eCo-FEV combining infrastructures for efficient electric mobility

D502.4 Exploitation plan

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Authors

Lan Lin	HIT
Massimiliano Lenardi	HIT
Maria Paola Bianconi	CRF
Roberto Tola	CRF
Daniel Roiu	CRF
Luca Bellino	Tecnositaf
Caterina Rittà	Tecnositaf
Fikret Sivrikaya	TUB
Paolo Bargero	BLU
Wolfgang H. Schulz	IERC
Sarah Metzner	EICT
Bruno Dalla Chiara	BLU

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Contact information

Coordinator
Dr. Massimiliano Lenardi
Hitachi Europe Limited

955 route des Lucioles “Ecolucioles B2”
06560 Valbonne Sophia-Antipolis France

phone: +33 (0)4 89 87 41 00
e-mail: Massimiliano.Lenardi@hitachi-eu.com

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Summary

The current deliverable reports the eCo-FEV project outputs as well as exploitation plan of the identified project outputs. In addition, the "Exploitation Plan" includes a high level analysis of potential eCo-FEV roadmap based on the outputs from partners. This roadmap is inputted to potential business model study (D502.3 "Potential Business Model") for more detailed analysis.

1 Introduction

The objective of the eCo-FEV project is to develop a cloud-based cooperative E-Mobility platform interconnecting with multiple relevant infrastructure IT systems. Thanks to collection and processing of data from multiple infrastructure systems such as road operator IT infrastructure, charging infrastructure, public transport infrastructure etc., the eCo-FEV platform enables service operators to provide real time smart mobility services to FEV users, allowing them to overcome range anxiety and therefore improve the user acceptance. In addition, the eCo-FEV platform also provides data processing services (e.g. FEV energy demand data) to these IT infrastructure operators, helping them to further improve infrastructure management efficiency.

The eCo-FEV consortium partners are constructed to cover main actors in the value chain of the eCo-FEV platform, including service provider, road operator, cloud platform provider, car manufacturers, charging infrastructure manager, energy trader and research institutes. Meanwhile, research challenges are also set by the project, in particular static and while-driving wireless charging and corresponding charging infrastructure management system. As consequence, the eCo-FEV project has produced a list of project outputs. These outputs range from research to close-to-deployment results. On the other hand, another main objective of the eCo-FEV project is to implement and contribute to the standardization activities, enabling the interoperability between E-Mobility infrastructure systems, and between infrastructure system and FEVs. It is the belief of the eCo-FEV consortium that such standard compliant development and standard dissemination activities will further accelerate the deployment of the eCo-FEV platform into smart mobility market.

The present deliverable presents the project outputs and the corresponding potential exploitation plan. It is organized as follows: chapter 2 gives an overview of the project outputs per project partner; chapter 3 describes the potential exploitation plan for each listed output in chapter 2; chapter 4 gives a high level summary of the project outputs and a potential roadmap is derived; chapter 5 concludes the present deliverable.

2 Overview of the eCo-FEV project results and perspectives

Table 2.1.1 below introduces a list of project outputs that are expected by eCo-FEV consortium partners. At first stage, architecture and use case design of the system enables partners to estimates such list, according to the agreed roles and responsibilities of partners.

Later on, in depth discussions and decision is made with regards to the partner's responsibilities for the development and integration of eCo-FEV systems. Meanwhile, business model development will further facilitate the detailed identification of project outputs by relevant partners.

For each result identified by partner, a further detailed overview and potential exploitation plan is provided.

Table 2.1.1: LIST OF RESULTS

No.	**Self-descriptive title of the result**	**Category A, B or C***	**Partner(s) exploiting the result(s) (referring in particular to specific patents, copyrights, etc.) & involved in their further use**
1	On board HMI touch devices for E mobility services	A	CRF
2	EV-CWD CRF Gateway	A	CRF
3	E-mobility services	A	TECSITAF
4	EV charging software and services	A	TUB
5	CWD technical and economic feasibility	A	BLU
6	E-mobility services (electricity supply)	A	Energrid
7	CWD Hardware	A	Polito
8	CWD on-road management SW	A	Polito
9	Advanced co-modal electro mobility services available on an operational technological platform	A	CG38
10	E-Mobility platform	A	HITACHI
11	E-mobility service, specification & implementation	A	Renault
12	Business model innovation	A	IERC, FACIT
13	Demonstration of the first heterogeneous 4G, 802.11p road deployment with electrical vehicles and IPv6	A	CEA
14	Research outputs on transport and CWD	A	Polito

15	Project management	B	EICT

* A: results usable outside the consortium / B: results usable within the consortium / C: non usable results

3 Impact and exploitation plan per result

3.1 Result 1: On board HMI touch devices for E mobility services (CRF)

3.1.1 Overview

During eCo-FEV project, several E-mobility services have been developed. Among these CRF developed the on board application and HMI interface for charging driver's assistance and dynamic routing towards the nearest charging spot.

