MOBI.EUROPE

D1.5 - Common CIP Projects Indicators

Final Version

Common high level indicators

Revision: 0.12

Authors:

Hans-Georg Frantz (BIM/ ICT4EVEU)
Gema Antequera/Ana Paul (CTAG / MOBI.EUROPE)
Rene Kelpin (DLR / MOLECULES)
Lucía Isasi (TECNALIA/ smartCEM)

Revision History

Revision	Date	Author	Organisation	Description
01	10/05/12	Lucia Isasi Rene Kelpin	TECN/smartCEM DLR/MOLECULES	Draft list from smartCEM project
02	14/05/12	ALL	ALL	14/5/12 meeting results
03	22/5/12	LI	TECNALIA	smartCEM and User Uptake
04	22/5/12	RK	DLR	MOLECULES and Transport and Mobility
05	22/05/12	Gema Antequera Ana Paul	CTAG	MOBI.Europe and Environment
06	23/05/12	Hans-Georg Frantz	B:I:M:	ICT4EVEU and Economic
07	28/05/12	LI	TECNALIA smartCEM	Chapter 2.3: CIPs high level common indicators
08	28/05/12	GA/AP	CTAG/MOBI.Europe	MOBI.Europe, suggestions, format
09	29/5/12	RK	DLR	Executive Summary and Conclusion
10	30/5/12	Zeljko Jeftic, LI	ERTICO, TECNALIA	Executive Summary and rest of document
11	30/5/12	GA/AP	CTAG/MOBI.Europe	Format revision
12	1/6/2012	GA/AP	CTAG/MOBI.Europe	Format revision

CIP Projects list of deliverables

CIP Project	Deliverable	Deliverable title	Dissemination level
ICT4eveu	D1.4	List of indicators for success evaluation	PU
mobi europe	D1.5	Common CIP Projects indicator	PU
molecules	D5.1	Electromobility common set of indicators	PU
smartCEM	D6.2	Agreed set of indicators	PU

Table of Contents

CIP Projects list of deliverables **3**

Table of Contents **4**

List of figures **5**

List of tables **5**

Executive Summary **6**

1 CIP individual evaluation objectives **7**

1.1 ICT4EVEU 8

1.2 MOBI.Europe 10

1.3 MOLECULES 12

1.4 SmartCEM 15

2 FESTA: CIP Preparing phase **18**

2.1 CIP preparing phase 18

2.2 From Research Question down to Measures 19

2.2.1 ENVIRONMENT Research Question 19

2.2.2 TRANSPORT AND MOBILITY Research Questions 20

2.2.3 USER UPTAKE Research Question 21

2.2.4 ECONOMIC Research Question 22

2.3 CIPs high level common indicators 23

3 Conclusion **27**

List of figures

Figure 1. Map with de different pilot sites ……………………..…………………………………..….6

Figure 2. Integrated approach in MOLECULES..13

Figure 3. MOLECULES Pilot Sites 14

Figure 4. Pilot sites of smartCEM 17

List of tables

Table 1. Comparative list of the different pilot sites ……………………..……………………. 6

Table 2. Environment Hypothesis 19

Table 3. Transport and Mobility Hypotheses 20

Table 4. User Uptake Hypotheses 21

Table 5. Economy Hypotheses 22

Table 6. CIP High Level Indicators..25

Executive Summary

As identified in the ICT PSP Work Programme 2011, the aim of the four pilots is to contribute to a pre-deployment and wider uptake of smart connected Electro-Mobility as a radical departure from today's transport system towards lower carbon emissions. The Pilot actions will test urban and inter-urban ICT services that facilitate and enhance the user experience of electrical vehicles. The work programme also highlights the following expected impacts:

- Contributing to the European goal of creating a sustainable transport system with lower carbon emissions, in particular through the development of European Smart Connected Electro-Mobility;

- Developing tools for measurement, monitoring and assessing carbon emissions from the Electro-Mobility sector;

- Contributing to meeting Europe's energy efficiency targets for 2020.

Within the Competitiveness and Innovation Framework Programme (CIP) «ICT PSP ElectroMobility pilot harmonisation» several expert working groups were originated in order to coordinate and synchronise activities and efforts between the participating projects ICT4EVEU, MOBI.Europe, MOLECULES and smartCEM. Evaluation representatives of those projects were invited to discuss and define high level research questions, hypotheses, performance indicators and corresponding measures and methods for electro mobility impact assessment in the “Evaluation” working group. The first outcome of the discussions of this working group is reported with this deliverable. It gathers a starting set of high level common indicators classified within an agreed set of evaluation categories, i.e. *Environment*, *Transport and Mobility*, *User Uptake* and *Economic*.

