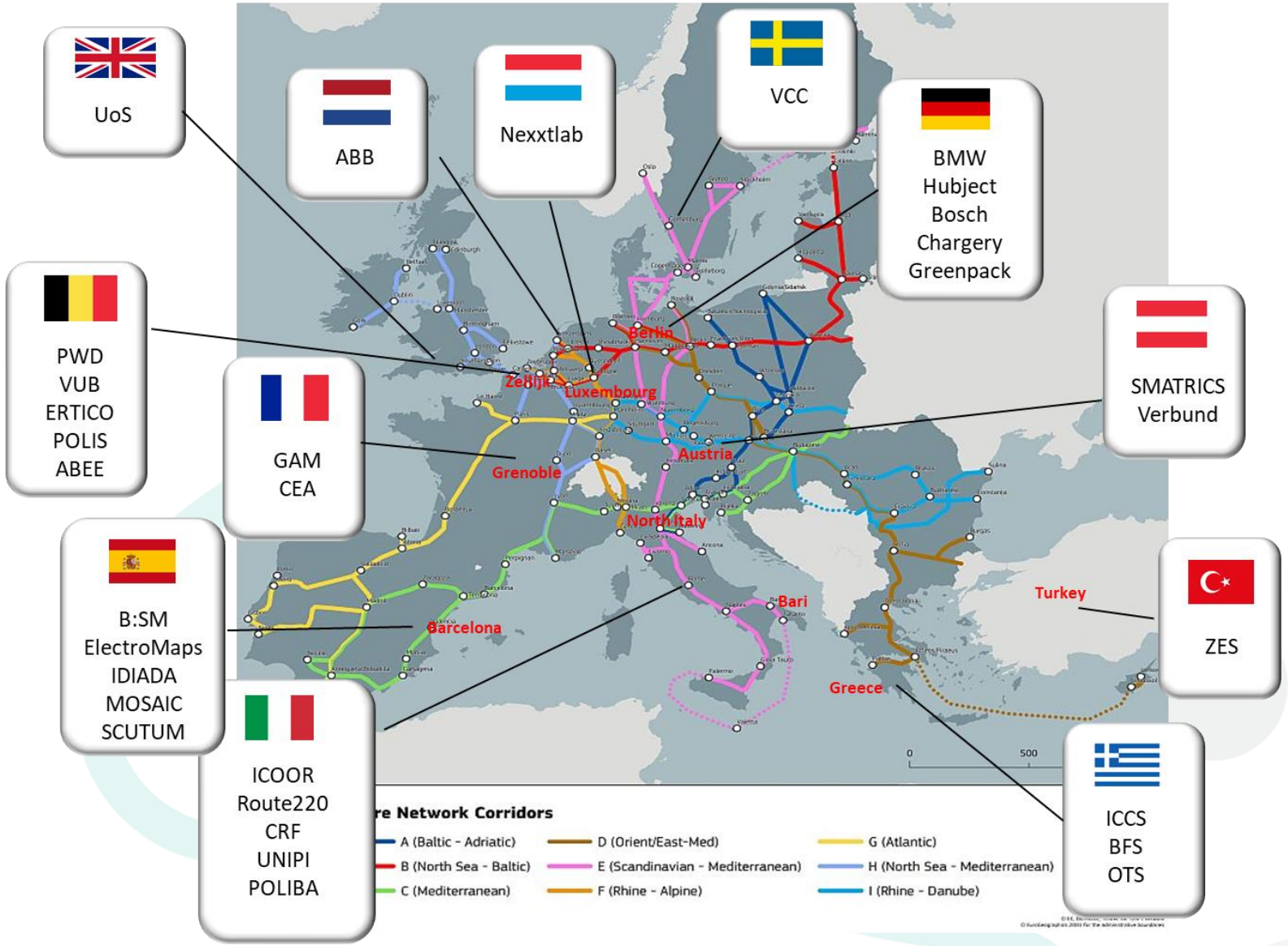
Improving the EV charging experience within cities and for longer trips: the eCharge4Drivers project

Dr. Evangelia Portouli
Senior Researcher
Institute of Communication and Computer Systems

eCharge4Drivers at a glance



Call identifier: H2020-LC-GV-2018-2019-2020

Topic: GV-10-2017 “Demonstration (pilots) for integration of electrified L-category vehicles in the urban transport system”

