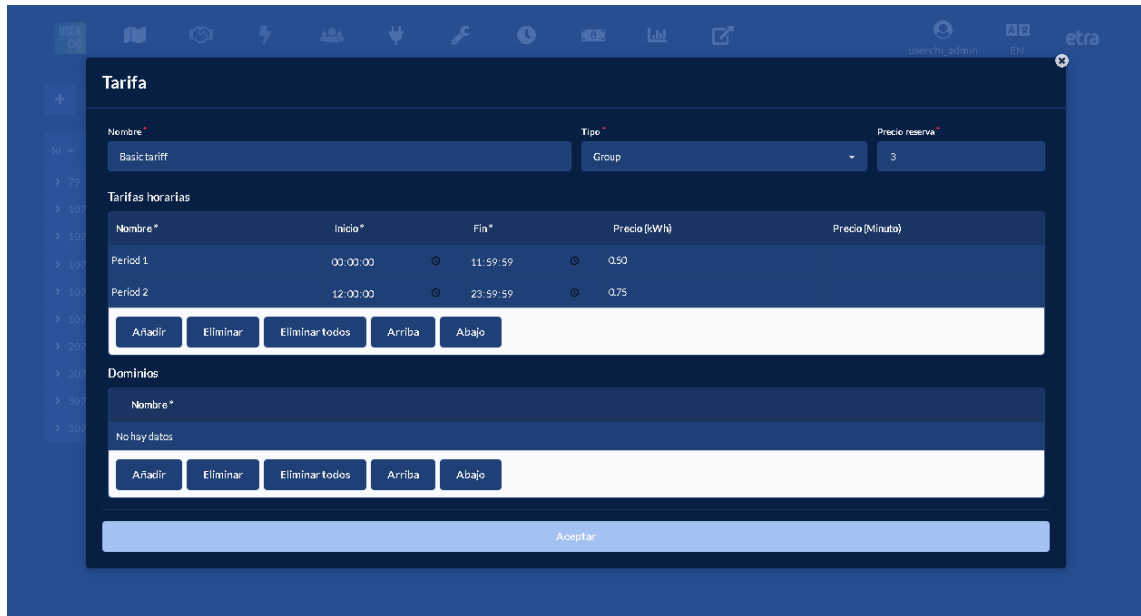
4.6.3 Management

4.6.3.1 Tariff registration

Micro-CPOs are allowed to define and manage different tariffs, which will be applied to any EV driver making use of the corresponding charging points. A tariff is defined by the following details:

- Name
- Reservation fixed cost
- ToU prices: Different energy or duration prices can be assigned to different period of time
- Group of charging points that will make use of the tariff

Figure 25 INCAR platform GUI - Micro-CPO tariff registration



Tarifa

Nombre: Basic tariff Tipo: Group Precio reserva: 3

Tarifas horarias

Nombre	Inicio	Fin	Precio (kWh)	Precio (Minuto)
Period 1	00:00:00	11:59:59	0.50	
Period 2	12:00:00	23:59:59	0.75	

Botones: Añadir, Eliminar, Eliminar todos, Arriba, Abajo

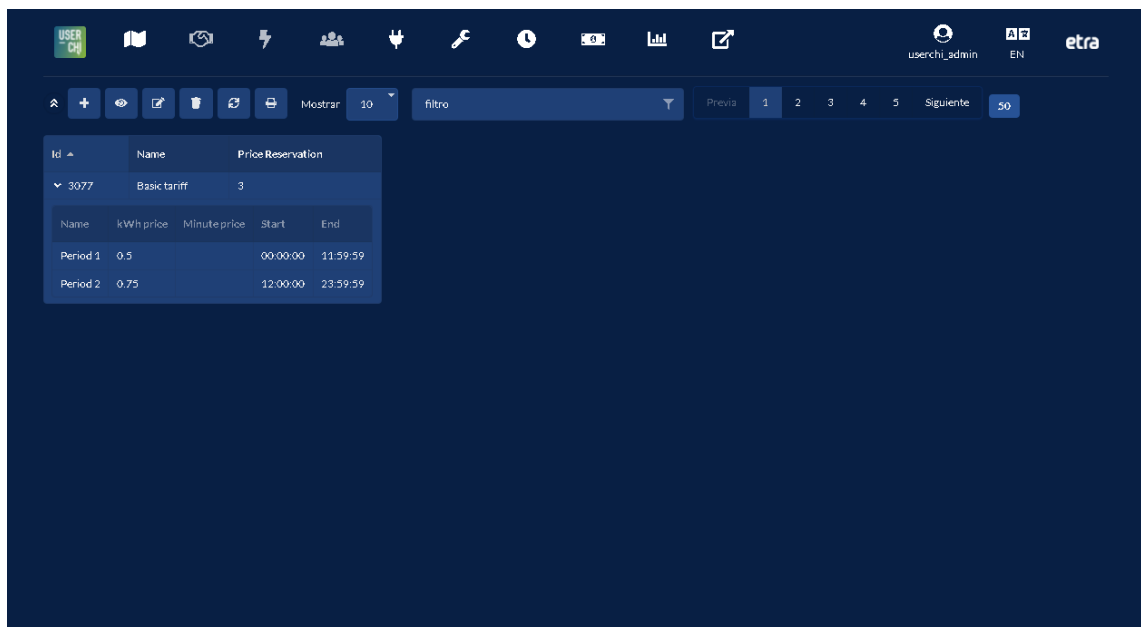
Dominios

Nombre: No hay datos

Botones: Añadir, Eliminar, Eliminar todos, Arriba, Abajo

Aceptar

Figure 26 INCAR platform GUI - Micro-CPO tariff overview



Mostrar: 10 filtro Previa 1 2 3 4 5 Siguiete 30

Id	Name	Price Reservation
3077	Basic tariff	3

Name	kWh price	Minute price	Start	End
Period 1	0.5		00:00:00	11:59:59
Period 2	0.75		12:00:00	23:59:59

4.6.3.2 Availability calendar registration

Micro-CPOs are allowed to define and manage different availability calendars for their charging points. The definition of a calendar includes:

- Name and description

- Group of charging points the calendar applies to
- Specification of the different availability time ranges

Figure 27 INCAR platform GUI - Calendar list

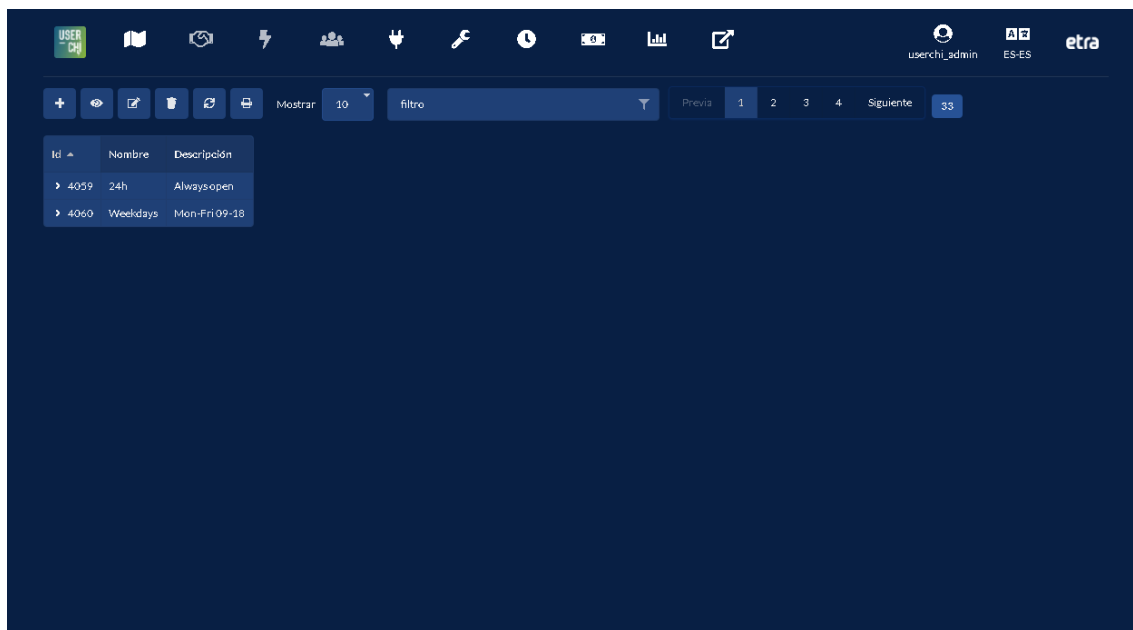
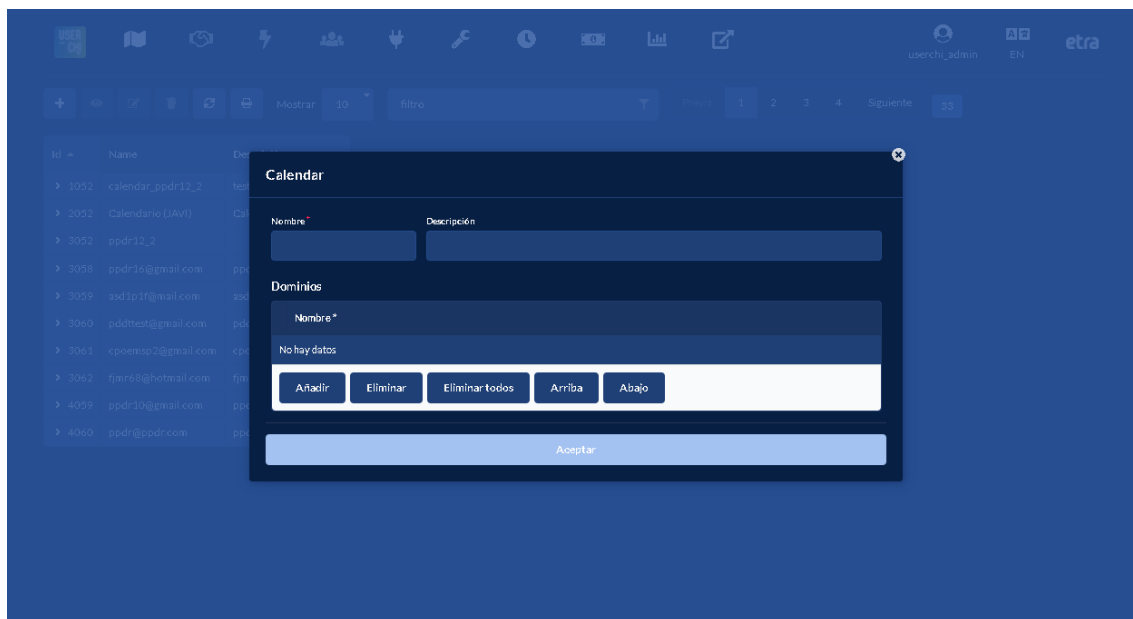


