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EnerNETMob

Mediterranean Interregional Electromobility Networks for intermodal and interurban low carbon transport systems

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Guidelines to develop BATs and Technical standards

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UNIVERSITÀ DEGLI STUDI DI PALERMO

University of Palermo – Department of Agricultural, Food And Forest Sciences

Viale Delle Scienze, Edificio 4 – 90128 Palermo – Italy

Prof. Maria Crescimanno - Scientific Coordinator

Prof. Antonino Galati – Project Manager

Arch. Alessandro Carollo – Technical Support

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3.0	Final	11/03/2019	UNIPA	Integration of contributions sent by PWM and CIMNE

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1. Introduction

The aim of the Activity 3.3 is to define common guidelines and models for sustainable electric transport planning in order to adopt shared strategies and plans, which will be implemented by project partners at local level within the pilot actions planned in WP4.

Therefore, as reported in the application form, the Activity 3.3 is preparatory to start all the studying and testing Activities 3.4 and 3.5 of the WP3 as well as the next WP4 and WP5 actions.

As confirmed during the 1st Steering Committee held in Tripoli on May 3rd and 4th 2018, the WP3 Scientific Committee Working Group (SCWG) is coordinated by UNIPA-SAAF (Project Partner 8) and CIMNE (Project Partner 13) that, as research institutions, will support the partnership in the Studying Phase and will assess the progress implementation and effectiveness of activities.

After a first draft edited by SCWG, the partners will share and use the guidelines in order to plan and design the electric transport infrastructures/services to be implemented in WP4 pilot actions according to common technical standards, best available technologies and legal requirements.

The Activity 3.3 will affect the definition of common planning models on the basis of electromobility policies and Regulations/Directives which were analyzed during previous Activity 3.2. Therefore the Activity will develop 2 kind of deliverables:

- Deliverable 3.3.1 - *Planning model to develop "Sustainable Electro-Mobility Plans" for electric transport network and services* (1 report);
- Deliverable 3.3.2 - *BAT and Technical standards to be used for charging infrastructures and ICT tools* (1 report).

The **Deliverable 3.3.1** is a planning model to develop "Sustainable Electro-Mobility Plans" with common indicators and procedures. UNIPA coordinates the drafting of guideline, to be used by partners to plan parallel regional "Small-Scale Infrastructure Network".

The **Deliverable 3.3.2.** develops the guideline with BAT and Technical standards to be used for charging infrastructures and ICT tools. Such guidelines, drafted also with the support of CIMNE, will be used by partners in order to design the infrastructures and ICT by using same communication protocols and technical standards.

The purpose of Activity 3.3 is to provide common technical standards and legal requirements to be used by partners to plan and design electric transport infrastructures/services to be implemented in WP4 pilot actions for the implementation of the *Mediterranean Interregional Electromobility Network* and connected *Small-Scale Infrastructure Networks*.

Moreover, such *"Mediterranean Interregional Electromobility Network"* has to be interoperable with other electric transport infrastructures which are implemented on European Union according to the Directive 2014/94/UE.

Purpose of the document within the project

Main expected result of EnerNETMob project is the creation of a pilot *"Mediterranean Interregional Electromobility Network"*, constituted by pilot regional *"Small-Scale Infrastructure Networks"* connecting cities, rural areas and intermodal terminals at transnational as well as at interurban level.

As reported in the Application Form, the *"Small-Scale Infrastructure Network"* consists of pilot modular systems of *"Electric Vehicle Supply Equipment"* (EVSE), which are connected to the public electric grid and in some cases are also co-powered by RES.

An amount of 13 local ***"EVSE Networks"***, as single modules of the overall *"Mediterranean Interregional Electromobility Network"*, are placed in different nodes of the partner regions in order to allow longer interurban/interregional displacements by Battery Electric Vehicles (BEVs).

Each *"EVSE network"* will be managed independently by its owner Authority, and at meantime it will be interfaced and interconnected with other infrastructures of *"Mediterranean Interregional Electromobility Network"*, according to the Directive 2014/94/UE.