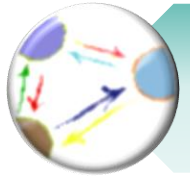
EC funding: 14,424,526.39 €

Duration: June 2020 – May 2024

Demonstrations in **ten** areas to cover needs for urban and for longer trips

Challenges

Improve comfortability of charging



Enable services interoperability and provide appropriate information to users

Promote smart charging solutions

Propose standardised charging options for LEVs

Support the wide deployment of charging infrastructure

Strategic objectives

- O-1:Develop and demonstrate **user-friendly charging stations** and smart charging solutions for passenger vehicles and LEVs

- O-2: Enable and demonstrate **interoperability of end-to-end communication** and provision of **enhanced information to the EV users**, before, during and after a charging session

- O-3Maximise benefits (i.e. reduce costs) for the users via **efficient** charging stations and charging components, **smart power management modules and smart charging strategies**

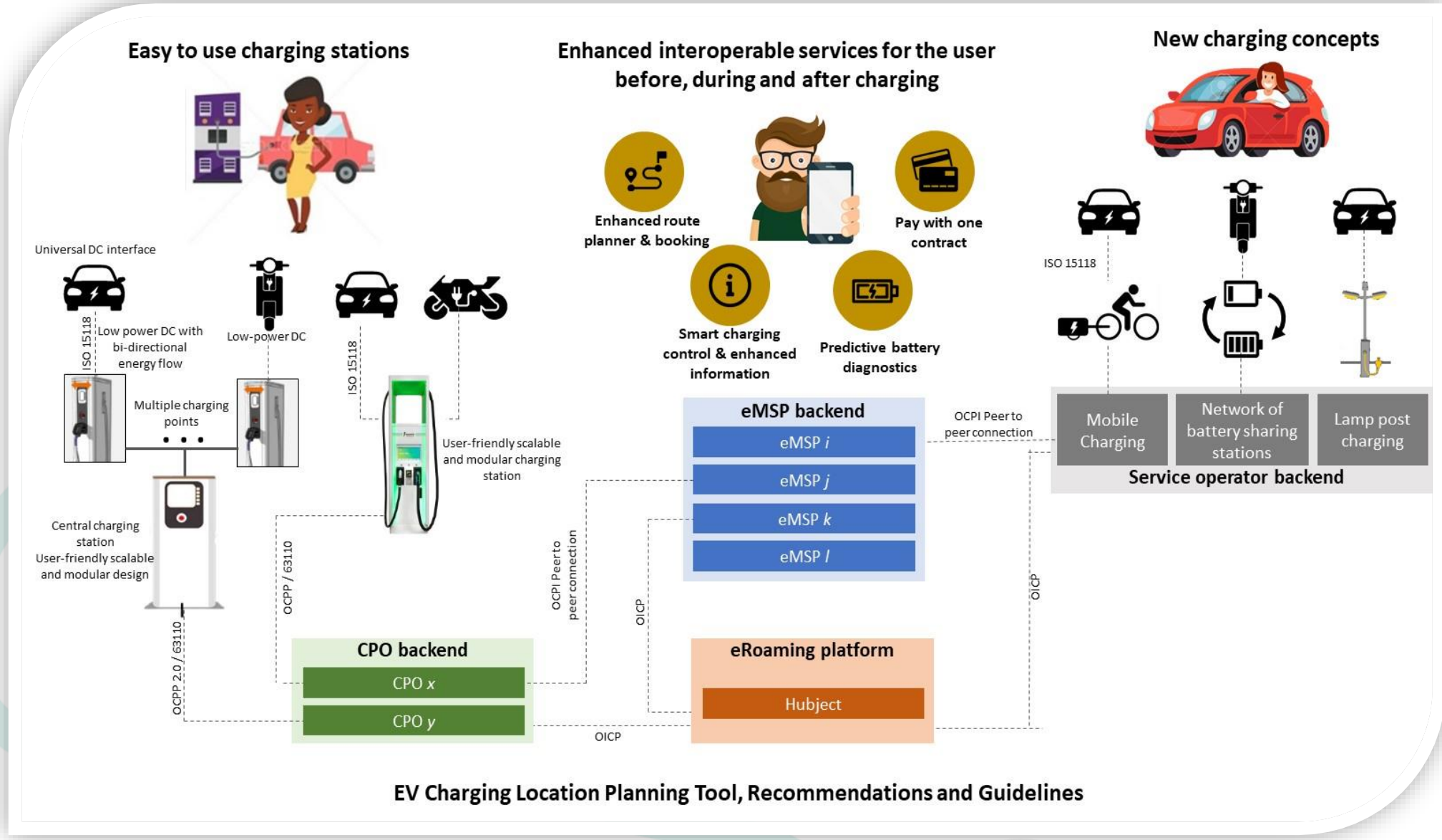
Strategic objectives

- O-4:Deploy and demonstrate **innovative charging solutions** for on-street residential charging for passenger vehicles (mobile charging service, charging points on lamp posts) and **standardised battery swapping stations** for LEVs

- O-5:Understand the user needs so that the project charging solutions and services substantially **improve the user charging experience**