Figure 28 INCAR platform GUI - New calendar form



In order to specify the availability time ranges, the following configuration needs to be performed:

- Define as many types of days as required. A type of day consists on a list of time slots, stating whether the charging points are available or not
- Assign a type of day to each calendar date

Figure 29 INCAR platform GUI - Type of day definition

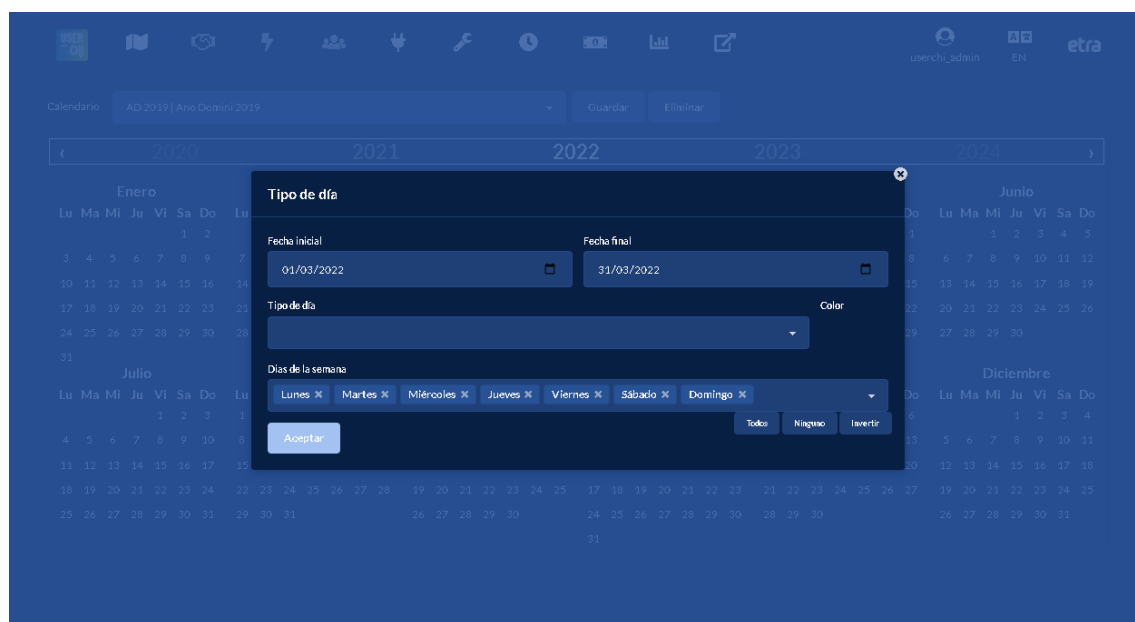
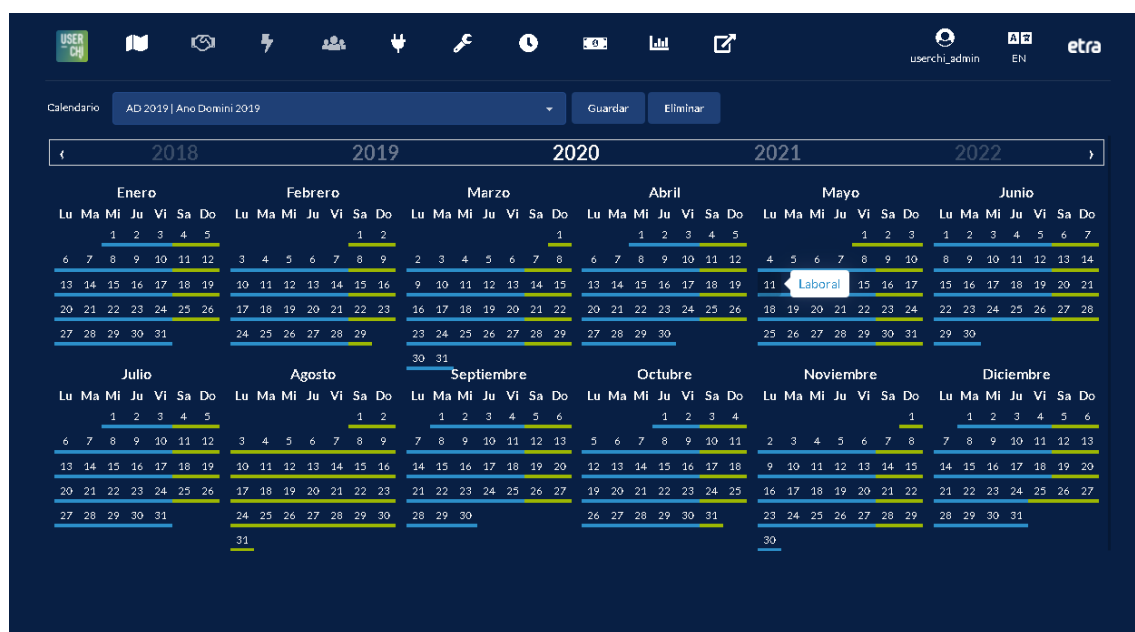


Figure 30 INCAR platform GUI - Calendar specification



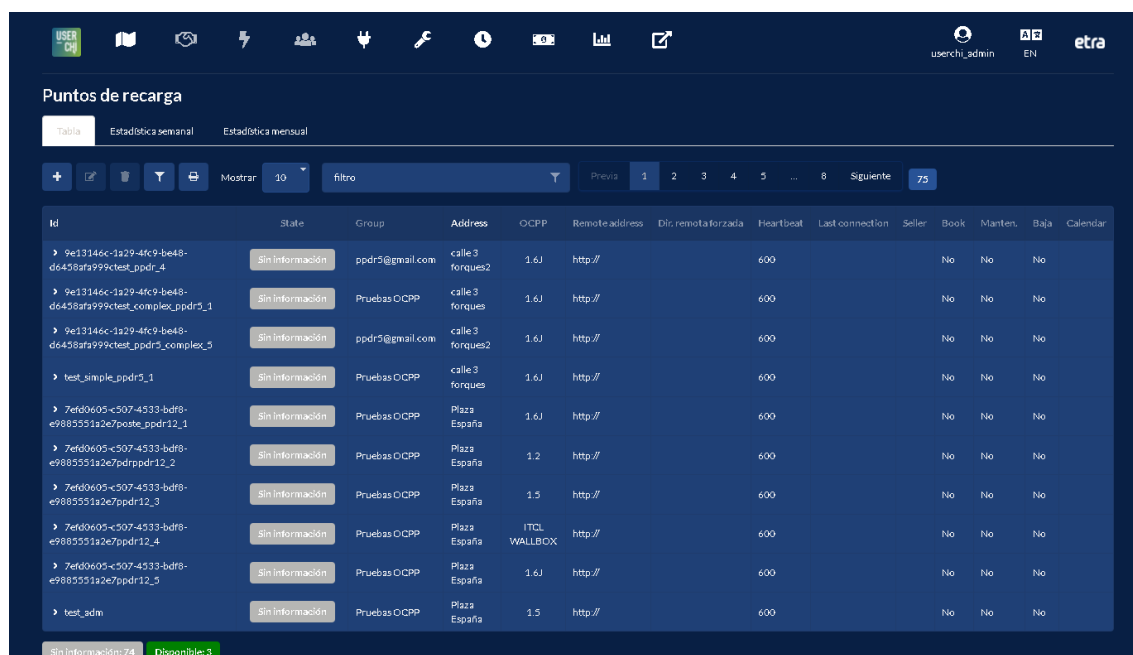
4.6.3.3 Charge Point registration

Under the Charge Point section, micro-CPOs are able to see the details and register new Charging Points. The Charging Point details that need to be provided include:

- OCPP version. OCPP 1.2, 1.5, 1.6 and 1.6JSON are supported
- Heartbeat interval. This setting can be obtained from the charge point configuration
- Group the Charge Point will belong to. A micro-CPO can organise its charge points in different groups
- Availability calendar
- Connector details, including
 - Id
 - Type
 - Nominal power
 - Nominal current
 - Mode

Upon registration of a new charging point, INCAR Platform will automatically create the necessary endpoints to allow the Charging Point to connect, via the selected OCPP protocol. Micro-CPO is also provided with the basic parameters that need to be configured in the charging point in order to start the connection with the platform and its operation.

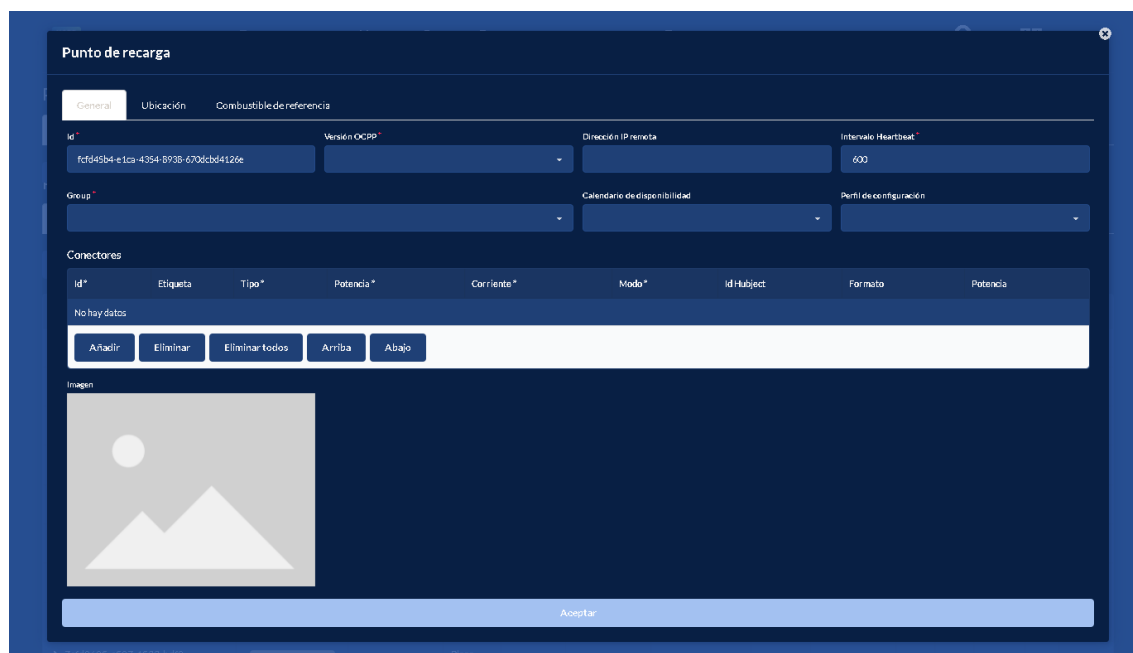
Figure 31 INCAR platform GUI – micro-CPOs Charge Point list