Therefore, for each local *"EVSE Networks"*, every appointed partner will draft:

- a *Structural Knowledge Framework*, with the analysis of the local context;
- a *Sustainable Electro-Mobility Plan*, with the preliminary design of the infrastructures and transport services.

Thus, EnerNETMob partners will test the abovementioned networks through **3 pilot actions**:

- *Pilot 1 – Intermodal Sea-Road Electromobility Networks*, linking cross-border islands and/or coastal regions;
- *Pilot 2 – Sharing Electromobility Services*, such as e-car pooling, e-car sharing, e-bike sharing;
- *Pilot 3 – City Logistic Electromobility Services*, for the last mile freight transport connections in urban and rural areas.

To develop and test such local *"EVSE Networks"* during pilot actions, the partners will develop some **small-scale investments** in all participating regions, by including the following **main outcomes**:

- "Battery Electric Vehicles" (BEV) to be used by the *relevant partners* as per the Application Form for the testing phase of pilot actions;
- "E-Bikes" to be used by some involved partners for the testing phase of pilot actions;
- "Charging points" to be installed in the participating regions as per the Application Form in order to provide electric energy to BEVs;
- "Photovoltaic charging points" to be installed in the relevant regions as per the Application Form in order to provide electric energy to BEVs, also through Renewable Energy Sources (RES);
- ICT tools for remote control of charging services using common communication protocols in the participating regions as per the Application Form.

Given the above, the ***Deliverable 3.3.2 – BAT and Technical standards to be used for charging infrastructures and ICT tools*** is drafted in order to be used by the relevant participating partners as per the Application Form to plan and design such electric transport infrastructures/services with same technical

standards, best available technologies (BATs) and minimum requirements.

These common guidelines aim to design the infrastructures/services of parallel *"EVSE Networks"* as integrated and interoperable components of an *"Interregional Electromobility Network"*, in order to allow the relevant partners:

1. to plan and design parallel regional *"EVSE Network"* within a common framework of *"Mediterranean Interregional Electromobility Network"*, using same communication protocols and same Electric Vehicle Supply equipment (Activities 3.5 and 4.2);
2. to install/build parallel regional "*EVSE Network"* according to the above mentioned plans and executive designs (Activity 4.3 and Pilot Activities 4.4, 4.5 and 4.6).

After the testing phase of WP 4, the deliverables of Action 3.3 (*"Guidelines for Sustainable Electro-Mobility Planning"*) will be upgraded and finalized with the Deliverable 5.2.2 (*"Electromobility Implementation Guidelines"*) to be developed within *WP 5 – Transferring*.

Structure of the document

This Guidelines were drafted on the basis of the *Directive 2014/94/EU of the European Parliament and of the Council on the Deployment of Alternative Fuels Infrastructures* (DAFI), that establishes a common framework of measures for the deployment of alternative fuels infrastructure in the European Union in order to minimize dependence on oil and to mitigate the environmental impact of transport.

According to such Directive, the Guidelines set out minimum requirements for the building-up of alternative fuels infrastructure, with special regards to recharging points for electric vehicles to be implemented by project partners, as well as common technical specifications for such recharging points and user information requirements.

With this purpose, the current version of the present document has been structured in the following chapters:

1. *Introduction;*
2. *Main legal references;*
3. *Main technical standards;*
4. *Common terms and definitions;*
5. *Minimum requirements for executive design and implementation of electromobility services/infrastructures.*

2. Main legal references

The project partners involved in the pilot activites have to consider the following EU legal references for the drafting of executive designs and related technical reports, as well as for the thematic equipment and the small-scale investments to be developed, purchased and/or implemented within the project.

For the implementation of WP 3 (Activity 3.5) and WP 4, each of the relevant project partner as per the Application Form has to develop the actions and deliverables according to at least the following European legal framework:

- **Directive 2007/46/EC** of the European Parliament and of the Council of 5 September 2007 establishing a framework for the approval of motor vehicles and their trailers, and of systems, components and separate technical units intended for such vehicles (Framework Directive);
- **Directive 2009/28/EC** of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC;
- **Directive 2009/72/EC** of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC;
- **Directive 2012/27/EU** of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC;
- **Directive 2014/94/EU** of the European Parliament and of the Council of 22 October 2014 on the Deployment of Alternative Fuels Infrastructures;
- **Regulation (EU) N. 168/2013** of the European Parliament and of the Council of 15 January 2013 on the approval and market surveillance of two- or three-wheel vehicles and quadricycles.