CRF tested different graphic solutions for displaying information relating to the operation of a FEV taking advantage of the availability of a touch device and explored different solutions for monitoring and displaying the charge status of the FEV.

The HMI touch is the name assigned to an app running on a nomadic device (CRF used an Android based tablet, Samsung Galaxy Tab) which plays the following roles:

- FEV standard and electric signal acquisition, monitoring and visualization
- Charging process control
- Charging telemetry data gathering and dispatch to the eCo-FEV backend and, if required, also to third part modules
- Communication and data exchange in real time with other apps and/or services running on the same device

3.1.2 Impact

The major impacts from the HMI touch for E-mobility services will come from the ability to facilitate the EV driver in approaching EV services according to their functional specification. A friendly interaction with the charging systems and the information provided by routing application may increase EVs usage.

This result is expected to have also a positive impact on the mobility services market enabling third party providers to create a wide range of interoperable, value-added services, and applications for drivers and other road users and allowing road users to make use of the information provided by applications and to interact with them.

3.2 Result 2: EV-CWD CRF Gateway (CRF)

3.2.1 Overview

According to the Charge While Driving (CWD) architecture developed in the Italian test site of eCo-FEV project, the activation/deactivation of the energy transmission from the charging infrastructure to the EV is controlled by an RSU that communicates with an approaching vehicle. Both the RSU and the EV are equipped with a MK3 Cohda board enabling ad-hoc communication between communication nodes. CRF developed the CRF GateWay (CRFGW) application that implements a wireless IEEE 802.11p gateway that connects with the Controller Access Network (CAN) bus. Whenever a CAN message is generated from the vehicle/road side unit it will be intercepted by CRFGW application and it will be sent through wireless IEEE802.11p radio channel. On the other side whenever a MK3 station receives a wireless message it will forward it to its CAN module. These CAN messages exchanges are required to control the CWD charging process.

In addition to that the MK3 stations periodically send a broadcast informative message with vehicle's information. These informative messages are known as Cooperative Awareness Messages (CAM) following the ETSI standard (ETSI EN 302-637-02). They provide information of presence, positions as well as basic status of vehicle. The eCo-FEV application reads from a received CAM message: an identification ID and the position of the transmitting station. Knowing its own position the receiving station is able to calculate the distance between the two stations then it sends a CAN message following the specifications of the eCo-FEV application for charging operation control.

3.2.2 Impact

The major impact from the EV-CWD CRF Gateway will come from the capability to control wireless charging operation through wireless communication between Electric vehicle and infrastructure through IEEE 802.11p link. Moreover the developed solution adopt CAN Messages structure to exchange data between vehicle and infrastructure.

This result is expected to have also a positive impact for other charging methods and to create a wide range of interoperable applications independent from the adopted technological solution.

3.3 Result 3: E-mobility service (Tecnositaf)

3.3.1 Overview

One of the most important objectives of eCo-FEV project is to define the integration of the electric vehicles into road and IT infrastructure. In particular, from the Road Traffic Operator point of view, it is mandatory to specify and implement an infrastructure able to guarantee the eCo-FEV technical requirements in terms of networking structure, services, communication, application facilities and vehicle charging solution.

For the eCo-FEV system and use cases validation and evaluation, eCo-FEV plans to validate the services both in urban environments and highway situations in two EU countries (i.e. Italy and France), taking into account specific requirements and mobility needs of the different test sites.

With reference to the highway situations, it is important for the Road Traffic Operator to evaluate the effectiveness of the e-mobility applications and its potential impact on the traffic flow and traffic management strategies. For this purpose, Tecnositaf, with other partners' cooperation involved in these specific tasks, has specified and realized a test site where the eCo-FEV solution can be tested and technically validated.

3.3.2 Impact

The increasing market demand for electric vehicles implies the availability of a road infrastructure able to give the drivers "range confidence" that recharging is available and easily to be done also in the long distance trips.

Considering that the main objective of vehicle electrification is to provide drivers with best fuel consumption while maintaining or exceeding the performance and drive quality of conventional vehicles, the road infrastructure adaptation plays a role of primary importance.

The possibility of the eCoFEV project to implement an inductive charging system implies the long-term goal of a developing of an all-electric highway that wirelessly charges cars and trucks as they transit down the road.