Id	State	Group	Address	OCPP	Remote address	Dic. remota forzada	Heartbeat	Last connection	Seller	Book	Manten.	Baja	Calendar
9e13146c-1a29-4fc9-be48-d6458afa999ctest_ppdr5_4	Sin información	ppdr5@gmail.com	calle 3 forques2	1.6J	http://		600			No	No	No	
9e13146c-1a29-4fc9-be48-d6458afa999ctest_complex_ppdr5_1	Sin información	Pruebas OCPP	calle 3 forques	1.6J	http://		600			No	No	No	
9e13146c-1a29-4fc9-be48-d6458afa999ctest_ppdr5_complex_5	Sin información	ppdr5@gmail.com	calle 3 forques2	1.6J	http://		600			No	No	No	
test_simple_ppdr5_1	Sin información	Pruebas OCPP	calle 3 forques	1.6J	http://		600			No	No	No	
7ef0d605-c507-4533-bdf8-e988551a2e7ppdr12_1	Sin información	Pruebas OCPP	Plaza España	1.6J	http://		600			No	No	No	
7ef0d605-c507-4533-bdf8-e988551a2e7ppdr12_2	Sin información	Pruebas OCPP	Plaza España	1.2	http://		600			No	No	No	
7ef0d605-c507-4533-bdf8-e988551a2e7ppdr12_3	Sin información	Pruebas OCPP	Plaza España	1.5	http://		600			No	No	No	
7ef0d605-c507-4533-bdf8-e988551a2e7ppdr12_4	Sin información	Pruebas OCPP	Plaza España ITCL WALLBOX	1.6J	http://		600			No	No	No	
7ef0d605-c507-4533-bdf8-e988551a2e7ppdr12_5	Sin información	Pruebas OCPP	Plaza España	1.6J	http://		600			No	No	No	
test_adm	Sin información	Pruebas OCPP	Plaza España	1.5	http://		600			No	No	No	

Sin información: 74 Disponible: 3

Figure 32 INCAR platform GUI – Micro-CPOs Charge Point registration



4.6.4 Information provided

Micro-CPOs will have access to the same information that is registered for CPOs. Therefore, all content under section 4.2.3 applies.

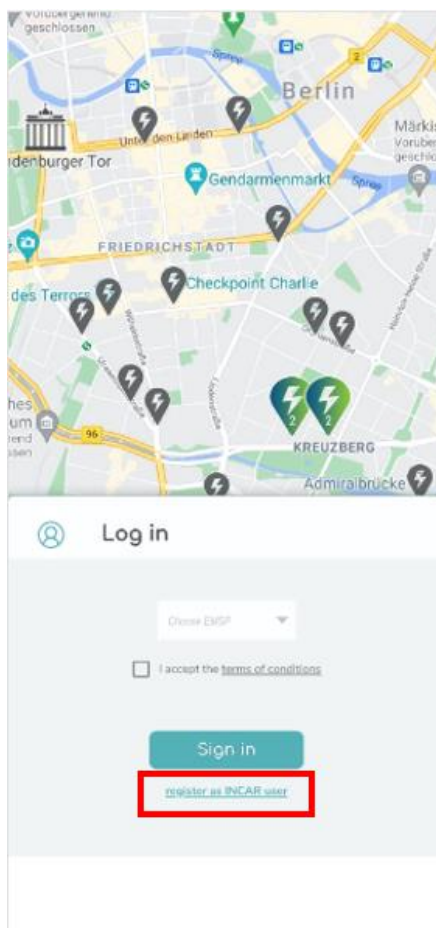
4.7 Usage of INCAR by casual EV drivers

In the case of casual EV drivers, the app offers a registration process to become an INCAR user without a contractual relationship with an EMSP. The INCAR features are basically the same for both user groups.

If a casual EV driver wants to reserve a charging station he/she needs to select “INCAR” among the list of EMSPs and login, if a registration process has already been performed, or register as a new INCAR user.

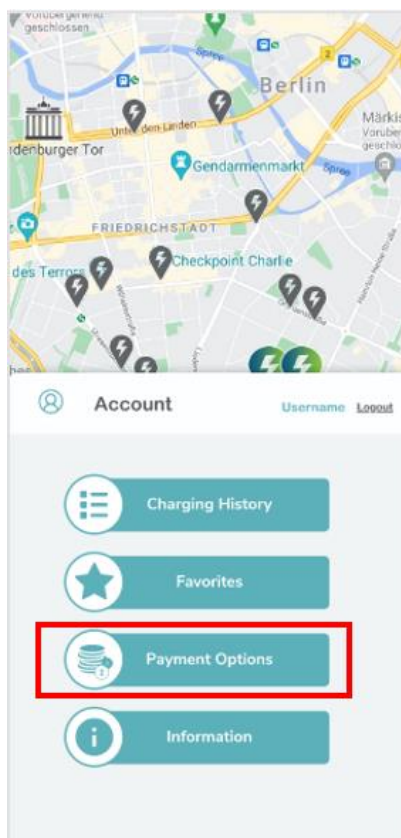
In the case of registration, the user must click on register and will be redirected to the Keycloak Registration page of INCAR.

Figure 33 INCAR app - Registration as INCAR user for casual EV drivers



Unlike e-drivers with a contractual relationship with an EMSP, where payment is made bilaterally between the EMSP and the customer, casual e-drivers have the option to make payment for charging in the INCAR app. For this reason, the INCAR app integrates a Stripe payment SDK enabling direct payment over a credit card.

Figure 34: INCAR app - Payment options for casual EV drivers



5. Lab-testing

5.1 Methodology

The lab-testing approach that has been followed for this tool is based on the work taken in former H2020 projects such as NOBEL GRID [7] or WiseGRID [8]. This method has shown to be successful for these types of projects, so it has been thoroughly studied and applied to take into account the specifics of the USER-CHI project.

5.1.1 Test plan

For this activity, each software module has been deployed and evaluated in a staging environment. In order to provide a common framework for all involved partners, the testing activities are all based on the following test plan:

1. Review the project requirements and use cases
2. Define the features to be tested from those and classify them into test groups
3. Detail test cases for validation of named features
4. Execute the test cases
5. Document the test protocols

In this context, work detailed in deliverables D1.1 “User requirements for USER-CHI solutions” [9] and D3.1 “Design and specification of interoperability and roaming services” [1] are taken as a core input, considering that requirements and use cases are already defined and mapped to specific applications developed within the project. The focus of the tests reported in this deliverable is put on functional testing, mainly motivated by the primary objective at the current stage of the USER-CHI project, which is the preparation of the applications to be demonstrated in the upcoming piloting phase. With this in mind, most tests have been defined from a perspective that is close to the end-user perspective (i.e. a single test is proving that a particular feature, which potentially involves interaction among several components, works as expected), and are therefore designed to be executed manually.

5.1.2 Test cases specification

All test cases specified in the following section use a template sheet as shown in the following table.



Table 1 Test case template

Name	The test case code and name which is unique to the project.		
Module under test	The devices or systems under test	Resp.	Main partner responsible for the test
Module requirement	The requirement, use case, or certification rule which is validated by the test case		
Test environment	List of elements needed for the test execution		
Features to be tested	List of features to be tested		
Features not to be tested	(Optional) Remark on features that are specifically left out of this testing procedure		
Preparation	Short list of steps needed for preparing the test environment for test execution		
Dependencies	(Optional) List of test case codes defining test cases which need to be passed before the test case at hand can be started		
Steps	Testing procedures		
Pass criteria	Expected (measurable) results, allowing to unambiguously judge if the test is passed or not passed (i.e. the product requirement was validated or not validated)		
Suspension criteria	(Optional) Conditions under which continuation of the test is considered pointless because testing results would be invalid		
Results	Short list of results		

5.1.3 Testing environment

In order to conduct the tests of the different software modules, a (private) staging installation of all software components has been performed. Under this staging environment, two CPO and EMSPs backend systems have been configured and integrated, thus allowing partners to test the applications in an environment where 2 partners with CPO+EMSP role interoperate with each other.

Additionally, six charge point simulators have been configured (three charge points per CPO), and a simulation software has been developed specifically to simulate six EV drivers (three per EMSP) making use of these charge points. This way, a context as much similar as possible to reality has been recreated.

5.2 Results

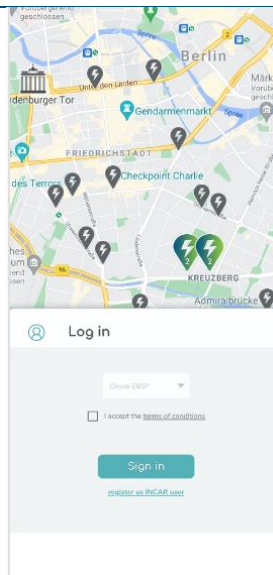
The following sections present the results of the tests that have been performed, most of them from the perspective of end users making use of the applications by using the corresponding User Interfaces. Since the features under test depend on the correct functioning of the underlying components, the correct functioning of the entire chain of components is validated by these tests.

5.2.1 INCAR Mobile app

Name	Request List of available eMSPs		
Module under test	Authentication Module	Resp.	VMZ
Module requirement	IAR_026 INCAR app must have access to Identity and Access Management (IAM) system to confirm eMSP user credentials for authentication		
Test environment	Dev App Backend calls endpoint of Dev INCAR Backend		
Features to be tested	Requesting list of integrated eMSPs and receiving list of eMSPs including Keycloak URLs for each eMSP		
Features not to be tested			
Preparation	Postman Request following INCAR platform API specification		
Dependencies			
Steps	The execution of this test must happen automatically upon publication of data in the IOP		
Pass criteria	INCAR app backend successfully receives list of eMSPs including necessary information or further login procedure		
Suspension criteria			
Results	<p>Test successful</p> <p>Test GET Request:</p> <p>https://userchi-incar.tec.etra-id.com/ocpi/2.2/hubclientinfo/emsp</p> <p>Test Response:</p> <pre>{ "status_code": 1000,</pre>		

```
"timestamp": "2021-12-15T12:09:33.893Z",
"data": [
  {
    "business_details": {
      "name": "EMT Madrid",
      "logo": {
        "url":
"https://clientes.emtm.recargagic.com/site/logos/logoCorp.png",
        "category": "OPERATOR",
        "type": "png",
        "width": 192,
        "height": 138
      },
      "website": "https://www.emtmadrid.es"
    },
    "country_code": "ES",
    "party_id": "VLC",
    "keycloakUrl": "http://test.com",
    "keycloakRealm": "test",
    "keycloakClient": "test"
  }
],
"status_message": "Success"
}
```