The present document is divided into a number of sections in order to introduce the evaluation objectives together with the high level common indicators for the different CIP projects foreseen, i.e. ICT4EV, MOBI.Europe, MOLECULES, smartCEM. As the four projects are integrated into the FOT-Net support action framework as pre-deployed pilot projects, the FESTA methodology and terminology has been used in order to achieve a harmonised evaluation approach in terms of indicator descriptions and definitions.

This deliverable is not intended to be the final set of indicators, but rather the best starting point based on current discussions, knowledge and experience. It is expected that the indicators in Table 6. will be improved and refined during the course of the project. However it is also expected that the high level indicators remain most stable, while project specific indicators will be derived and more focused and detailed in course of the project. The exchange of ideas and experiences between the projects is expected to be of particular importance for identifying indicators that represent the "best-in-class" since it will be possible to assess the use of these indicators from different perspectives. The set of common CIP indicators will ensure the effective use of resources in the projects and the comparability of measures in order to fulfil CIP goals.

1 CIP Individual Evaluation Objectives

Figure 1. Map with the different pilot sites

Table 1. Comparative list of the different pilot sites

CIP Project	Pilots	CIP Project	Pilots
ICT4EVEU	Bristol (UK) Vitoria/Pamplona (ES) Ljubljana/Maribor (SI)	molecules	Barcelona (ES) Berlin (DE) Paris (FR)
mobi europe	Portugal (PO) Irland (IR) Galicia (ES) Amsterdam (NL)	smartCEM	Barcelona (ES) Gipuzkoa- San Sebastian (ES) Newcastle (UK) Turin (IT)

1.1 *ICT4EVEU*

ICT4EVEU is a project born with the aim of deploying an innovative set of ICT services for electric vehicle (EV) in different and complementary pilots across Europe.

The scope of the ICT services is the integration of different Management Systems operating on the existing EV infrastructures in the cities where the pilots will be run, so that related services are deployed making use of these interconnected infrastructures (charging points, control centres and vehicles).

The main services for the users will be the reservation of charging points in advance, creation of an interactive map or charging points for drivers, review of charging reports, SMS notifications and communication with energy suppliers among others. The services will be accessed through website or/and via smart-phones.

TARGET USERS and THEIR NEEDS

Target users will be electric vehicle drivers, public and privately owned fleets and public transport systems. The pilot will support the interaction among different kind of vehicles: cars and vans, HGV's, motorbikes, bicycles, pedestrians and public transport system EVs.

Different needs have been identified:

UK pilot: the urban focus of the project bases the proposal into the need of more efficient transports for the commuters in the area of Bristol. EVs implementation is thought to be one of the solutions in terms of energy efficiency in the area. Bristol needs an interconnected and fast charging infrastructure to sort out their problems.

Interurban pilot: the connection of neighbouring regions, with an important flow of traffic as Vitoria and Pamplona, requires real interconnectivity services for the EV users, as well as the existence of roaming/billing services among the companies managing the infrastructure.

Transnational approach: the creation of a real connectivity corridor among two major towns in a country requires an upper scale of interconnectivity of the infrastructures, as well as a scalable design to export the solutions adopted out of the country (Austria). The international interaction requires a higher level of integration among services and infrastructures.

SERVICES

Every pilot will include different integrated services. According to each city, the following list summarises the services that will be included per target group:

For **drivers in all pilots**: Monitoring of the location and use status of charging points via web, specific hardware devices and/or smartphones, reservation of charging points in advance, integration of payment methods for users as there are different depending on the energy policy of each of the cities.

For the **energy management companies**: creation of an interconnected network of charging points, monitoring of the network status (in-use status, energy pricing, car location, charging points usage, etc.) thanks to the creation of a General Management System (GMS), cross-billing services among Energy managers as the users will use non location-based charging points and their energy provider needs to be able to invoice them (focused in Spain and Slovenia-Austria only).

For the **technology and related experts**: development of new products integrating the required elements to support the services intended (conversion of non-connected charging points to interconnected ones, etc.) and the standardisation of different instruments within the infrastructures of the pilots (charging points, communications standards, charging methods, software protocols, etc)

For the **public administration**: Pamplona will perform economic & environmental impact studies on the use of e-bus in the local transportation system. Vitoria, as the European Green Capital 2012, will develop a rental service of electric vehicles for the citizens. Bristol will be focused in the creation of a unique “travel card” allowing to pay different modes of transport, parking and charging. Slovenian energy managers will be using the interface provided by the Office for Climate Change in the country, supporter of the project, and integrating it with their systems.