The aforementioned list of legal references is only a first legal framework on electromobility. Therefore such list is not exhaustive and may be integrated during the implementation of the project on the basis of the shared needs and/or suggestion of the partnership.

Moreover, during the executive design phase the relevant partners have to **integrate and detail** the above mentioned legal framework with their National/Local regulations.

3. Main technical standards

The project partners participating in the pilot activites have to consider the following international technical standards for the drafting of executive designs and technical reports, as well as for the thematic equipment and the small-scale investments to be developed, purchased and/or implemented within the project.

For the implementation of WP 3 (Activity 3.5) and WP 4, each relevant project partner has to develop the activities and deliverables considering at least on the following technical standards:

- **IEC 62196-1** applied to “Plugs, socket-outlets and vehicle couplers - Conductive charging of electric vehicles” - Part 1: General requirements;
- **IEC 62196-2** applied to “Plugs, socket-outlets and vehicle couplers - Conductive charging of electric vehicles” - Part 2: Dimensional interchangeability requirements for a.c. pin and contact-tube accessories;
- **IEC 62196-3** applied to “Plugs, socket-outlets and vehicle couplers - Conductive charging of electric vehicles” - Part 3: Dimensional compatibility and interchangeability requirements for d.c. and a.c./d.c. pin and contact-tube vehicle couplers;
- **IEC 61851-1** applied to “Electric vehicle conductive charging system” - Part 1: General requirements.
- **IEC 62752** applied to “In-cable control and protection device for mode 2 charging of electric road vehicles (IC-CPD)”. *[To be used only in case of private charging points, if it is not possible to implement public recharging point]*.
- **ISO/TR 8713** applied to “Electrically propelled road vehicles – Vocabulary”.
- **ISO 15118-1** applied to “Road vehicles - Vehicle to grid communication interface” - Part 1: General information and use-case definition.

The aforementioned list of technical standards is only a first framework on parameters to be used for executive design of electromobility infrastructures/services. Therefore such list is not exhaustive and may be integrated during the implementation of the project on the basis of the shared needs and/or suggestion of the partnership.

Moreover, during the executive design phase each pilot partner has to **integrate and detail** the above mentioned technical standards with its National/Local regulations.

4. Common terms and definitions

The following pages show the description of the common terms and definitions to be shared and used by partners for the implementation of the small-scale investments and thematic equipment, following the EU Directives and technical standards for electric transport which were reported in the previous chapters.

For the purpose of these Guidelines, the following table reports the main common Electromobility terms definitions to be applied according to the Directive 2014/94/UE and other EU Directives as well as according to main technical standards on electric transport.

Main common Electromobility terms and definitions	
Definition	**Description**
Relevant partners	EnerNETmob project partners that are involved in the WP3 and WP4 pilot actions according to the Application Form working plans. For the tasks of each partners please refer to approved Application Form (version 6.0)
DAFI Directive	Directive 2014/94/EU of the European Parliament and of the Council on the Deployment of Alternative Fuels Infrastructures
Electricity (or Electric Energy)	"Alternative fuels" or "power sources" serving, at least partly, as a substitute for fossil oil sources in the energy supply to transport and which have the potential to contribute to its decarbonisation and enhance the environmental performance of the transport sector.
Electric Vehicle (EV)	Motor vehicle equipped with a powertrain containing **at least** one non-peripheral electric machine as energy converter with an electric rechargeable energy storage system, which can be recharged externally. Electric Vehicle typologies includes 2 categories of vehicles: - Battery Electric Vehicles (BEV); - Fuel Cell Hydrogen Vehicle (FCEV). For the project, partners will consider only BEV categories.
Battery Electric Vehicle (BEV)	Pure Electric Vehicle or All-Electric Vehicle, equipped with a powertrain containing **only one** non-peripheral electric machine as energy converter with an electric rechargeable energy storage system, which can be recharged externally.
Electric Vehicle Supply Equipment (EVSE)	Infrastructure with conductors, including the phase(s), neutral and protective earth conductors, the EV couplers, attached plugs, and all other accessories, devices, power outlets or apparatuses installed specifically for the purpose of delivering energy from the premises wiring to the EV and allowing communication between them as necessary.
Recharging point	Interface that is capable of charging an Electric Vehicle at a time or exchanging a battery of one electric vehicle at a time.