Connected App Screens



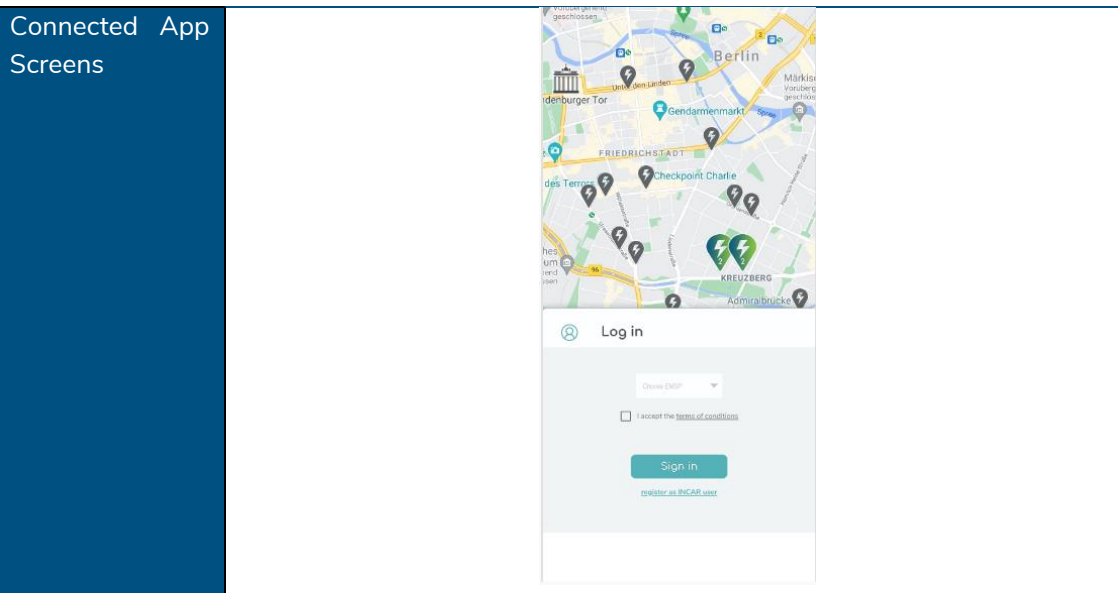
Name	User login over Keycloak instance and receive OCPI token		
Module under test	Authentication Module	Resp.	VMZ
Module requirement	IAR_026 INCAR app must have access to Identity and Access Management (IAM) system to confirm eMSP user credentials for authentication		
Test environment	App requests eMSP Keycloak instance URL, redirect to respective Keycloak page, user enters login data. App receives success response and user data for further OCPI operations		
Features to be tested	App login, login form on respective Keycloak instance, Keycloak instance user data return		
Features not to be tested			
Preparation	User provides user name and password in keycloak login form, specific Keycloak instance for EMSP is revoked, OCPI token and further user data is returned		
Dependencies			
Steps	User provides user name and password in keycloak login form, specific Keycloak instance for EMSP is revoked, OCPI token and further user data is returned		
Pass criteria	INCAR app successfully receives user data from Keycloak instance for further OCPI operations		

Suspension criteria	
Results	<p>Test succesful</p> <p>Test GET-Request:</p> <p>https://auth.tec.etra-id.com/auth/realms/vmz/.well-known/openid-configuration</p> <p>Headers:</p> <p>User-Agent: PostmanRuntime/7.29.0</p> <p>Accept: */*</p> <p>Postman-Token: d80609bb-bd33-4689-9931-f456602df778</p> <p>Host: auth.tec.etra-id.com</p> <p>Accept-Encoding: gzip, deflate, br</p> <p>Connection: keep-alive</p> <p>Test Response (Shortened):</p> <p>Response: 200 OK</p> <p>Headers:</p> <p>Date: Fri, 28 Jan 2022 13:28:36 GMT</p> <p>Server: Apache/2.4.41 (Ubuntu)</p> <p>Cache-Control: no-cache, must-revalidate, no-transform, no-store</p> <p>Content-Length: 3168</p> <p>Content-Type: application/json</p> <p>Referrer-Policy: no-referrer</p> <p>Strict-Transport-Security: max-age=31536000; includeSubDomains</p> <p>X-Content-Type-Options: nosniff</p> <p>X-Frame-Options: SAMEORIGIN</p> <p>X-Xss-Protection: 1; mode=block</p> <p>Keep-Alive: timeout=5, max=100</p> <p>Connection: Keep-Alive</p> <p>Body:</p> <pre>{</pre>

```

"issuer": "https://auth.tec.etra-id.com/auth/realms/vmz",
"authorization_endpoint": "https://auth.tec.etra-
id.com/auth/realms/vmz/protocol/openid-connect/auth",
"token_endpoint": "https://auth.tec.etra-
id.com/auth/realms/vmz/protocol/openid-
connect/token",
"introspection_endpoint": "https://auth.tec.etra-
id.com/auth/realms/vmz/protocol/openid-connect/token/introspect",
"userinfo_endpoint": "https://auth.tec.etra-
id.com/auth/realms/vmz/protocol/openid-
connect/userinfo",
"end_session_endpoint": "https://auth.tec.etra-
id.com/auth/realms/vmz/protocol/openid-connect/logout",
"jwks_uri": "https://auth.tec.etra-
id.com/auth/realms/vmz/protocol/openid-
connect/certs",
"check_session_iframe": "https://auth.tec.etra-
id.com/auth/realms/vmz/protocol/openid-connect/login-status-
iframe.html",
"grant_types_supported": [
  "authorization_code",    "implicit",
  "refresh_token",
  "password",
  "client_credentials"

```



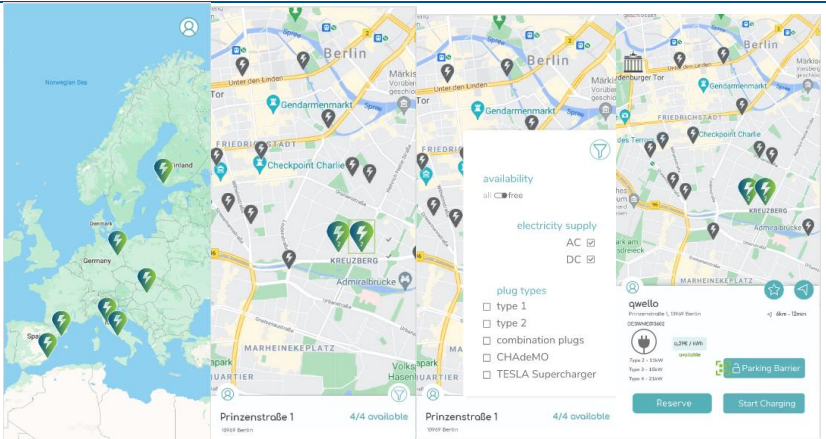
Name	Visualization of INCAR charge points in app		
Module under test	Locations Module	Resp.	VMZ
Module requirement	<p>IAR_008 INCAR app must show INCAR EVSEs located in a map view</p> <p>IAR_011 Current availability status of EVSEs should be represented in map view</p> <p>IAR_014 EVSE information must include types of connector</p>		
Test environment	Dev App Backend requests charge point information from Dev INCAR platform		
Features to be tested	Map view of app including EVSE information, filtering of EVSE, detailed information about EVSE including real-time availability		
Features not to be tested			
Preparation	Dev App backend requests Locations module of Dev INCAR platform		
Dependencies			
Steps	User opens map view of app, app requests EVSE from app backend, app backend requests EVSE from INCAR platform, app backend sends EVSE information to INCAR app, visualization of EVSE in app		

Pass criteria	INCAR app successfully and correctly shows EVSE in map including real-time availability
Suspension criteria	
Results	<p>Test successful</p> <p>Test Request:</p> <p>https://userchi-incar.tec.etra-id.com/ocpi/hub/2.2/locations</p> <p>Test Response (shortened to one object):</p> <pre>{ "status_code": 1000, "timestamp": "2021-12-15T12:16:29.094Z", "data": [{ "address": "Diagonal 385", "city": "Barcelona", "coordinates": { "latitude": "41.396719", "longitude": "2.161015" }, "country": "ESP", "country_code": "ES", "id": "3", "last_updated": "2021-12-15T12:12:16.097Z", "name": "Diagonal 385 08008 Barcelona ESP", "opening_times": { "regular_hours": [{ "weekday": 3, "period_begin": "00:00", "period_end": "00:00" }] } }] }</pre>

```
},  
{  
  "weekday": 4,  
  "period_begin": "00:00",  
  "period_end": "00:00"  
},  
{  
  "weekday": 5,  
  "period_begin": "00:00",  
  "period_end": "00:00"  
},  
{  
  "weekday": 6,  
  "period_begin": "00:00",  
  "period_end": "00:00"  
},  
{  
  "weekday": 7,  
  "period_begin": "00:00",  
  "period_end": "00:00"  
},  
{  
  "weekday": 1,  
  "period_begin": "00:00",  
  "period_end": "00:00"  
},  
{  
  "weekday": 2,  
  "period_begin": "00:00",  
  "period_end": "00:00"  
}
```

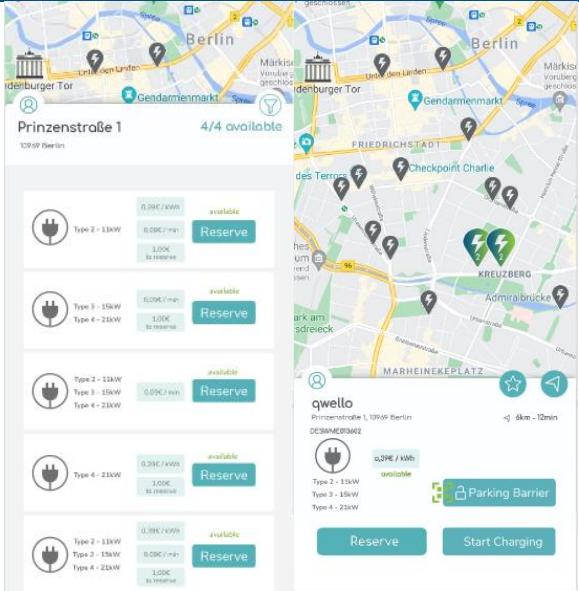


```
],  
  "twentyfourseven": false  
},  
  "parking_type": "ON_STREET",  
  "party_id": "BCN",  
  "postal_code": "08008",  
  "publish": true,  
  "time_zone": "Europe/Brussels",  
  "evses": [  
    {  
      "capabilities": [  
        "REMOTE_START_STOP_CAPABLE"  
      ],  
      "connectors": [  
        {  
          "id": "1",  
          "standard": "IEC_62196_T2",  
          "max_voltage": 700,  
          "max_amperage": 10,  
          "max_electric_power": 7000000,  
          "last_updated": "2021-12-15T12:08:54.190Z"  
        }  
      ],  
      "coordinates": {  
        "latitude": "41.396719",  
        "longitude": "2.161015"  
      },  
      "evse_id": "ES*BCN*E3*1",  
      "last_updated": "2021-12-15T12:12:16.097Z",  
      "status": "CHARGING",  
      "uid": "3.1"
```