For the **stakeholders:** a verification tool of unique identification for EVs, charging stations and EV users/owners will be developed. This will allow unambiguous identification needed for purposes as for instance international roaming, European interactive map of charging stations, international billing & clearing, international cross country navigation, etc.

IMPACT

The following technologies and applications will be evaluated:

Charging points: different charging points will be adapted in the project in order to create the integrated network in the pilots. Among them there are models with RFID integration, others do not count with a communication system and others already have smart capabilities to develop the services intended for the project.

Electric vehicle devices / nomad devices / smartphones integration will be also an important part of the project. The users input will be registered thanks to the use of this kind of devices and its integration with the information from the vehicles.

General Management System (GMS) or Infrastructure Management Systems (IMS) for EV charging infrastructure will enable the charging infrastructure operators the control and maintenance of their charging stations farms. Data acquisition about each individual charging process is needed for technical, safety, and commercial reasons. These present applications will be upgraded in the way to enable data exchange with the superior portal for EV users (front end).

Portal application for EV users (front end): The creation of a front end gathering all the information coming from vehicles and charging points will be the base for the majority of the services involved in the pilots. The portal will provide data also for mobile applications.

Unique identification verification tool: The creation of such tool is essential for automatic data exchange among different ICT systems. Experience from best practices, present standardisation of equipment and communication protocols will be taken into account in order to define state-of-the-art ontology and attributes.

1.2 MOBI.Europe

The MOBI.Europe project promotes the **full integration and interoperability of a cloud of ICT applications associated with electro-mobility**. It will bring together four electro-mobility initiatives that are been implemented in Portugal, Ireland, Amsterdam (The Netherlands) and Galicia (Spain).

MOBI.Europe will be capable of delivering comprehensive and innovative solutions to foster electro-mobility among European citizens. The Project aims to integrate these four initiatives, generating additional mobility services in benefit of the EV user.

Main features of MOBI.Europe are:

Make the **user more comfortable to use EV** beyond the limits of “range anxiety” by providing EV users with **universal access to an interoperable charging infrastructur**e independent from its energy utility and region,

Promote energy-efficient mobility services through a seamless integration with the transport system and with the EV ecosystem,

Contribute to the standardization and openness of the EV ecosystem through a **System of Systems (SoS) approach** establishing open interfaces between the different systems and stakeholders,

Establish the management interface between the EV infrastructure and the electric grid, taking benefit of this information to create a **more reliable and efficient end-to-end energy system**,

Make GHG emissions visible to the user, to the community and to the authorities, and encourage them to act on this information.

TARGET USERS and THEIR NEEDS

Central targets are the **electric vehicles users**. In an urban environment, these need to have real time information about availability of charging stations, associated parking and functionality of the charging management system. Also, effective EV introduction into urban metabolism will depend on the possibilities of smart charging. In the future, EV will be crossing borders in Europe; ICT applications will have to guarantee roaming functionality to allow drivers to have access to charging services electricity from suppliers operating in other countries. And in view of decarbonisation of road transport, drivers should also be able to track the carbon footprint associated with their mobility. Although the main focus is the EV user, MOBI.Europe will also look at other stakeholders, like grid companies, utility companies and service providers. The services piloted in MOBI.Europe will give good opportunities for new parties to enter the market and for existing players to optimize their services.

SERVICES

ICT applications for electro-mobility need to guarantee their interoperability and the smart integration of Electric Vehicles (EV) into the transport and energy systems. They also need to contribute to a wider adoption by users through the availability of dedicated services that facilitate and enhance user experiences. MOBI.Europe will test urban, interurban and cross-border ICT services. It will also test services for real time information on the charging infrastructure, services that allow for roaming between different electric mobility operators and electricity retailers, services dedicated to smart managing of EV charging, services for vehicle sharing, and services that allow for the smart and efficient integration of EV in the urban metabolism.

USAGE

Final users will have **multiplatform access** to the services, enabling real-time interaction between the driver, the vehicle and the transportation and energy infrastructures in a comprehensive but seamless information environment. Grid companies, utility companies and all kind of service providers will use the system as a means to promote their services. They will be able to have access to real time management information through the integration of the MOBI.Europe system with their own proprietary management systems. Electricity system operators will be able to harness the benefits of smart charging which will ensure that the charging of EV will have a net positive impact on the grid by providing ancillary services and reducing the need for cycling of base load plant.