Main common Electromobility terms and definitions	
Definition	**Description**
Public recharging point	Recharging point accessible to the public for electric energy supply, which provides Union-wide non-discriminatory access to users. Non-discriminatory access may include different terms of authentication, use and payment. *Public recharging point has to adopt open charging protocols in order to allow the energy provision through business contracts of third economic operators.*
Private recharging point	Recharging point installed in private households or the primary purpose of which is not recharging electric vehicles, and which are not accessible to the public.
Slow power recharging point	Recharging point that allows for a transfer of electricity to an electric vehicle with a power less than or equal to 3,7 kW, which are installed in private households or the primary purpose of which is not recharging electric vehicles, and which are not accessible to the public.
Normal power recharging point	Recharging point that allows for a transfer of electricity to an electric vehicle with a power less than or equal to 22 kW, excluding devices with a power less than or equal to 3,7 kW, which are installed in private households or the primary purpose of which is not recharging electric vehicles, and which are not accessible to the public.
High power recharging point	Recharging point that allows for a transfer of electricity to an electric vehicle with a power of more than 22 kW.
Category L1e-A vehicle	Powered two-wheels pedal cycle with pedal assistance which are equipped with an auxiliary electric motor having a maximum continuous rated power of less than or equal to 250 W, where the output of the motor is cut off when the cyclist stops pedaling and is otherwise progressively reduced and finally cut off before the vehicle speed reaches 25 km/h.
Category L7e vehicle	Heavy quadricycle designed and constructed according to Regulation (EU) No 168/2013, with following classification criteria: 1. length ≤ 4 000 mm 2. width ≤ 2 000 mm 3. height ≤ 2 500 mm 4. four wheels and powered by a propulsion as listed under Regulation (EU) No 168/2013 5. mass in running order: a. ≤ 450 kg for transport of passengers; b. ≤ 600 kg for transport of goods.
Category M1 vehicle	Vehicle designed and constructed according to Directive 2007/46/CE for the carriage of passengers and comprising no more than 8 (eight) seats in addition to the driver's seat.
Category N1 vehicle	Vehicles designed and constructed according to Directive 2007/46/CE for the carriage of goods and having a maximum mass not exceeding 3,5 tonnes.

Main common Electromobility terms and definitions	
Definition	**Description**
Smart metering system or **Intelligent metering system**	Electronic system that can measure energy consumption, providing more information than a conventional meter, and can transmit and receive data using a form of electronic communication.
Energy from renewable sources	Energy from renewable non-fossil sources, namely wind, solar, aerothermal, geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases.

The aforementioned list of terms is only a first framework on common definitions to be used for executive design of electromobility infrastructures/services. Therefore such list is not exhaustive and may be integrated during the implementation of the project on the basis of the shared needs and/or suggestion of the partnership.

5. Minimum requirements for executive design and implementation of electromobility services/infrastructures

This Part of the document will summarize the results of the 15 national and local reports which will be delivered by the relevant partners in Deliverable 3.2.2.

The purpose is to have a comparison of the legal framework and policies state of art of the involved member States, in order to develop the benchmark in the Part III of the document.

This section provides some parameters to develop the design of electromobility infrastructures and equipment and implement them within following Activities:

- *Activity 3.5 – Action Plans of "Sustainable Electro-Mobility Plans"* (especially for Deliverables 3.5.2 and 3.5.3);
- *Activity 4.2 – Setting-Up of Small Scale Investments* (for all Deliverables);
- *Activity 4.3 – ICT Electromobility Platform* (for all Deliverables, with particular reference to communication interface);
- *Activities 4.4-6 – Pilot actions 1-3* (for all Deliverables).

In particular, with the *Preliminary* and *Executive Design* for electromobility infrastructures and equipment, each partner has to define the minimum requirements for *small-scale investments* and *thematic equipment* to be purchased and/or installed before the pilot actions.