	<pre> }] }</pre>
Connected App Screens	

Name	Visualization of charge points tariffs in app		
Module under test	Tariff Module	Resp.	VMZ
Module requirement	IAR_017 INCAR app should show charging tariffs for EVSE		
Test environment	Dev App Backend requests tariff information from Dev INCAR platform		
Features to be tested	Map view of app including EVSE information, , detailed information about EVSE including tariff information		
Features not to be tested			
Preparation	Dev App backend requests tariff module of Dev INCAR platform		
Dependencies			
Steps	User opens map view of app, app requests EVSE from app backend, app backend requests EVSE from INCAR platform, app backend requests tariff information for EVSE from INCAR backend, app backend merges EVSE and tariff information, app backend sends EVSE and tariff information to INCAR app, visualization of EVSE in app,		
Pass criteria	INCAR app successfully and correctly shows tariff of EVSE in map including real-time availability		

Suspension criteria	
Results	<p>Test successful</p> <p>Test Request:</p> <p>https://userchi-incar.tec.etra-id.com/ocpi/hub/2.2/tariffs</p> <p>Test Response (shortened to one object):</p> <pre>{ "status_code": 1000, "timestamp": "2021-12-15T12:41:33.448Z", "data": [{ "country_code": "ES", "currency": "EUR", "elements": [{ "price_components": [{ "type": "ENERGY", "price": 0.08, "vat": 21, "step_size": 1 }], "restrictions": { "start_time": "00:00", "end_time": "23:59", "start_date": "2021-06-10", "day_of_week": ["SUNDAY",</pre>

	<pre>"MONDAY", "TUESDAY", "WEDNESDAY", "THURSDAY", "FRIDAY", "SATURDAY"] } }]</pre>
Connected App Screens	

Name	Routing to selected EVSE or other destination address		
Module under test	Routing Module	Resp.	VMZ
Module requirement	IAR_020	INCAR app supports a European wide modal car routing	
	IAR_046	INCAR should allow the users plan long range trips	

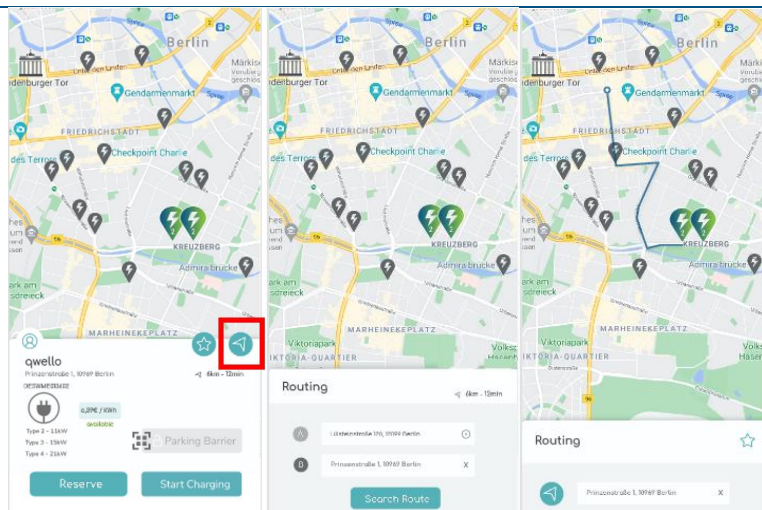
Test environment	App requests European-wide routing service in Dev INCAR backend for example route to charge point
Features to be tested	Routing features in app, routing service in app backend
Features not to be tested	
Preparation	App requests routing service in app backend
Dependencies	Successful previous request of charge points
Steps	User opens map view of app, user selects EVSE, user clicks on routing to this POI, EVSE is prefilled in destination address field of routing feature, user selects start address and requests a car route to EVSE, fastest car route is displayed in map view of app
Pass criteria	INCAR app shows car route to selected EVSE
Suspension criteria	
Results	<p>Test successful</p> <p>Test Request:</p> <p>https://vmz.services/routing-europe/routing/car?departure=52.45313461008475,13.38848666080206&arrival=52.498877155636855,13.406487324870104</p> <p>Test Response (shortened):</p> <pre>{ "type": "CarRoutingResponse", "id": "someResponseId", "timestamp": "2021-12-14T11:36:51+01:00", "informations": [</pre>

```
],  
"journeys": [  
  {  
    "type": "CarJourney",  
    "costs": {  
      "co2": {  
        "unit": "gram",  
        "value": 1196.4  
      },  
      "distance": {  
        "unit": "meter",  
        "value": 7976.0  
      },  
      "duration": {  
        "unit": "second",  
        "value": 1298.0  
      },  
      "price": {  
        "unit": "euro",  
        "value": 3.5892  
      }  
    },  
    "id": "JourneyId",  
    "information": [  
  
    ],  
    "routers": [  
      "HERE"  
    ],  
    "arrival": {
```

```
"type": "DescriptiveArrivalDepartureLocation",
"type": "Point",
"coordinates": [
  13.4066268,
  52.4990558
],
"time": "2021-12-14T11:58:29+01:00"
},
"departure": {
  "type": "DescriptiveArrivalDepartureLocation",
  "type": "Point",
  "coordinates": [
    13.3884888,
    52.4531206
  ],
  "time": "2021-12-14T11:36:51+01:00"
},
"parts": [
  {
    "costs": {
      "co2": {
        "unit": "gram",
        "value": 1196.4
      },
      "distance": {
        "unit": "meter",
        "value": 7976.0
      },
      "duration": {
        "unit": "second",
        "value": 1298.0
      }
    }
  }
]
```

```
    },  
    "price": {  
      "unit": "euro",  
      "value": 3.5892  
    }  
  },  
  "id": "PartId",  
  "information": [  
  
  ],  
  "routers": [  
  
  ],  
  "guidingPoints": [  
    {  
      "type": "GuidingPointLocation",  
      "type": "Point",  
      "coordinates": [  
        13.388489,  
        52.453121  
      ],  
    }  
  ]  
]
```


Connected App Screens



Name	Reserve an EVSE		
Module under test	Commands Module	Resp.	VMZ
Module requirement	IAR_012 Authorized users must be able to reserve/book an EVSE		
Test environment	Dev App backend requests Commands module of Dev INCAR platform		
Features to be tested	Send a reservation from app over app backend to INCAR platform		
Features not to be tested			
Preparation	App sends EVSE reservation request to backend, backend sends EVSE reservation request to INCAR platform		
Dependencies	Successful previous request of locations		
Steps	User opens map view of app, user selects EVSE, user clicks on Reserve, After succesful reservation, remaining reservation time is shown		
Pass criteria	After succesful reservation, remaining reservation time is shown		
Suspension criteria			
Results	<p>Test successful</p> <p>Test POST-Request:</p>		

```
https://userchi-incar.tec.etra-
id.com/ocpi/hub/2.2/commands/app/receiver/RESERVE_NOW

Headers:

Authorization: Token 50cf4475- ...
OCPI-to-party-id: BCN
OCPI-to-country-code: ES
OCPI-from-party-id: VLC
OCPI-from-country-code: ES
Content-Type: application/json
User-Agent: PostmanRuntime/7.29.0
Accept: */*

Postman-Token: 9bf7e0ab-4150-4384-8a31-e68b7dc9f1ec
Host: userchi-incar.tec.etra-id.com
Accept-Encoding: gzip, deflate, br
Connection: keep-alive
Content-Length: 156

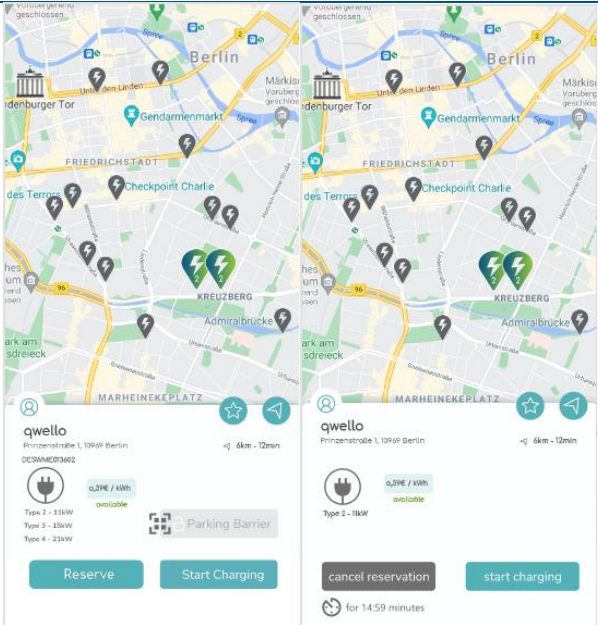
Body:
{
  "location_id": "1",
  "token": {
    "uid": "VLC_003"
  },
  "response_url": "https://somewhere-in-
vmzberlin.com/reservation/ABC123"
}

Test Response

Response: 200 OK

Headers:

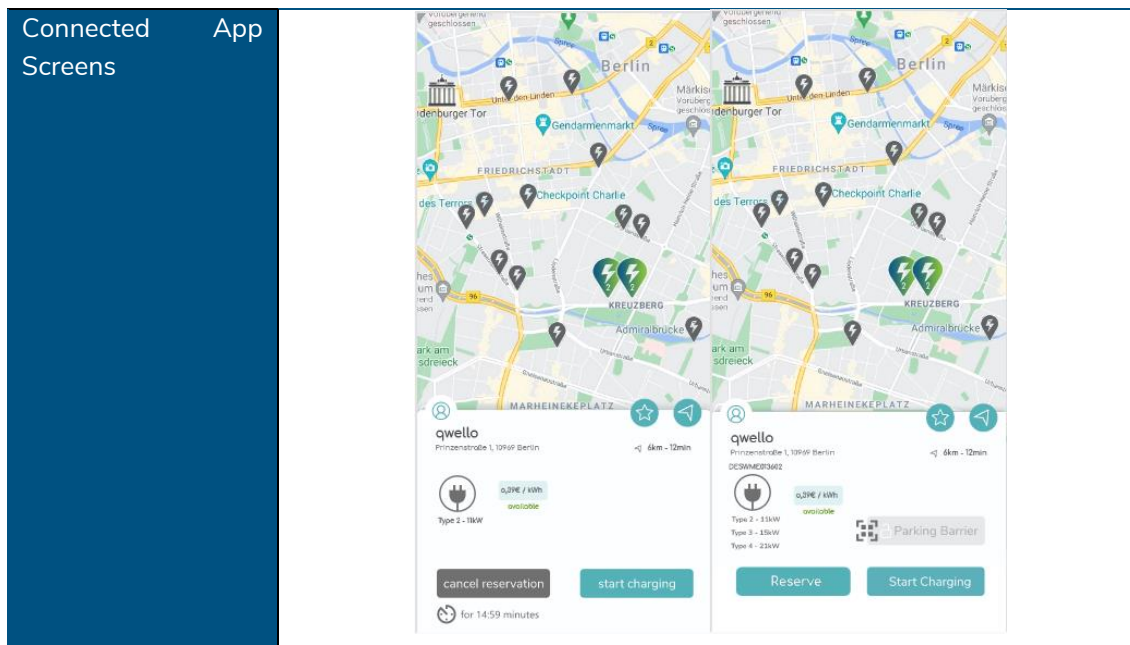
Date: Thu, 27 Jan 2022 15:57:12 GMT
Server: Apache/2.4.41 (Ubuntu)
Content-Length: 135
Content-Type: application/json; charset=utf-8
```