SUSTAINABILITY

MOBI.Europe relies on four on-going electro-mobility initiatives partnered with private companies that are actively looking for offering services associated with sustainable mobility. If acceptance is high and EV deploy fast, the end-user will be a client of a dedicated service with guaranteed quality and running costs that are much lower than conventional internal combustion engine vehicles.

IMPACT

MOBI.Europe will contribute to achieve the objectives of the ICT PSP Work Program 2011 implementing the common goals of innovation, energy conservation and reduction of GHG emissions through electro-mobility. MOBI.Europe will focus its efforts on generating additional mobility services in benefit of the EV users based on:

- Providing EV users with universal access to an interoperable charging infrastructure.

- Promoting energy-efficient mobility services through ICT applications.
- Creating a more efficient end-to-end energy system.
- Increasing the use of electricity from renewables.
- Decreasing CO2 emissions and making them visible to the users, to the community and to the authorities through a new set of ICT applications.

1.3 MOLECULES

MOLECULES is a demonstration oriented project, with three large scale pilots in Barcelona (ES), Berlin (DE) and Grand Paris (FR) aiming to use ICT services to help achieve a consistent, integrated uptake of Smart Connected ElectroMobility (SCE) in the overall framework of an integrated, environmentally friendly, sustainable multimodal mobility system.

CHALLENGE and OBJECTIVES

Electric Vehicles (EV) is an important part of the response to these challenges, but in order to become a successfully deployed option there is a need of coordination between the recharging infrastructure, the EV and the overall mobility schemas of a city or interurban road network.

Key questions are:

- How can we integrate EV smoothly and consistently in the overall mobility system?
- How can we optimize the energy used/emissions generated per passenger transported?
- How can we make operational new business models which will be required for the successful deployment of EVs?
- How can ICT services contribute to the long term sustainable success of EVs?

MOLECULES addresses these challenges by:

- Enhancing EV user experience through the evolution and adaptation of seven categories of ICT services (personal trip planning, EV sharing/pooling, recharging advisor, carbon footprint advisor, billing support, incentives and network strategies), integrating them on an open architecture enabling SCE.

- Enabling interoperability of SCE with multiple transport and grid infrastructures.
- Supporting and contributing to standards on ElectroMobility, ITS and grid.
- Executing three large scale pilots in flagship European sites.
- Measuring thoroughly the project impact in terms of - among others - emissions reduction, considering the source of the electric energy used in the pilots.
- Preparing a roadmap to facilitate large scale deployment of SCE.

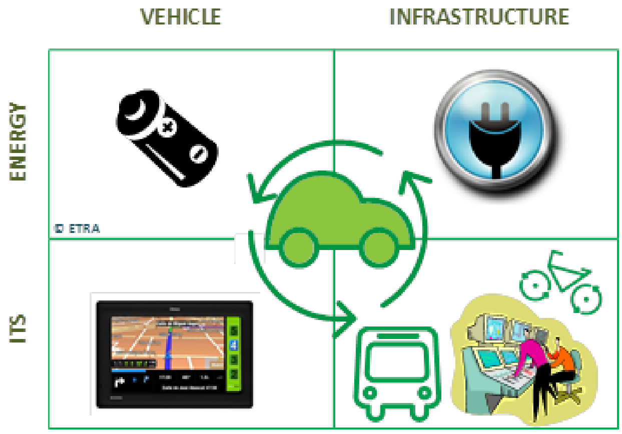

Figure 2. Integrated approach in MOLECULES

IMPLEMENTATION and PILOTS

Setting the basis for uptake and deployment of SCE through a number of large scale pilots requires the evolution and integration of a number of diverse and innovative systems, ICT services and mobility offers in order to assess effectiveness, user acceptance and operational feasibility. The user’s mobility experience must be enhanced whilst at the same time Greenhouse Gas emissions GHG are reduced.

MOLECULES will adopt an implementation approach which specifies a number of ICT services categories which should set a general, common standard of what should be understood across the three sites by each certain type of ICT service in the context of SCE, including e.g. stakeholders involved, input/output data, etc. This will set a common ‘high level language’ which will facilitate interaction among services and the cooperation across sites, both in terms of ‘legacy’ ICT services and newly deployed ones.