The following table reports the suggested minimum requirements to be respected and to be requested in the calls for tenders that each partner will publish for the public procurements of *small-scale investments* and *thematic equipment*.

Considering the budget allocated by each project pilot partner and the current market prices for best available technologies in automotive sector, we considered:

- for the Electric Vehicles the following categories:
  - Category L7e Electric Vehicle
  - Category L1e-A Vehicle
  - Category N1 Electric Vehicle
  - Category M1 Electric Vehicle
- for the recharging points the following powers:
  - Normal power (suggested for the majority of partners)
  - High power (only for the partners allocating enough budget for fast charging point in d.c.)
  - Low power (only in exceptional cases of necessity to install private charging point because of operative restrictions)

Such minimum requirements use the parameters reported in the legal references and technical standards which were explained in the previous pages. Anyway, during the executive design phase each partner has to

integrate and detail the minimum requirements with its National/Local regulations.

Minimum requirements for *Small-Scale Investments* and *Thematic Equipment*	
Small-Scale Investments* or *Thematic Equipment	**Description and minimum requirements**
Category L7e Electric Vehicle	Quadricycle having following minimum requirements: - Vehicle type: L7e category homologated according to the Regulation (EU) N. 168/2013 - Seats: suitable 2 (anyway no less than 1 seats) - Engine: full electric (not hybrid) - Minimum range: 40 km - Maximum Power: no less than 15 kW - Maximum speed: no less than 40 km/h - AC Charging time with "Mode 1" as described in IEC 61851-1 standard: not more than 8 hours for 100 Km of range. - CO_2 Emissions:0gm/km - (if available as Best Available Technology in current national market) Charging Cable with charging connection plug conforming to connector of *"Type 2"* (single and three phase vehicle coupler, reflecting the VDE-AR-E 2623-2-2 plug specifications), or *"Type 3A"* (Single-phase vehicle coupler) as described in IEC 62196 standard, for charging with at least 16A in single phase. The minimum length of the cable shall be at least 2 metres. - An eventual adaptor from IEC 62196 "Type 2" and/or "Type 3A" plug to local domestic plug must be supplied, for charging at a maximum 16A (domestic charging purposes) - Battery type: Long life Lithium Ion and/or Lithium Ceramic and/or Lithium Polymer
Category M1 Electric Vehicle	Passenger car having following minimum requirements: - Vehicle type: M1 category homologated according to the Directive 2007/46/EC - Seats: suitable 4 or more (anyway no less than 2 seats) - Engine: full electric (not hybrid) - Minimum range: 100km - Maximum Power: no less than 40 kW - Maximum speed: no less than 80 km/h - AC Charging time with "Mode 1" as described in IEC 61851-1 standard: not more than 8 hours for 100 Km of range. - CO2 Emissions: 0gm/km - Charging Cable with charging connection plug conforming to connector of *"Type 2"* (single and three phase vehicle coupler, reflecting the VDE-AR-E 2623-2-2 plug specifications), as described in IEC 62196 standard, for charging with at least 16A in single phase. The minimum length of the cable shall be at least 2 metres - Battery type: Long life Lithium Ion and/or Lithium Ceramic and/or Lithium Polymer