	<p>Etag: W/"87-HPjMU9KoamKJg9MuNxy4Aiglf84"</p> <p>Ocpi-From-Country-Code: ES</p> <p>Ocpi-From-Party-Id: BCN</p> <p>Ocpi-To-Country-Code: ES</p> <p>Ocpi-To-Party-Id: VLC</p> <p>Vary: Accept-Encoding</p> <p>X-Correlation-Id: undefined</p> <p>X-Powered-By: Express</p> <p>X-Request-Id: undefined</p> <p>Keep-Alive: timeout=5, max=100</p> <p>Connection: Keep-Alive</p>
Connected App Screens	

Name	Cancel an existing reservation of an EVSE		
Module under test	Commands Module	Resp.	VMZ
Module requirement	IAR_013 Authorized users should be able to cancel an existing reservation of an EVSE		
Test environment	Dev App backend requests Commands module of Dev INCAR platform		
Features to be tested	Send a cancel reservation from app over app backend to INCAR platform		

Features not to be tested	
Preparation	App sends EVSE cancel reservation request to backend, backend sends EVSE cancel reservation request to INCAR platform
Dependencies	Successful previous request of locations Successful POST Reserve Now request
Steps	During remaining reservation time, user clicks on Cancel Reservation, buttons turns back to “Reserve”
Pass criteria	After succesful cancel reservation request, app turns from active reservation to reservable mode, EVSE can be reserved by other users
Suspension criteria	
Results	<p>Test successful,</p> <p>Test POST-Request:</p> <p>https://userchi-incar.tec.etra-id.com/ocpi/hub/2.2/commands/app/receiver/CANCEL_RESERVATION</p> <p>Headers:</p> <p>Authorization: Token 50cf4475-613...</p> <p>OCPI-to-party-id: VLC</p> <p>OCPI-to-country-code: ES</p> <p>OCPI-from-party-id: BCN</p> <p>OCPI-from-country-code: ES</p> <p>Content-Type: application/json</p> <p>User-Agent: PostmanRuntime/7.29.0</p> <p>Accept: */*</p> <p>Postman-Token: 45006784-539a-4ee9-8237-f1526e631370</p> <p>Host: userchi-incar.tec.etra-id.com</p> <p>Accept-Encoding: gzip, deflate, br</p> <p>Connection: keep-alive</p> <p>Content-Length: 112</p> <p>Body:</p> <p>{</p>

```
"reservation_id" : "XYZ",  
"response_url": "https://somewhere-in-  
vmzberlin.com/reservation/ABC123"  
}  
Test Response: 200 OK  
Headers:  
Date: Thu, 27 Jan 2022 15:59:47 GMT  
Server: Apache/2.4.41 (Ubuntu)  
Content-Length: 162  
Content-Type: application/json; charset=utf-8  
Etag: W/"a2-YFXdNrKIIRDO7DmC9dghWG/3UGI"  
Ocp-From-Country-Code: ES  
Ocp-From-Party-Id: VLC  
Ocp-To-Country-Code: ES  
Ocp-To-Party-Id: BCN  
Vary: Accept-Encoding  
X-Correlation-Id: undefined  
X-Powered-By: Express  
X-Request-Id: undefined  
Keep-Alive: timeout=5, max=100  
Connection: Keep-Alive
```



Name	Start a charging process (StartSession)		
Module under test	Commands Module	Resp.	VMZ
Module requirement	IAR_019 INCAR app must support the start and stop of a charging session		
Test environment	Dev App backend requests Commands module of Dev INCAR platform		
Features to be tested	Send a Start Session request from app over app backend to INCAR platform		
Features not to be tested			
Preparation	App sends EVSE start session request to backend, backend sends EVSE start session request to INCAR platform		
Dependencies	Successful previous request of locations Successful previous request of OCPI token		
Steps	During remaining reservation time or without reservation, user clicks on Start Charging button in app		
Pass criteria	After successful start session request, app shows ongoing session in app after acknowledge response from INCAR platform		
Suspension criteria			
Results	Test succesful		

Test POST-Request:

`https://userchi-incar.tec.etra-id.com/ocpi/hub/2.2/commands/app/receiver/START_SESSION`

Headers:

Authorization: Token 50cf4475-6...

OCPI-to-party-id: BCN

OCPI-to-country-code: ES

OCPI-from-party-id: VLC

OCPI-from-country-code: ES

Content-Type: application/json

User-Agent: PostmanRuntime/7.29.0

Accept: */*

Postman-Token: 2d0ae9bd-48ea-4d99-b546-f57d5bf4e18a

Host: userchi-incar.tec.etra-id.com

Accept-Encoding: gzip, deflate, br

Connection: keep-alive

Content-Length: 156

Body:

```
{
  "location_id": "1",
  "token": {
    "uid": "VLC_003"
  },
  "response_url": "https://somewhere-in-vmzberlin.com/reservation/ABC123"
}
```

Test Response: 200 OK

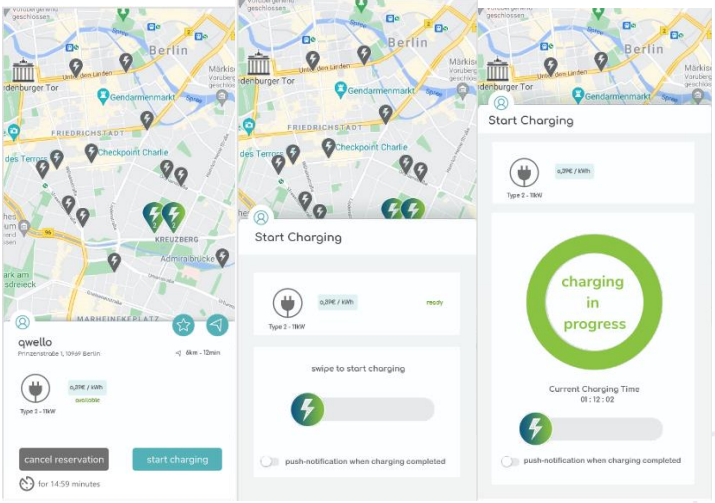
Headers:

Date: Thu, 27 Jan 2022 15:49:10 GMT

Server: Apache/2.4.41 (Ubuntu)

Content-Length: 128

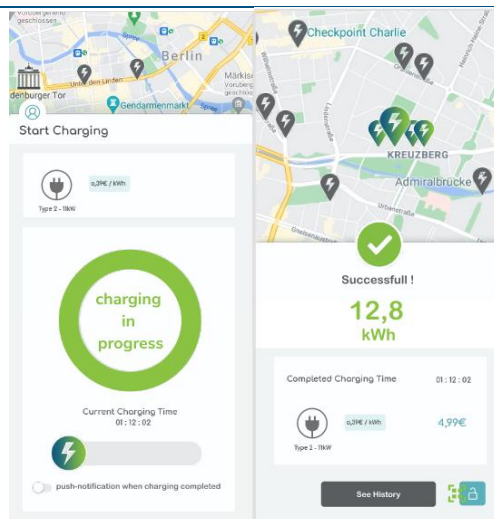
Content-Type: application/json; charset=utf-8

	<p>Etag: W/"80-1Vv7HSieTAVP15RvA4u6wuqW1ZU"</p> <p>Ocpi-From-Country-Code: ES</p> <p>Ocpi-From-Party-Id: BCN</p> <p>Ocpi-To-Country-Code: ES</p> <p>Ocpi-To-Party-Id: VLC</p> <p>Vary: Accept-Encoding</p> <p>X-Correlation-Id: undefined</p> <p>X-Powered-By: Express</p> <p>X-Request-Id: undefined Keep-Alive: timeout=5, max=100</p> <p>Connection: Keep-Alive</p> <p>Body:</p> <pre>{ "status_code": 1000, "timestamp": "2022-01-27T15:49:10.027Z", "data": { "result": "ACCEPTED", "timeout": 30 }, "status_message": "Success" }</pre>
Connected App Screens	

Name	End a charging process (StopSession)		
Module under test	Commands Module	Resp.	VMZ
Module requirement	IAR_019 INCAR app must support the start and stop of a charging session		
Test environment	Dev App backend requests Commands module of Dev INCAR platform		
Features to be tested	Send a Stop Session request from app over app backend to INCAR platform		
Features not to be tested			
Preparation	App sends EVSE stop session request to backend, backend sends EVSE stop session request to INCAR platform		
Dependencies	Successful previous request of locations Successful previous request of OCPI token Successful start session request		
Steps	During ongoing session, user swipes to stop session,		
Pass criteria	After successful stop session request, app finishes ongoing session in app, and after receiving the CDR for the session shows the summary in app		
Suspension criteria			
Results	Test not successful Test POST-Request: https://userchi-incar.tec.etra-id.com/ocpi/hub/2.2/commands/app/receiver/STOP_SESSION Headers: Authorization: Token 50cf4475-6... OCPI-to-party-id: BCN OCPI-to-country-code: ES OCPI-from-party-id: VLC OCPI-from-country-code: ES Content-Type: application/json User-Agent: PostmanRuntime/7.29.0 Accept: */* Postman-Token: 2d0ae9bd-48ea-4d99-b546-f57d5bf4e18a		

```
Host: userchi-incar.tec.etra-id.com
Accept-Encoding: gzip, deflate, br
Connection: keep-alive
Content-Length: 156
Body:
{
  "session_id": "XYZ",
  "response_url": "https://somewhere-in-vmzberlin.com/reservation/ABC123"
}
Response: 404 Not Found -----
-----
Headers:
Date: Thu, 27 Jan 2022 15:49:10 GMT
Server: Apache/2.4.41 (Ubuntu)
Content-Length: 128
Content-Type: application/json; charset=utf-8
Etag: W/"80-1Vv7HSieTAVP15RvA4u6wuqW1ZU"
Ocpi-From-Country-Code: ES
Ocpi-From-Party-Id: BCN
Ocpi-To-Country-Code: ES
Ocpi-To-Party-Id: VLC
Vary: Accept-Encoding
X-Correlation-Id: undefined
X-Powered-By: Express
X-Request-Id: undefined
Keep-Alive: timeout=5, max=100
Connection: Keep-Alive
```

Connected App Screens



Name	Show summary of charging transaction		
Module under test	CDR Module	Resp.	VMZ
Module requirement	IAR_022 INCAR app could show charging transaction history in a list view		
Test environment	Dev App backend requests CDR module of Dev INCAR platform		
Features to be tested	Send a GET CDR request from app over app backend to INCAR platform		
Features not to be tested			
Preparation	App sends GET CDR request to backend, backend sends GET CDR request to INCAR platform		
Dependencies	Successful previous request of locations Successful previous request of OCPI token Successful stop session request		
Steps	During ongoing session, user swipes to stop session, app shows transaction summary of the finished session as well as the list of previous transactions in transactions list		
Pass criteria	After successful stop session request, and shows specific transaction summary and transactions list based on CDRs for that user		
Suspension criteria			
Results	Test successful		

Test GET-Request:

`https://userchi-incar.tec.etra-id.com/ocpi/hub/2.2/cdrs/ES/VLC/VLC_003`

Headers:

Authorization: Token 50cf4475-6...