The project proposes a user-oriented strategy where the common beneficiary of most of the services is the citizen. Considering this approach, the four main elements involved in ElectroMobility would be (i) the users, (ii) the EV, (iii) the infrastructure (transport and energy) and (iv) the authorities and operators.

MOLECULES will integrate car sharing schemes within the traditional transport solution to enhance the users experience with electric vehicles and to foster multi-modal mobility options.

In Barcelona, MOLECULES will integrate three different experiences: the sharing e-bikes schemes, the deployment of electrical fleets for urban maintenance of public services, and the offer of e-bikes and joint public mobility services to city visitors.

Grand Paris pilot will demonstrate that it is possible to integrate and complete the existing network transportation of an extended metropolitan area adding some environmental value with local car pooling, car sharing and intermodal experiences and especially in Marne la Vallée the cluster of the sustainable city of Le Grand Paris.

Figure 3. MOLECULES Pilot Sites

IMPACT

- The pilot sites in MOLECULES will strongly contribute to the EU objectives of improved energy efficiency, emissions reduction, and comfort and sustainability of transport.
- Improve seamless, cost-efficient accessibility to mobility.
- Reduce GHG emissions and increase the share of renewable energies - expect to reduce GHG emissions by up to 73000 Tons within the project duration.
- Improve Europeans citizens' quality of life by offering a safer, healthier, more accessible, more convenient and more environmentally friendly ICT supported ElectroMobility system.
- Foster economic growth by decreasing dependency from oil and offering savings in personal mobility.

1.4 SmartCEM

The smartCEM pilot aims to demonstrate the potential for electric vehicles (EVs) in urban and inter-urban context and to encourage their station management, EV sharing management) uptake through advanced and heterogeneous mobility services (EV navigation, EV efficient driving, EV trip management, EV charging.

Through the integration of information and communication technologies and electro mobility, smartCEM intends to increase the awareness of electro mobility and encourage the use of EVs as part of everyday life.

OBJECTIVES

SmartCEM aims to achieve the following objectives:

- prove that user acceptance of electric vehicles can be increased by at least 15 % thanks to smartCEM services;
- evaluate to what extent transport efficiency can be optimised;
- develop tools for assessment and evaluation of the impact on CO2 and improve acceptance of electro mobility;
- identify barriers and address all deployment elements;
- support pan-European interoperability;
- increase adoption of electro mobility in all types of road transport;
- support integration of new schemes and develop of business models;
- provide information about the smartCEM services experiences.

SERVICES

The smartCEM project aims to achieve the above mentioned objectives through five complementary services:

1. *EV navigation* starts from eco-navigation and integrates EV-related points of interest (POIs) such as charging points or charging stations.
2. *EV efficiency driving* is intended to support energy-efficient driving styles.

3. *EV trip management* starts from existing multimodal journey planning systems and provides a new management system that includes EV sharing as a transport option.

4. *EV charging station management* will include station operation, station energy management, power supply status, range estimator, charging point booking, payments and scheduling.

5. *EV sharing management* starts from existing online and off-line systems for vehicles.

TECHNOLOGY CONCEPT

SmartCEM uses a combination of technologies that can be used for gathering the data needed to evaluate the indicator(s). The hardware architecture will be based on the following components:

- on-boards units: a bidirectional on-board system, which is connected to the vehicle CAN bus and manages all internal and external data (from the back office);

- back office platform: general management system that controls all vehicles, charging spots, energy and commercial transactions;

- web interface: to give users access to electro mobility management and booking systems;

- nomadic devices: whose use will also be studied and proposed as an alternative flexible media.

The software architecture will be based on standards like web services (SOA, XML, WSDL, SOAP protocol). Standard communication channels such as GSM/UMTS will also be used and technologies like 5.9 GHz–M5 will be studied and proposals made for their use.

It is also planned to gather data for the qualitative indicators by means of interviews and questionnaires as well as focus groups.

SUSTAINABILITY

Each test site has a balanced consortium, in which private companies are already running electro mobility services or commercialising management systems. These companies will integrate the services in their solutions and provide their facilities and channels for commercialisation, which will ensure the future sustainability of the solutions.

IMPLEMENTATION

The smartCEM services will be implemented and operated in four European pilot sites using different types of vehicles and practices:

Barcelona will focus on motorcycles.

Gipuzkoa will combine urban and interurban car-sharing facilities and a hybrid bus in the capital (San Sebastian).

Newcastle will develop the use of existing EVs assigned to the public.