Minimum requirements for *Small-Scale Investments* and *Thematic Equipment*	
Small-Scale Investments* or *Thematic Equipment	**Description and minimum requirements**
Category N1 Electric Vehicle	Light good van having following minimum requirements: - Vehicle type: N1 category homologated according to the Directive 2007/46/EC - Seats: suitable 2 or more (anyway no less than 1 seats) - Engine: full electric (not hybrid) - Suggested minimum payload ≥ 500kg - Minimum range: 100km - Maximum Power: no less than 40 kW - Maximum speed: no less than 80 km/h - AC Charging time with "Mode 1" as described in IEC 61851-1 standard: not more than 8 hours for 100 Km of range. - CO2 Emissions: 0gm/km - Charging Cable with charging connection plug conforming to connector of *"Type 2"* (single and three phase vehicle coupler, reflecting the VDE-AR-E 2623-2-2 plug specifications), as described in IEC 62196 standard, for charging with at least 16A in single phase. The minimum length of the cable shall be at least 2 metres - Battery type: Long life Lithium Ion and/or Lithium Ceramic and/or Lithium Polymer
Category L1e-A Vehicle	Powered two-wheels pedal cycle with pedal assistance having following minimum requirements: - Vehicle type: L1e-A category homologated according to the Regulation (EU) N. 168/2013 - Seats: no less than 1 seats - Engine: auxiliary electric motor (the output of the motor is cut off when the cyclist stops pedaling and is otherwise progressively reduced and finally cut off before the vehicle speed reaches 25 km/h) - Minimum range: 20 km - Maximum Power: less than or equal to 250 W - Maximum speed: 25 km/h
Public recharging point – AC Normal Power category	Recharging point accessible to the public for electric energy supply to motor vehicles with following minimum features: - Charging mode: "Mode 3" as described in IEC 61851-1 standard; - Alternating current (AC) Normal Power (max 22 kW, 63 A, 400 V, three phase) recharging points for electric vehicles shall be equipped, for interoperability purposes, at least with socket outlets or vehicle connectors of "Type 2" (single and three phase vehicle coupler, reflecting the VDE-AR-E 2623-2-2 plug specifications), as described in EN 62196-2 standard. While maintaining the Type 2 compatibility, those socket outlets may be equipped with features such as mechanical shutters.

Minimum requirements for *Small-Scale Investments* and *Thematic Equipment*	
Small-Scale Investments* or *Thematic Equipment	**Description and minimum requirements**
Public recharging point – AC High Power category	Recharging point accessible to the public for electric energy supply to motor vehicles with following minimum features: - Charging mode: "Mode 3" as described in IEC 61851-1 standard; - Alternating current (AC) High Power (max. 43 kW, 63 A, 400 V, three pase) recharging points for electric vehicles shall be equipped, for interoperability purposes, at least with "Type 2" connectors (single and three phase vehicle coupler, reflecting the VDE-AR-E 2623-2-2 plug specifications), as described in EN 62196-2 standard..
Public recharging point – DC High Power category	Recharging point accessible to the public for electric energy supply to motor vehicles with following minimum features: - Charging mode: "Mode 4" as described in IEC 61851-23 standard; - Direct current (DC) High Power (max. 50 kW, 200 A, 1000 V) recharging points for electric vehicles shall be equipped, for interoperability purposes, at least with "CSS Combo 2" and/or "CHAdeMO" connectors, as described in EN 62196-3 standard.
Private recharging point (only in exceptional cases of necessity, since it is not foreseen in AF)	Recharging point for electric energy supply to motor vehicles with following minimum features: - Charging mode: "Mode 2", with In-Cable Control and Protection Device) as described in IEC 61851-1 and IEC 62752 standards; - Alternating current (AC) Slow Power (less than or equal 3,7 kW) recharging points for electric vehicles shall be equipped, for interoperability purposes, at least with connectors of "Type 2" (single and three phase vehicle coupler, reflecting the VDE-AR-E 2623-2-2 plug specifications), as described in EN 62196-2 standard. *or, if not possible,* - Alternating current (AC) Normal Power (from 3,7 kW to 22 kW) recharging points for electric vehicles shall be equipped, for interoperability purposes, at least with socket outlets or vehicle connectors of "Type 2" (single and three phase vehicle coupler, reflecting the VDE-AR-E 2623-2-2 plug specifications), as described in EN 62196-2 standard. While maintaining the Type 2 compatibility, those socket outlets may be equipped with features such as mechanical shutters.

6. Attachments

After the version 2.0 delivered to partnership, PWD and CIMNE partners sent some contributions to be attached to this guidelines as follows:

- *"Minimum requirements for interoperability of Electromobility infrastructures and the ICT Electromobility Platform"* (contribution of CIMNE);
- *"Electrical bicycles specifications"* and *"Sowtware specifications"* for bike sharing services (contribution of PWD).

The following pages report the above mentioned contributions.

Attachment 1

Minimum requirements for interoperability of Electromobility infrastructures and the ICT Electromobility Platform

This section provides a set of requirements that the different regional systems and equipment that have to be implemented in the different pilot in order to be able to be connected to the ICT Electromobility Platform.