The new technology has the potential to dramatically increase the driving range of electric vehicles.

3.4 Result 4: EV charging software and services (TUB)

3.4.1 Overview

The EV charging infrastructure software developed at TU Berlin consists of two main components: one running on the charging station and the other at the backend for Electric Vehicle Supply Equipment (EVSE) operators.

- The *Charging Station Control Unit (CSCU) software* serves for the technical management of a charging station; for authentication, authorization and accounting (AAA) functions; and for interfacing with the power electronics (PE) and the automatic number plate recognition (ANPR) camera.

- The *software for EVSE Operators* serves for interfacing with different charging stations over different protocols (SNMP, RADIUS, and OCPP v1.5) for monitoring, user management, and accounting on one hand, and interfacing with an e-mobility provider on the other.

The set of functionalities provided by these integrated software components, implemented at the CSCU and the EVSE-Operator, covers all the state of the art functionalities for the EV charging infrastructure. It is flexible enough to be adapted for any business model in the field of electric mobility, allowing roaming scenarios and different business role separations (Infrastructure provider, Distribution System Operator - DSO, Mobility provider, etc.).

3.4.2 Impact

- Contributing to the uptake of electric vehicles by improved accessibility to charging services;
- Contributing to the overall socio-economic impact of the e-mobility ecosystem e.g.job creation;

3.5 Result 5: CWD technical and economic feasibility (BLU)

3.5.1 Overview

BlueThink develops a feasibility study of the inductive charging system "Charge While Driving". This challenging technology that the consortium wants to investigate is very demanding and has considerable problems to solve. Our work aims to study the technical and economic feasibility of such system. By comparing the characteristics of the classical inductive charging systems will be outlined some guidelines for a possible deployment of the CWD.

3.5.2 Impact

The feasibility study of BlueThink will serve primarily as a reference for the business plan that will be developed at the end of the project. In addition, the information gathered will be of fundamental importance for the realization of the best charging systems compatible with the philosophy of eCoFEV, by affecting the choices of many stakeholders.

3.6 Result 6: E-mobility services (electricity supply) (Energrid)

3.6.1 Overview

Inductive charging is undoubtedly one of the most promising technologies for the enhancement of long-distance mobility. The extra-urban environment is of primary importance to enhance E mobility services resulting from the collaboration between electricity providers and infrastructure operators (i.e. highways concessionaires). Up to now most part of national funded projects related to the development of the charging infrastructure have been focused on urban mobility only, after the so called "distributor model". These initiatives are mainly based on traditional plug-in charging stations that may be simply considered as new devices to be installed on the existing distribution grid. From an energy trader point of view, the AS-IS scenario does not leave enough space for the development of new services and new business models, because it strictly depends on the ownership of the electricity network. In Italy the distribution service is only partially liberalized: the application of the "distributor model" affects the possibility to fully enhance the commercial offer coming from other operators, such as energy traders. Therefore new E mobility services will not be only boosted through the technical development but also through the improvement of the supporting legislative frame and the related incentive schemes.

Regardless of the current legislative limits, the most important result expected from the eCo-FEV project is the delivery to the infrastructure operator of the electricity supply service. From the trader point of view this will result in the enlargement of its customer's portfolio and in the development of new tariff schemes, according to the different charging needs. It must be underlined that this commercial offer needs the development – on the concessionaire's side - of its own business model supporting the delivery of charging services to final customers. At national level, the sale of electricity – even if liberalized – must be managed following some general rules: the most relevant one establishes that electricity can be sold to final customers only by operators certified as energy traders. Therefore the infrastructure operator cannot directly invoice the cost of electricity to its final customers, following the same method adopted by its electricity supplier. The costs of providing electricity to its final customers must be covered through tariff schemes based on other rationales, for example related to the concessionaire core business. As a consequence, a strong collaboration between the highway operator and the electricity supplier is needed to make economically sustainable the whole process of charging electric vehicles through the infrastructure.

3.6.2 Impact

The enhancement of a new business model for the provisioning of electricity to the charging infrastructure, beside the current "distributor model", may result in more competitive prices – on the energy trader's side - and in the need of innovative tariff schemes - both on the energy trader's side and on the infrastructure operator's side.