- O-6:**Accelerate the deployment** of charging infrastructure and other charging services in a sustainable and user-centric way

Concept

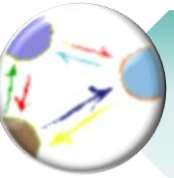

Easy to use charging stations
Universal DC interface
ISO 15118
Low power DC with bi-directional energy flow
Low-power DC
ISO 15118
Multiple charging points
User-friendly scalable and modular charging station
Central charging station
User-friendly scalable and modular design
OCPP / 63110
OCPP 2.0 / 63110
Enhanced interoperable services for the user before, during and after charging
Enhanced route planner & booking
Pay with one contract
Smart charging control & enhanced information
Predictive battery diagnostics
New charging concepts
ISO 15118
Mobile Charging
Network of battery sharing stations
Lamp post charging
Service operator backend
eMSP backend
eMSP i
eMSP j
eMSP k
eMSP l
OCPI Peer to peer connection
OCPI Peer to peer connection
OICP
OICP
CPO backend
CPO x
CPO y
eRoaming platform
Hubject
OICP
EV Charging Location Planning Tool, Recommendations and Guidelines

eC4D solutions towards Challenges

eCHARGE 4DRIVERS

Improve comfortability of charging

- User Analysis
- Innovative Interoperable charging solutions
- Enhanced Booking Service & Route Planner



Enable services interoperability and provide appropriate information to users

- ISO15118 P&C
- OCPP IEC 63110
- e-roaming services (OCPI, OICP)