We have not considered any requirement for an individual Electric Vehicles Supply Equipment in terms of connectivity to Internet; instead**, we will let the internal connections of the pilot infrastructure as a responsibility of the provider for each pilot** and define the ICT interoperability requirements on the local ICT managing platform governing all the equipment.

The minimum requirement for any local ICT platform managing EVSE platform is **to provide an Web API** that provide access to the different resources managed by the platform (eg. Users, vehicles, stations).

Web APIs are the defined interfaces through which interactions happen between an enterprise and applications that use its assets, which also is a Service Level Agreement (SLA) to specify the functional provider and expose the service path or URL for its API users. An API approach is an architectural approach that revolves around providing a program interface to a set of services to different applications serving different types of consumers.

When used in this context, a Web API is typically defined as a set of specifications, such as Hypertext Transfer Protocol (HTTP) request messages, along with a definition of the structure of response messages, usually in an Extensible Mark-up Language (XML) or JavaScript Object Notation (JSON) format. While "web API" historically virtually has been synonymous for web service, the recent trend (so-called Web 2.0) has been moving away from Simple Object Access Protocol (SOAP) based web services and service-oriented architecture (SOA) towards more direct representational state transfer (REST) style web resources and resource-oriented architecture (ROA).

Although SOAP based API's will be supported by the global ICT Electromobility Platform, **RESTful Web Services based API's will be the preferred way to connect with local IT systems**.

Representational State Transfer (REST) is a software architectural style that defines a set of constraints to be used for creating Web services. Web services that conform to the REST architectural style, termed RESTful Web services (RWS), provide interoperability between computer systems on the Internet.

RESTful Web services allow the requesting systems to access and manipulate textual representations of Web resources by using a uniform and predefined set of stateless operations.

A RESTful API breaks down a transaction to create a series of small modules. Each module addresses a particular underlying part of the transaction. This modularity provides developers with a lot of flexibility, but it can be challenging to design.

JSON (JavaScript Object Notation) is a lightweight data-interchange format. It is easy for humans to read and write and it is easy for machines to parse and generate. JSON is based on a subset of the JavaScript Programming Language but is a text format that is completely language independent which make it an ideal data-interchange language.

Since the JSON format is text only, it can easily be sent to and from a server, and used as a data format by any programming language. When exchanging data between a browser and a server, the data can only be text.

JSON allows to convert any JavaScript object into JSON text and send it to the server. We can also convert any JSON text received from the server into objects. This way we can work with the data as objects, with no complicated parsing and translations.

In order to ensure security we will need a set of standard technologies to allow users to authenticate themselves in a safe way. Although the global ICT Electromobility **Platform will support any OAuth based authentication mechanism, OpenID Connect will be the recommended** technology.

OpenID Connect is an interoperable authentication protocol based on the OAuth 2.0 family of specifications. It uses straightforward REST/JSON message flows with a design goal of “making simple things simple and complicated things possible”.

OpenID Connect lets developers authenticate their users across websites and apps without having to own and manage password files and allows for clients of all types, including browser-based JavaScript and native mobile apps, to launch sign-in flows and receive verifiable assertions about the identity of signed-in users.

In order to complement the security in the user authentication with OAuth and OpenID Connect **we will ensure privacy by securing every web service call with token mechanisms**. The recommended mechanism is **JSON Web Token**.

JSON Web Token (JWT) is an open standard (RFC 7519) that defines a compact and self-contained way for securely transmitting information between parties as a JSON object. This information can be verified and trusted because it is digitally signed.

Signed tokens can verify the integrity of the claims contained within it, while encrypted tokens hide those claims from other parties. When tokens are signed using public/private key pairs, the signature also certifies that only the party holding the private key is the one that signed it.

Authorization: Once the user is logged in, each subsequent request will include the JWT, allowing the user to access routes, services, and resources that are permitted with that token. Single Sign On is a feature easily used across different domains.

Information Exchange: JSON Web Tokens are a good way of securely transmitting information between parties. Because JWTs can be signed you can be sure the senders are who they say they are. Additionally, as the signature is calculated using the header and the payload, you can also verify that the content hasn't been tampered with.