Turin will combine delivery vehicles and car-sharing practices.

Figure 4. Pilot sites of smartCEM

IMPACT

smartCEM will seek to facilitate smart, sustainable and inclusive growth by accelerating the wider uptake of smart connected electro mobility in the form of electric vehicles, powered two-wheelers and road-based public transport.

Specifically, smartCEM will develop electro mobility ICT services that facilitate and enhance the user experience of electric vehicles. In doing so, it will address the relatively slow uptake of ICT in the public sector and the lack of interoperability of ICT solutions across Europe.

smartCEM particularly focuses on a key societal challenge — that is, sustainable mobility — and will help society achieve a radical departure from today's internal combustion engine (ICE)-based transport system towards a more sustainable future with lower carbon emissions from the transport sector.

2 FESTA: CIP Preparing phase

2.1 CIP preparing phase

Methodology

Based on the FESTA framework, the given CIP methodology is going to address general research questions, hypotheses and corresponding performance indicators applicable for all four CIP demonstration projects. So, the following considerations are related to four main evaluation categories that have been derived from FESTA methodology paying special attention to CIP demonstration aspects. Derived research questions and hypotheses are intended to be as CIP-general and common as possible – in order to make them directly applicable for all four CIP projects.

More project-specific research questions, hypotheses and performance indicators have to be defined within the individual CIP projects in parallel or in a later phase – when project objectives, use-cases or/and demonstrations are clearly defined and well described.

Main fields of CIP interests and, thus, general CIP evaluation categories are:

- *Environment:*

  The goal of this high level indicator, in the context of the CIP pilots, is to contribute to achieve the “20-20-20” objectives**:** 20% reduction in emissions, 20% renewable energies and 20% improvement in energy efficiency by 2020 Environmental category will assess the carbon emissions from the electro-mobility sector taking into account the origin of the electric energy and the charging events.

- *Transport and Mobility:*

  In the high level context of the CIP demonstration activities (projects) the main objective of this category is twofold: (i.) to substitute conventional car sharing trips by electric vehicle trips supported by (ii.) the promotion and highlighting of environmental advantages and easiness-to-use of electro mobility for daily routines in urban and sub-urban contexts.

- *User Uptake:*

  This category covers one of the main focus and outcomes of the call’s *Objective 1.3: Smart Connected Electro-mobility*, which is “the Pilot actions will test urban and inter-urban ICT services that facilitate and enhance the user experience of electrical vehicles”.

  User Uptake evaluation category is here defined as how drivers make use of the CIP pilot services, invest in them, trust and accept them. User uptake is hereby specifically related to aspects of the amount of knowledge and awareness about the intended impact of the implemented services and the compliance with the functions of the services. Additionally, usefulness and satisfaction with the services and usability/user experience are relevant influences on user uptake as well as trust in the impact and functionality of the services. Willingness-to-pay is also covered under the user uptake evaluation category.

- *Economic:*

  To enable the development of international business models it is necessary to ensure the financial flow between different operators. The system has to be designed based on technologies and management systems and they have evaluated. The most important evaluation is based on the usage.

2.2 From Research Question down to Measures

According to the "*Objective 1.3: Smart Connected Electro-mobility*", key research questions (RQ) have been identified for each of the evaluation categories. These RQs have been answered into a more specific and statistical testable Hypotheses (HY) following a top-down approach. In order to conclude if the HYs are successful (or not) a single or a set of Performance Indicators (PI) were chosen. The value of each indicator is based on certain measurements - subjective or objective – collected during system operation. These Measures will help to monitor and assess the foreseen evaluation categories, i.e. *Environment, Transport and Mobility, User Uptake and Economic*.

2.2.1 ENVIRONMENT Research Question

This category is one of the main targets in the Europe 2020 strategy. The high level category "Environment" will establish different measures to help to monitor and assess carbon emissions from the electro-mobility sector. These measures will be quantifiable for all four CIP projects and will answer to the main research question:

"To what extent can CIP projects/pilots ICT implementations **reduce CO2 emissions** of road transport systems?"

The following hypothesis in the environment category is foreseen within under the CIP projects scope:

Table 2. Environment hypothesis

Hypothesis Nº	Hypothesis description	Performance indicator
HY-ENV-01 – CO2 emissions	CIP projects/pilots ICT implementations will decrease CO2 emissions of road transport systems by **taking into account the origin of**	CO2 emission reduction (in %)

	the electric energy.	