- Enhanced Charging Information

Promote smart charging solutions

- Smart charging suite

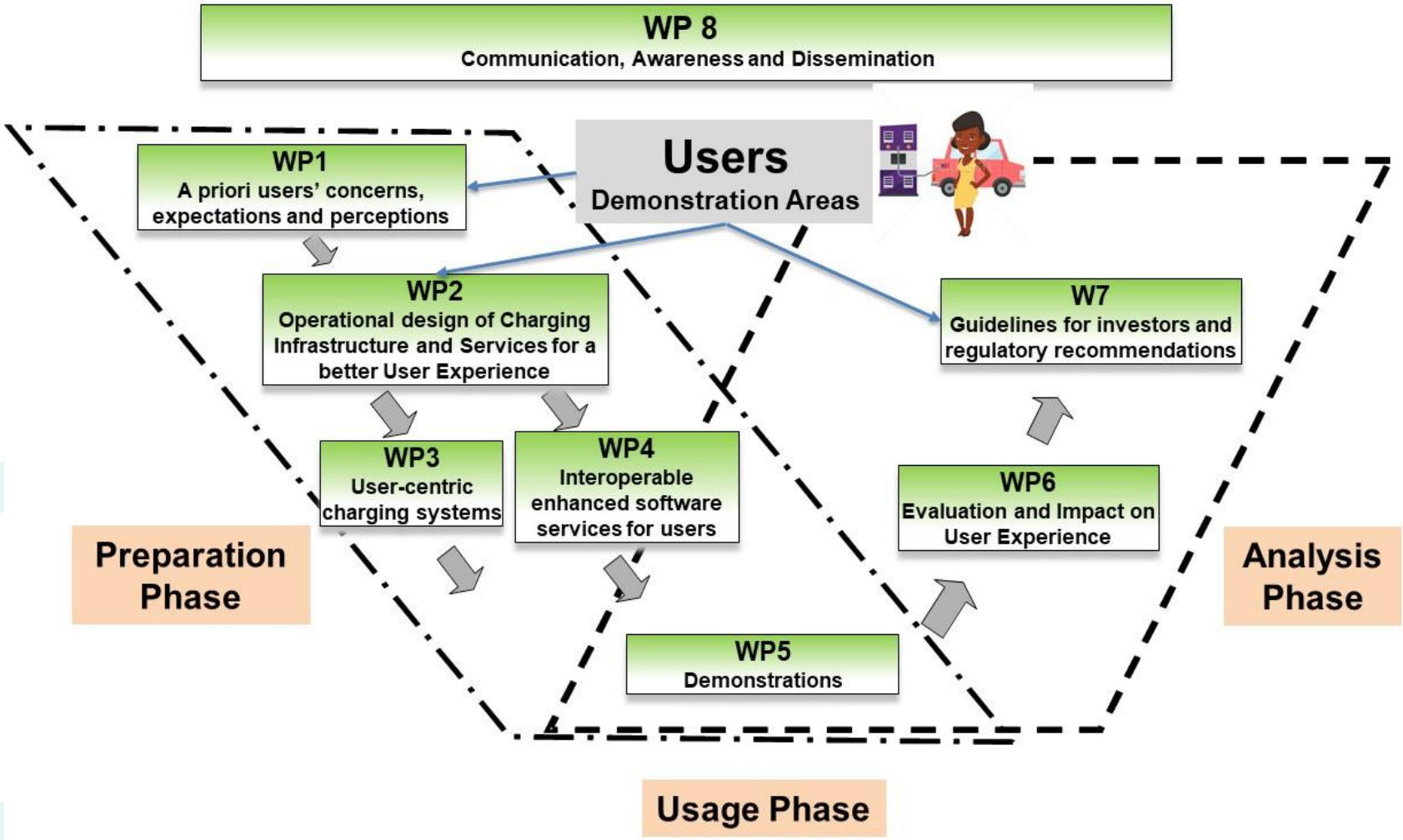
Propose standardised charging options for LEVs

- Modular Combined CS
- Battery Swapping Stations

Support the wide deployment of charging infrastructure

- Charging Location Planner
- Incentives & Tariff schemes
- Recommendations & Guidelines

Methodology



eC4D Charging technologies to be demonstrated

Advanced charging stations (ABB)

- Modular AC/DC CS (20 - >350kW)
- ISO 15118/OCPP/IEC63110
- Supporting CSS/CHAdeMO plugs
- Site power manager optimising power distribution to multiple outlets
- User-friendly, interactive screens

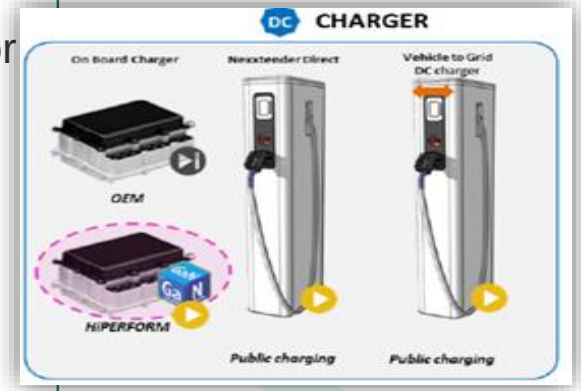
Mobile charging stations (Chargery)

- System already operational for fleet owners and managers in Berlin
- Project advancements:
  - private customers
  - Enhanced information
  - Booking service
  - More payment options
  - Integration with other services (ex. Route planner)

eCHARGE 4DRIVERS

Low Cost DC Charging Stations (PowerDale)

- Low cost bi-directional (11kW) and uni-directional (15-45kW) DC CS for passenger vehicles
- Low power DC CS (1.5kW) for L1e vehicles
- ISO 15118/OCPP/IEC63110
- Central charging station serving multiple connected CS
- User friendly interfaces/multiple payment methods



Battery swapping stations (Greenpack)

- System already operational for private LEV users
- Interoperability: battery vendor agnostic
- Aims:
  - a dense hub with a full battery in a range of 3-5 km (Berlin)
  - Battery swapping duration < 2 minutes.