Attachment 2

Electrical bicycles specifications

Electric bicycles will be accompanied by a good performance guarantee covering 1 year material failure from the date of delivery. The skeleton of the bicycles should have a 5-year anti-rust protection.

The specifications are detailed below:

Maximum number of recharges ≥700

Maximum recharge time Up to 5 hours

Chain Drive System

Suspension On front wheel

Tire Size 28 '' x 1.75

Total weight under 25Kg without battery

Colors In consultation with the Technical Service

Positioning system Built-in GPS / GPRS bicycle system for position and motion data transfer to the control center. The minimum requirements listed in "Central Back Office System" and especially in "eBike Software System" must be met "

Motion and vibration sensor :YES

Ability to use a RF-ID card on the bicycle to unlock the lock: YES (optional)

Possibility to unlock a bicycle by sending an SMS : NAI

Maximum data consumption : Not more than 50 MB per bike per month

Maximum autonomy with full

a charged battery : at least 50 km

Maximum top speed : 25km / h (25km / h should be aided in accordance with applicable law)

Maximum motor power : 250Watt

Battery type : Removable with anti-theft system, Lithium Ion battery

Feathers : YES

Lights (front / rear) : YES

Saddle With Vibration Absorption And Height Adjustment Non-Detachable Saddle Neck: Quick Release

Grid or basket : YES

Lock : YES

Warranty 1 year from date of delivery. The skeleton of the bicycles should have a 5-year anti-rust protection.

Bicycles will also have:

 Lock for bicycle insurance between leases.

 Lights front and rear

 Reflective on wheels

 Pedals with reflectors

 Stand (Stand)

➜ Ensured availability to enable the contracting authority to obtain

more identical bicycles over the next 5 years

All Electric Bikes must comply with EU safety rules

SOFTWARE specs

A) Back Office Software System

The automated system will operate via a dedicated software application that will be available to the operator either through a local installation or through remote access. The software will take care of the complete and orderly operation of the system and will provide the ability to issue billing, usage and on-line system tracking data. The software will have complete documentation and that it is needed so that it can be given in order to be able to incorporate additional electric bicycles, scooters etc. from and be able to control - communicate - it displays all the data in the same way as the first bicycles to be integrated.

All these data will be provided in open access (open data) through an Application Programming Interface (API) with full analysis and explanation of each API documentation file in Greek and English so that the contracting authority beginning to give it in the future in order to be able to interconnect in this system or electric bicycles. The API will have all the information necessary for the system to be able to distribute data to other IT systems, to be able to connect with either existing or future Smart Systems platforms.

The application will include the following features:

 Constant communication with bicycles and control of bicycle locking mechanisms and user identification. Remote electronic locking of damaged bicycles.

 to make real-time measurements, present location, total time of each use, km of each use, battery consumption of each use

 Carry out user registration with data logging to access the system.

 Issue of usage statistics.

B) Bicycle Management Software (on eBike Software System)

Each bicycle / electric bicycle will have a built-in electronic lock and a built-in mechanism for measuring and monitoring it in real time. The internal mechanism for recording, measuring and retransmitting data from electric bicycles will be able to send data to BackOffice SW for:

• the battery condition of the bicycle at regular intervals. Not less than 4 times per day).

• Send instant battery alerts (below 20%)

Send data at the beginning of each use with:

• Position, direction, speed and battery level,

Then monitor the GPS device location and send it every 1 minute,

• send an immediate alert if the battery drops below 20% initially, counts when it is 10% again).

• If zero speed is found for more than one minute to send stop time with the position of each stop.

Send data at the end of each use with:

• Position

• Battery level,

• Usage time

• Km. which was distributed in the current year.

Then monitor the GPS location and send it every 60 minutes (if there is no other use),

Data from these metrics will be forwarded and stored on a server, either on the Internet or on a local server (using compatible technology). All such data will be provided in open access (open data) through an Application Programming Interface (API) with full analysis and explanation of each API documentation file in Greek and English so that the contractor to give it in the future to other manufacturers and / or electric lanes. bicycles to be able to interconnect their electric bikes in the future.


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