User-Agent: PostmanRuntime/7.29.0

Accept: */*

Postman-Token: b20ef5b0-648c-43d5-a18e-89db85434dbe

Host: userchi-incar.tec.etra-id.com

Accept-Encoding: gzip, deflate, br

Connection: keep-alive

Test Response: 200 OK

Headers:

Date: Thu, 27 Jan 2022 16:11:17 GMT

Server: Apache/2.4.41 (Ubuntu)

Content-Length: 96

Content-Type: application/json; charset=utf-8

Etag: W/"60-3ywtUN574YWTAYBF1FGGe6zCSBjM"

Vary: Accept-Encoding

X-Limit: 100

X-Powered-By: Express

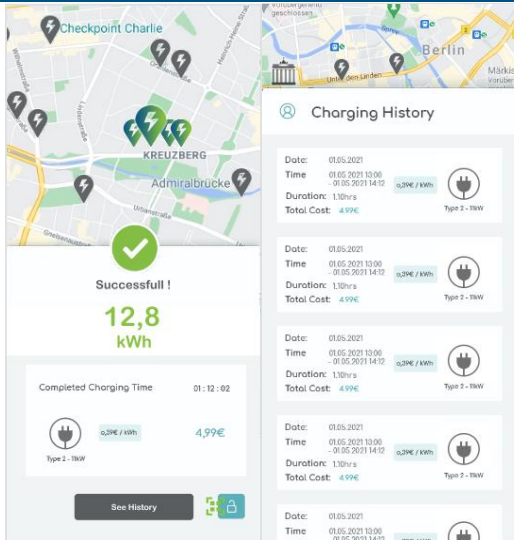
X-Total-Count: 0

Keep-Alive: timeout=5, max=100

Connection: Keep-Alive

Body:

```
{  
  "status_code": 1000,  
  "timestamp": "2022-01-26T07:34:30.332Z",  
  "data": [],  
  "status_message": "Success"
```

	}
Connected App Screens	

5.2.2 INCAR Platform GUI

Name	Display CPO's info in real time		
Module under test	UI Module	Resp.	ETRA
Module requirement	INB_004, INB_010		
Test environment	Local website requesting real-time data from the logged user		
Features to be tested	Correct display of the current CPO user logged data.		
Features not to be tested			
Preparation	A CPO with data must be previously generated		
Dependencies			
Steps	-Log in into the website -Navigate throw the different pages, each of which has different data.		
Pass criteria	The dashboard displays only the data from the current CPO user		
Suspension criteria	The dashboard displays data from other users or doesn't display all the data from the current user.		
Results	Test successful		

Real time information about his EVSE:



ID	Country Code	Period	Status	kWh Charged	Cost	Other Fees	Location ID	EVSE ID	Connector ID	Last Update
45427	ES	V2	Active	0.402	0.04	0.00	9791_001	2	2.0	2023-12-19 09:29:23
91407	ES	V2	Completed	0.910	0.04	0.00	9791_001	4	2.0	2023-12-19 10:18:19
91407	ES	V2	Completed	0.910	0.04	0.00	9791_001	1	1.0	2023-12-19 10:18:27
91407	ES	V2	Completed	0.910	0.04	0.00	9791_001	3	2.0	2023-12-19 10:18:18
91407	ES	V2	Completed	0.907	0.04	0.00	9791_001	4	2.0	2023-12-19 10:18:08
91407	ES	V2	Completed	0.909	0.04	0.00	9791_001	1	1.0	2023-12-19 10:18:07
91407	ES	V2	Completed	0.909	0.04	0.00	9791_001	2	2.0	2023-12-19 10:18:00
91407	ES	V2	Completed	0.904	0.04	0.00	9791_001	1	1.0	2023-12-19 10:00:07
91407	ES	V2	Completed	0.910	0.04	0.00	9791_001	4	2.0	2023-12-19 10:00:15
91407	ES	V2	Completed	0.910	0.04	0.00	9791_001	2	2.0	2023-12-19 10:00:07

Name	Display EMSP's info in real time		
Module under test	UI Module	Resp.	ETRA
Module requirement	INB_005, INB_007		
Test environment	Local website requesting real-time data from the logged user		
Features to be tested	Correct display of the current CPO user logged data.		
Features not to be tested			
Preparation	A EMSP with data must be previously generated		
Dependencies			
Steps	-Log in into the website -Navigate throw the different pages, each of which has different data.		
Pass criteria	The dashboard displays only the data from the current CPO user		
Suspension criteria	The dashboard displays data from other users or doesn't display all the data from the current user.		
Results	Test successful Real time information about his EVSE		

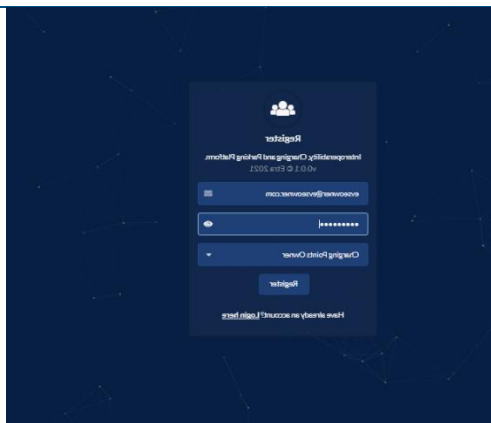
[illegible]



Name	Display EMSP's historic information		
Module under test	UI Module	Resp.	ETRA
Module requirement	INB_005, INB_022, INB_047		
Test environment	Local website accessing auto-generated test data from a mongo DB		
Features to be tested	Correct display of the data from the current user (EMSP)		
Features not to be tested			
Preparation	A EMSP with data must be previously generated		
Dependencies			
Steps	-Log in into the website -Navigate throw the different pages, each of which has different data.		
Pass criteria	The dashboard displays only the data from the current CPO user		
Suspension criteria	The dashboard displays data from other users or doesn't display all the data from the current user.		
results	Test successful Historic information from the EMSP transactions		



Name	Registration of an owner of a charging point		
Module under test	UI Module	Resp.	ETRA
Module requirement	INB_003,		
Test environment	An independent owner of a charging point tries to registers his EVSE to the hub, so it can be operative.		
Features to be tested	Generation of an EVSE owner user. Validation of a new user		
Features not to be tested			
Preparation	There must be an admin user already configured.		
Dependencies			
Steps	The user register himself in the website, an admin accepts the request and the user logs into the site.		
Pass criteria	The user is correctly registered and accepted to the hub.		
Suspension criteria			
Results	Test successful The user fills the form to register in the platform		



An admin accepts the request



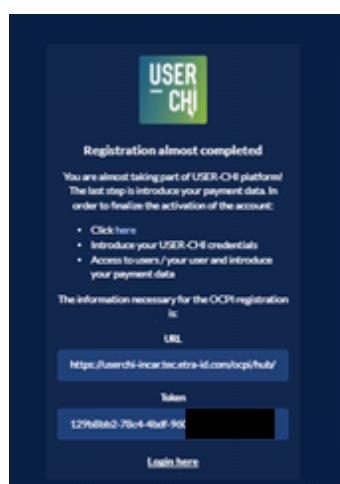
Then, the user receives one mail with a link to confirm the operation

Please confirm registration

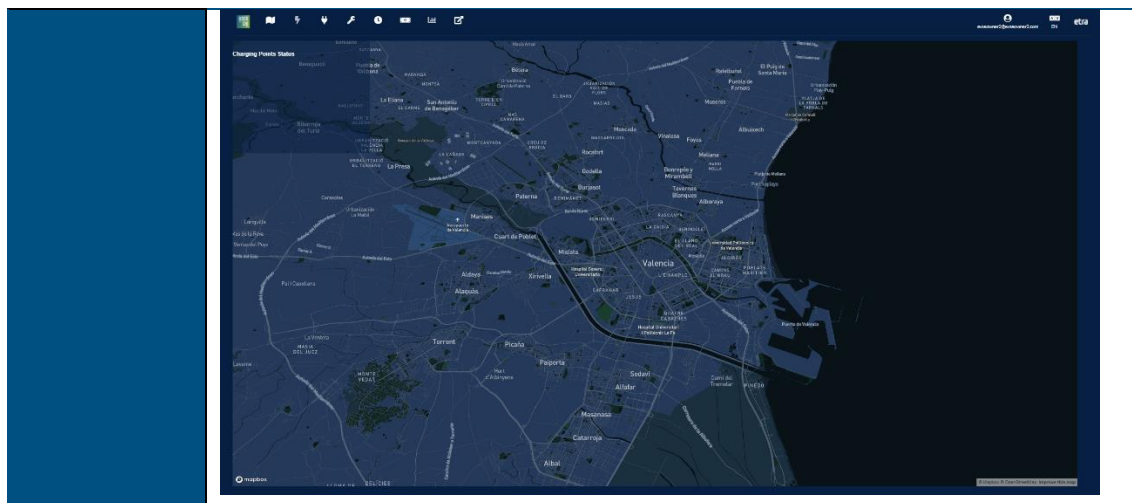
Your registration request in USER-CHI has been approved. In order to activate your account, please click on the following link:

* <http://linuxdev.lab.id-3300/confirmation/129b8bb2-78c4-4bdf-9605->

By following the link, the account gets confirmed.