Interoperable user-centric services

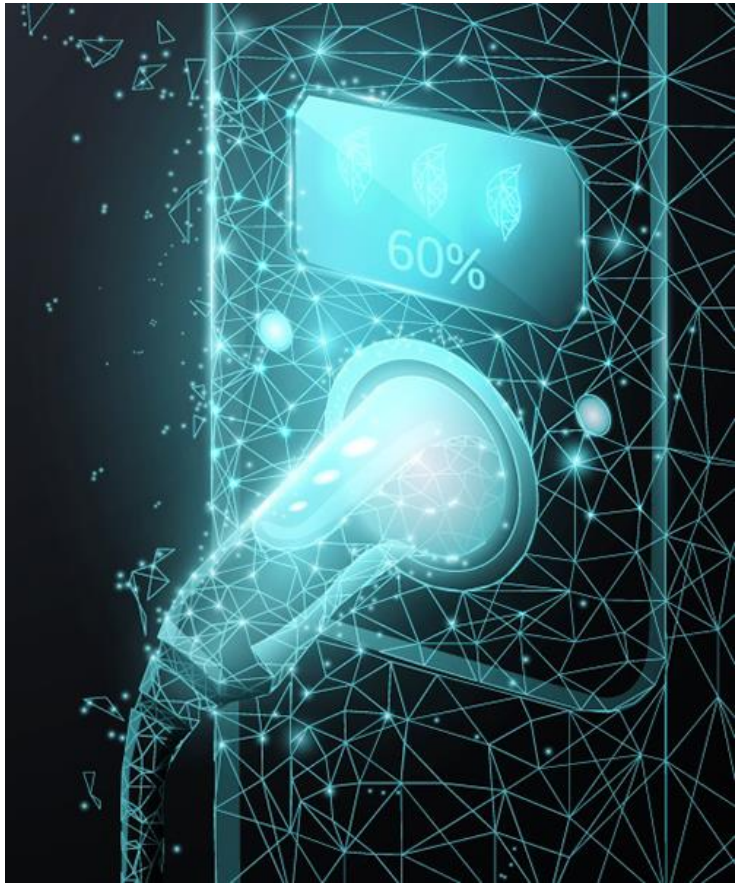
- Guidelines on implementing the ISO 15118 Plug & Charge feature and to secure the user data and the billing transaction

- Enhanced route planner:

  - ✓ *Calculating and proposing different plans based on user profile and preferences and real-time availability of charging stations and parking bays*

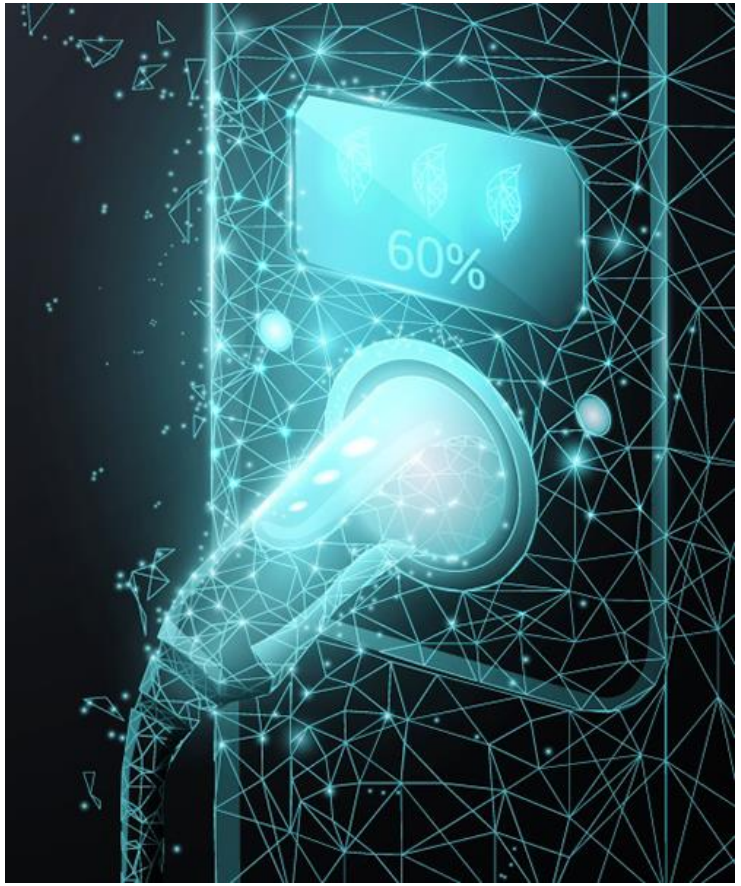
  - ✓ *Multi-user planner to optimise multiple charging requests with available charging stations and minimise the waiting times for all users*

- Enhanced booking service, using real-time and predicted availability of charging stations and parking bays, real-time and estimated tariffs, and enhanced information (e.g. presence of restaurants, shops or other facilities, RES in the mix, waiting time).