This PI will evaluate CO_2 emission reduction from EV road transportation compared to the baseline (ICE road transportation) during years 2012, 2013 and 2014. This PI will be analysed taking into account different direct or derived measures, common for all CIP Projects:

Direct measures:

Charging time (hours): time that a user spends on charging vehicle batteries.

Charging duration (hours): required time to fully charge vehicle batteries.

Derived measures:

Energy mix (%): amount of energy consumed by road transport from renewable sources compared to energy consumed from primary energy as coal or fuel.

Charging volume (number): number of charging events and connections carried out in charging stations in a given time frame.

Charging process (number): number of charging events and connections taking into account the kind of the EV (car-sharing, public or private transport).

Aggregated road mileage performance: Number of CIE driven kilometres substituted by EV.

2.2.2 TRANSPORT AND MOBILITY Research Questions

The most important aspect to be considered within the high level category “Transport and Mobility” is a significant and measurable substitution of conventional car sharing trips by electric vehicles (EV) or alternative transport modes as public transport, cycling or walking, and the promotion and support of electro mobility as an alternative also for daily routines for both private and business purposes within urban and sub-urban environments. The Transport and Mobility research question is valid and the progress has to be quantifiable for all four CIP projects.

Within the category “Transport and Mobility” the following research question is to be answered:

“To what extent can CIP projects/pilots ICT implementations ***contribute to the integration of EV-sharing*** *into road transport systems?”*

Table 3. Transport and Mobility hypotheses

Hypothesis Nº	Hypothesis description	Performance indicator
HY-T&M-01 – Modal-share	CIP projects/pilots ICT **implementations** will reduce the	Modal-share (trips per mode in %)

change	modal share of CIE trips by increasing the modal share of EV trips	
HY-T&M-02 – EV penetration	CIP projects/pilots will increase the **penetration rate** of incorporated EV at selected demonstration sites	Penetration rate (number of incorporated EV in %)

As listed performance indicators cannot be measured directly the following measures are to be applied:

HY-T&M-01 – Modal-share change

Required measure:

Number of conventional car trips replaced by EVs. (self-reported)

Derived measure: km driven with EV rather than conventional cars

HY-T&M-02 – EV penetration

Required measure:

Number of incorporated (taken into account by CIP services) EVs

Fleet size

Derived measure: Number of EV bookings replacing bookings of conventional cars

2.2.3 USER UPTAKE Research Question

The main research question the CIP projects want to answer in the user uptake category is:

"To what extent can the EV-sharing schemes of the CIP pilots enhance the user uptake of electrical vehicles?"

The following hypotheses in the user uptake category are foreseen within under the CIP projects scope:

Table 4. User Uptake hypotheses

Hypothesis Nº	Hypothesis description	Performance indicator
HY-USER-01	EV-sharing schemes of the CIP pilots will increase **user acceptance of EV**	User acceptance, in %
HY-USER-02	EV-sharing schemes of the CIP pilots	Willingness to pay, in %

	will increase **willingness to pay**	
HY-USER-03	EV-sharing schemes of the CIP pilots will increase **user awareness**	User awareness, in %

The previous descriptions on the hypothesis can be viewed as high level hypotheses that will need to be specified further at a larger stage in the CIP projects, when more information is available. Further on in the process, as it gets clearer what scenarios are foreseen, additional and more detailed hypotheses will be formulated for the user uptake validation category. Then, the feasibility of testing the new hypotheses needs to be assessed, in terms of needed data logging and data analysis efforts.

The performance indicators dealing with user uptake listed above are derived from subjective data coming basically from questionnaires. It is assumed that the high level hypotheses addressed by this set of subjective data are common for all CIP projects; therefore it is foreseen to have a single harmonized questionnaire.

2.2.4 ECONOMIC Research Question

The most important infrastructure of electric vehicles (EV) is the possibility of charging the vehicles. This infrastructure is normally set up by local operators that operate the charging system. Normally the users can only access the systems were they are enrolled. The local, commercial or public service, business models may differ between the enclosed participants and are a specific part of the projects. These local business models are individual pilots under specific political or commercial environments and cannot be evaluated themselves.

Nevertheless, from economic point of research, it is necessary to evaluate international economic structures including the wide accessibility to charging points, the usage of systems in different locations and the money flow including the financial revenue clearing structures. With the research results in this area the (inter-)national business of charging EV can be structured and developed.