And the user can now log in



6. Pilot site integration

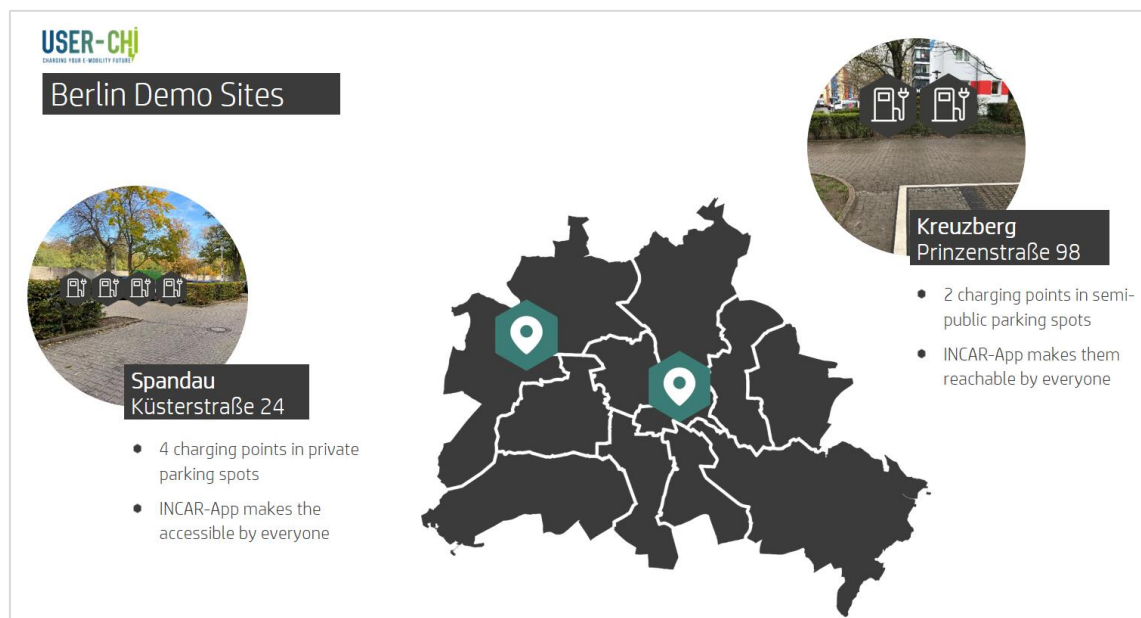
6.1 Barcelona

In order to enable the demonstration of the INCAR Platform in the city of Barcelona, the corresponding CPO and EMSP backends –provided by ETRA – have been evolved to support integration with external parties by means of the OCPI 2.2 protocol. The corresponding developments have been completed, and this implementation is actually the one used in the lab-testing environment of the INCAR Platform to validate the correct operation of all core components, as documented in section 5.

6.2 Berlin

Preliminary objectives to be reached through the implementation of INCAR in Berlin have been defined. After screening different housing districts, two suitable demonstration sites have been identified. The demonstration site in the heart of Berlin Kreuzberg offers non-discriminatory access to a newly built parking space that is to be equipped with AC chargers by Qwello. From the usage figures of the fast charger close by, higher demand for charging infrastructure at this location is expected, which helps to test and demonstrate the several user-centred functions of INCAR as well as incorporated business models of smart parking & charging. The second location is characterized by a high demand for parking and an existing parking garage that has not been managed yet. In addition, there are individual requests from tenants for charging infrastructure. This offers ideal conditions for a charging hub, which is to be integrated into a private parking lot and also made accessible to the public via the INCAR app.

Figure 35: Berlin Demo Sites Overview



Gewobag has specified the requirements for digital parking management in Küsterstraße in accordance with INCAR. The call for tenders for Gewobag's digital parking solutions has been completed and the submitted offers are currently being evaluated. The purpose of the tendering process was to identify a provider of hardware parking technology (i.e., parking barrier and the reader) and the software for digital parking management. Among others, the winner of the tender is required to support the arrangement of the communication between the INCAR app and the parking barrier. Although the technical details still need to be further elaborated, ideally, the user of the INCAR app should be able to open the parking barrier through and access charge/park spots after identifying himself via a QR code.

The integration of QWELLO, the charge point operator in the above-mentioned charge points, into the INCAR platform, is currently ongoing. QWELLO has already implemented four modules of OCPI 2.2, but further software implementation is pending to integrate the remaining OCPI 2.2 modules for the full INCAR integration.

6.3 Budapest

State-provided resources have not become available for the city for deploying 1100 e-charging points, as planned since 2017. Charging point deployment and operation are taken over by private and other public market players over time, meaning that the Municipality of Budapest haven't installed any e-charging point in the city. The changing regulatory environment and strong competition in the market for the installation and operation of e-charging stations have made it clear that the installation and operation of charging stations by municipalities is loss-making, coupled with concerns about economic problems caused by the pandemic, as the Hungarian charging market is dominated by large players who are very sensitive to any factors that could distort the market.

The Municipality of Budapest (and its LTP BKK) has no (legal) authorisation to operate e-charging points, therefore Budapest planned to select a CPO/EMSP via public procurement process in the project. Finding a technical partner for the demo was more complicated than anticipated.

This means the Municipality/BKK is not in the position to try to enter the e-mobility market in the publicly accessible segment but would like to perform its roles as a regulator (the Municipality and BKK is running the scale-up phase of micromobility points in Budapest currently, the mobility-network approach fits well to USER-CHI's citizen e-mobility station).

The original concept of the Budapest pilot was to use these mobility points as demonstration sites. These mobility points were planned to operate as multimodal transport minihubs where citizens can choose the vehicles best fitting their individual needs to reach their destination. Mobility points had been tested to include bike-sharing and e-scooter-sharing services. The E-Mobility Service Provider and the Charging Point Operator were to be designated in a public procurement process by mid-2021, but Budapest is still in the process of defining the content for launching the Public Tender.

The involvement of an implementing partner will be organized in early spring 2022, so demo activities can be conducted afterwards, that can contribute to the project's success.

6.4 Rome

The preliminary steps toward the implementation of INCAR for the demo in Rome have followed two workstreams. The first workstream is related to the identification of the demonstrations sites. The second workstream is instead rather focused on the assessment of the functional needs for an integration of Enel X proprietary back-end platform and INCAR.

6.4.1 Identifying the right sites for INCAR implementation

After screening different possibilities, the partners involved in the Roman demo had to iterate the screening since one of the main location identified (along via Cristoforo Colombo, an urban expressway in the South of Rome) has revealed administrative times not compatible with the project. The research of the demonstration sites has been performed considering the following aspects:

- Urban and administrative constraints and timelines
- Services available nearby
- Distribution
- Project timeline
- Accessibility

For the Roman demo several type of EVSEs will be made available such that the response of the user to different technologies can be also assessed.

For the EVSE relying on the HPC (High Power Charger) technology the site identified has to be necessarily a private site with public access since the current city policy forbid the installation of HPCs on public sole and given that the installation foresees also a supplementary ESS (Energy System Storage) unit able to provide peak shaving benefits. For this reason the HPC station at disposal for INCAR will be placed in Enel X premises in Via Flaminia, within 5 km distance from the GRA (Grande Raccordo Anulare, the main ring motorway of the city) with public access granted 24/7. This site is well fitted for the needs of users along this type of highway where the main needs is to charge the electric vehicle as fast as possible.

EVSEs with power range of 22 kW and 50 kW available for INCAR integration will be instead distributed inside the city ring. The sites are characterized for the high level of intermodality they can offer to the user, being all very close to either metro stations (close to Lepanto and Conca d'Oro, linked to the two main metro lines) and shops or to services like the Enel X Store in Corso Francia designed as an Intermodal Exchange Hub with Coffee & restaurant, Smart working facilities and Co-Working space and with other EVSEs realised thanks to the CEF program.

6.4.2 Assessment of functional needs to integrate back-end platform with INCAR

The EVSEs (mentioned in section 6.4.1) will be made available to INCAR by Enel X acting as CPO. They are managed trough Enel X back-end proprietary platform. Currently the platform is based on OCPI 2.1.1 and updates toward OCPI 2.2 are not scheduled soon so a very important workstream ongoing is the assessment on whether the INCAR use-cases, as described in D3.1, can be properly satisfied with OCPI 2.1.1 for what pertains the mutual exchanges expected between the platform and INCAR. Further the payment system currently available for Enel X acting as CPO is via bank/wire transfer: it has been recently verified that Stripe registration, deposit authorization on the bank account for the services provided are requirements not feasible and as such an alternative solution will have to be identified.

6.5 Turku

Turku with its partners has been slightly behind schedule in the INCAR integration. Finding a technical partner for the demo was more complicated than anticipated. Tendering for the technical partner with OCPI 2.2 support and V2G charging point capabilities started Spring 2021 and in the Autumn 2021 a subcontract with IGL-Technologies Oy was agreed.

OCPI and INCAR integration development has started and communication with INCAR servers and IGL back-end will be working in the start of January 2022. If everything goes as planned, testing Turku demo charging points in INCAR network starts in June 2022.

Both demo areas that test INCAR in Turku are new buildings that are constructed at this moment. Constructions in Kupittaa demo of the Turku Energy will be fully ready in early summer 2022. Vaso demo building in Pääskyvuorenrinne will be ready in late 2022, but the parking should be ready in summer 2022 and testing can start.

7. Conclusions

At this report the work that was carried out from the partners in charge of application development and testing during the tasks T3.3 and T3.4 of WP3 has been presented. The overview of the INCAR Platform solution and its features, technical details and end user documentation is provided. Additionally, the methodology that was adopted for the evaluation and assessment of the operation of the different software components proved to be useful and sufficient. Having established a common terminology and framework for all the involved partners allowed to prepare, conduct and document the tests coherently.

All in all, the results achieved within T3.3 and T3.4 prove that the INCAR Platform implementation is at a good level for the initiation of the piloting phase. No serious issues have been identified and only in a few cases there are some features that can be improved during the execution of the demo, when also additional end user feedback is expected.

This deliverable concludes the work of WP3. On the overall picture of the USER-CHI project, work takes over in WP6, where the developed solutions will be deployed and integrated with demo partner systems, thus demonstrating all the INCAR Platform features in real environment. Results of T3.4 prove that the INCAR Platform is in position to start the piloting phase with the appropriate reliability.



Acronyms

Acronym	Meaning
API	Application Programming Interface
CPO	Charge Point Operator
D	Deliverable
EMSP	Electro Mobility Service Provider
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
GUI	Graphical User Interface
OCPI	Open Charge Point Interface
OCPP	Open Charge Point Protocol
SCSP	Smart Charging Service Provider
T	Task
WP	Work Package

References

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