Interoperable user-centric services

- Smart charging services:
  - ✓ *Charging control by the user by indicating the desired departure time*
  - ✓ *Optimum matching of demand versus availability, taking into account the possibility of bi-directional energy flow if available, so that more users can be served with the same available grid power*
  - ✓ *Offering dynamic prices or other incentives to minimize the price for charging*
  - ✓ *Enabling the use of locally produced renewable energies for users who wish to do so;*
  - ✓ *Integrating electric vehicles into microgrid concept*
  - ✓ *Reducing the battery aging by having the car fully charged just before departure time*



- Predictive diagnostics service to continuously monitor the status of the vehicle battery, provide an optimized charging profile to the charging station and inform the user in advance of any problems with the battery

Demonstrations overview

Topic Demonstrated	Metropolitan areas						Nationwide long-distance trips			
	Barcelona	Grenoble	Berlin	Luxemburg	Zellik	Bari	Austria	Northern Italy	Greece	Turkey
User-friendly, low- and high-power charging stations for passenger vehicles and motorcycles supporting ISO 15118 Plug & Charge	X	X			X	X		X		X
Upgrades of high-power charging stations to support ISO 15118 Plug & Charge and OCPP							X		X	
Back-ends supporting ISO 15118 Plug & Charge	X		X		X		X	X	X	X
Low-power DC charging stations supporting ISO 15118 Plug & Charge					X					
Enhanced route planners	X					X		X	X	X
Enhanced booking service	X	X	X	X	X	X		X	X	X
Enhanced information during charging	X				X	X		X	X	X
Smart charging services	X	X		X	X					
Mobile charging service		X	X							
Charging points on lamp posts		X								
Battery swapping stations for LEVs	X		X							
New tariff schemes	X	X	X		X	X		X		
Incentives	X		X	X	X	X		X		

Location planning tool

- Stakeholders: public administrations and private players (investors)
- A tool enabling the efficient planning and development of a sustainable charging network considering diverse charging solutions.
- The tool outputs an optimum mix of charging options and their respective location to satisfy the charging demand considering user needs and habits
- User-friendly web interface with interactive maps for input/output
- Easy creation of scenarios, representing different penetration levels of EVs and LEVs, for scalable planning

Data collection

- Aim: capture users' perceptions about the demonstrated systems and services and users' and citizens' attitudes towards electromobility
- Usage data and wide surveys
- At least 800 questionnaires per each of the 10 demonstration areas
- Interviews with at least 10 investors and authorities per area

Analysis

- Study the impact of the project developments on the user charging behaviour and experience and on their attitudes towards the various charging options and services demonstrated and towards electromobility in general.
- Formulate guidelines for future superfast charging systems proposing how local energy assets and bi-directional energy flow can be used to manage their impact on the local grid
- Develop test methods and a specific testing environment to test the interoperability of end-to-end communication between partners and its conformance with the ISO 15118 requirements
- Analyse market models in each demonstration area
- Prepare recommendations to harmonise regulation and legislation among regions
- Prepare guidelines for investors and authorities as regards tariffs schemes and alternative revenues, via for example smart charging strategies, to support sustainable investments in charging infrastructure

Expected impact

- **Wide user acceptance** beyond early adopters, urban users and garage parkers
- **Foster investors to invest** in charging infrastructure
- **Determine legal gaps** which slow down infrastructure expansion and propose solutions
- **Improve interoperability** of vehicle-to-charger and charger-to-infrastructure **communication**
- **Better grid integration of high-power chargers**
- **Standardized charging solutions and payment systems for LEVs** for price reduction and higher market acceptance in urban environments

eCHARGE 4DRIVERS

@Charge4E

eCharge4Drivers

v.portouli@iccs.gr

www.echarge4drivers.eu

Co-financed by t
Connecting Europ

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 875131 (Innovation Action)