The following hypotheses in the economic category are foreseen within under the CIP projects scope:

Table 5. Economy hypotheses

Hypothesis Nº	Hypothesis description	Performance indicator
HY-ECON-01	CIP projects/pilots EV-sharing schemes are used for **charging cars** by users from different pilots.	Number of successful or failed roaming sessions from users including technical details and problems
HY-ECON-02	CIP projects/pilots show the **cooperation of the operators**	Number of successful or failed roaming sessions and the

	including the clearing activities.	clearing processes including the analysis of problems

The performance indicators dealing with economic are analysed from the operator's data on the different pilots. It is again assumed that the high level hypotheses addressed by this set of data are common for all CIP projects; therefore it is foreseen to have common indicators mainly based on quantitative data of the charging cases.

2.3 CIPs high level common indicators

The following table summarises and briefly describes the common indicators foreseen for all CIP projects. This list can be viewed as high level indicators that will need to be specified further at a larger stage in the CIP projects, when more information is available. Further on in the process, as it gets clearer what use cases are foreseen, additional and more detailed test cases will be formulated for the CIP projects. Then, the feasibility of these proposed indicators need to be assessed, in terms of needed data logging and data analysis efforts.

For each of the common indicators these parameters are given in table 6:

1. *Evaluation category*, which of the categories defined in page 17 covers the objective of the indicator.
2. *Common indicator title*, name of the indicator that intuitively describes its purpose.
3. *Type of indicator*, whether the indicator is subjective (for instance: self reported measure) or objective (directly measured by a sensor, for example).
4. *Type of data*, whether the data is quantitative or qualitative.
5. *Required measures* needed to obtain the value of the performance indicator.
6. *Type of measure*, as foreseen in FESTA methodology, measures can either be the following:
    - Direct/Raw measure: it is logged directly from a sensor, without any processing before saving the data to the log file, whether the data is quantitative or qualitative.
    - Derived or pre-processed measure: it is not directly logged from a sensor, but either a variable that has been filtered,
    - Event or singularity based on direct and/or derived measures, or on a combination of those

- Self reported measures which are gleaned from questionnaires, rating scales, interviews, focus-groups, or other methods requiring introspection on the part of the participant.

Table 6. CIP High Level Indicators

Evaluation category	Common indicator title	Type of indicator	Type of data	Required measures	Type of measure
ENVIRONMENT	CO_2 emission reduction, in %	Objective	Quantitative	Energy mix	Derived
				Charging time	Direct
				Charging duration	Direct
				Charging process	Derived
				Charging Volume	Derived
				Aggregated road mileage performance	Derived
TRANSPORT & MOBILITY	Modal share, in %	Objective	Quantitative	Number of CIE car trips replaced by EV	Derived
	Penetration rate, in %	Objective	Quantitative	Number of incorporated CIP services by EV	Derived
USER UPTAKE	User acceptance	Subjective	Qualitative	Easy of use	Self reported
				Satisfaction	Self reported

Evaluation category	Common indicator title	Type of indicator	Type of data	Required measures	Type of measure
				Usefulness	Self reported
				Trust	Self reported
				Compliance	Self reported
	Willingness to pay	Subjective	Qualitative	Willing to pay	Self reported
	User awareness	Subjective	Qualitative	Knowledge	Self reported
				Usage	Self reported
ECONOMIC	Roaming charging processes of users	Objective	Quantitative	Number of charging processes	Derived
	Roaming charging processes of operators	Objective	Quantitative	Number of clearing processes	Derived

3 Conclusion

With the present deliverable a first set of common CIP indicators for high level ElectroMobility impact assessment is designed and reported. The deployment of ICT technologies in EV should provide significant opportunities to reduce GHG emissions. The measures developed in this document, taking into account the FESTA methodology, will help the EC to make significant decisions in its target for EU 2020 related to the GHG emission reduction, the increase of renewable energy resources and energy efficiency.

The reported set of indicators will be applied within the evaluations of pilot implementations and services of the four CIP projects in a rather global CIP scale. Following the FESTA methodology the indicators have been deduced from general CIP research questions and hypotheses. For more specific considerations of particular project targets high level indicators may be supplemented and further detailed by a variety of (low level) project specific indicators which will reflect the specific orientation and research questions of the project.

However, the fruitful cooperation within the evaluation expert working group will be continued to further discuss the applicability and measurability of defined indicators on one hand and the exchange of project specific low level indicators on the other. Besides that, the coordination between the CIP projects within the expert working group on evaluation will also help to define methods and best-practices for impact assessment and its later implementation during the evaluation phase by for instance designing and applying one common user questionnaire.