Coming to the specific case of EVs charging supported by highway operators, the invoice of the charging service will be likely included into the toll-payment. As a consequence, the electricity supply service will have to follow similar market principles usually applied to tolling facilities. The most impacting one might be the roaming service: the final customer will pay only once - at the end of his/her travel – for a charging service physically delivered by more than one infrastructure operator and energy trader. At the moment, the roaming facility applied to the toll payment is studied for supporting the change in the infrastructure operator. After applying the eCo-FEV technology, the roaming facility will have to be improved to manage not only the change in the infrastructure operator, but also in its/their energy provider(s). This might be a challenging issue considering that the correspondence between infrastructure operators and energy providers might not be necessary one to one. For example, different highway sections might be supplied by different energy providers, even if managed by the same operator.

An indirect impact of the eCo-FEV solution - enhancing extra-urban mobility – might be the need of providing electricity to remote areas. Renewable energy sources and distributed generation might represent the right solution to avoid new investments in the power grid. As a consequence energy suppliers might enlarge their commercial services managing at local level the electricity demand and the electricity offer, according to the principles of the micro-smart grids.

3.7 Result 7: CWD Hardware (Polito)

3.7.1 Overview

The structure for the CWD and the static wireless charging developed by POLITO consists of two parts: the on-road and the on-vehicle one.

The on-road (transmitting) structure is composed by:

- The insulation transformer used for guarantee the operators safety and the protection of the devices (only for the experimental test site);
- The AC/DC converter for the DC power distribution;
- Two DC/AC HF converters that supply the transmitting coils
- Five transmitting coils placed on the road surface and forming the CWD track
- One transmitting coil for the static wireless charge

The on-vehicle (receiving) structure is made of:

- The receiving coil structure placed under the vehicle floor and magnetically coupled with the transmitting coils on the road

- The HF AC/DC converter that manages the received power and provides the supply for the EV battery

The CWD structure provides all the operations for the wireless charging of the electric vehicle and the management of the communication with the CSCU software. It also manages the errors originated by safety issues or incorrect behaviour of the EV.

3.7.2 Impact

The CWD system allows eliminating the two principal drawbacks of EVs diffusion. In fact, the system helps to reduce the on-board battery capacity, reducing this way the vehicle cost and also mitigate the delay due to the vehicle stops for battery recharging. This aspect could have a strong impact on the economy creating new jobs, new productive activities and also contributing to eliminate the local emission of pollutants in populated areas improving the quality of life.

3.8 Result 8: CWD on-road management SW (Polito)

3.8.1 Overview

The system operation software of the CWD is based on the National Instrument sbRIO board. It manages the power electronics until the charge procedure is active, acquiring information about the state of the charging operations and communicates the information to the other element of the system. The programmed sbRIO has the ability to recognise messages coming from EV (CODA) and CSCU and to transform these messages in commands that modify the state of the power electronic.

The operative conditions, the possible error state and the related error variables could be monitored and downloaded through a user interface installed on a host PC.

3.8.2 Impact

- Contribution to the technical validation of the CWD technology.
- Contribution to the update of CWD technologies as long term objective.

3.9 Result 9: Advanced co-modal electro mobility services available on an operational technological platform (CG38)

3.9.1 Overview

Sustainable mobility requires developing new mobility modes as electrical mobility and co-modal mobility, enabling reducing traffic congestion to improve mobility safety, reducing travel times and reducing air pollution due to thermal vehicle traffic. Grenoble area is a particular area for demonstration of these solutions, considering the combination of important commuting due to economic activity, urban area density and narrowness of available space between mountains.

eCo-FEV project enables to deploy a pilot EV charging station site where advanced e-service could favour use of electrical vehicle possible combined with other mobility mode as express interurban buses or cycle. IT infrastructure enables to deliver advanced services.

eCo-FEV project enables the test and demonstration of advanced mobility services specifically dedicated for EV users, possibly with co-modal approach.

3.9.2 Impact

- Contributing to the uptake of electric vehicles by improved accessibility to charging services and to make easier and safer the travel;
- Contributing to the uptake of co-modal mobility
- Contributing to the overall socio-economic impact of the e-mobility ecosystem.

3.10 Result 10: E-Mobility platform (Hitachi)

3.10.1 Overview

E-Mobility platform (eCo-FEV back end sub-system) provides a technology neutral and service independent platforms to enable cooperative data exchanges with FEV and with relevant infrastructure IT systems, thanks to standardized data exchange interfaces offered by these infrastructure IT systems. The E-Mobility platform supports the following main functions:

- Communication support: functions that manage the communication with FEVs in mobility, and with different IT infrastructure systems. They enable collecting of data from FEVs and from different infrastructure systems that are required to realize E-mobility services from the cloud, as well as providing user request and E-mobility services relevant information to infrastructure operators in order to improve the infrastructure operation efficiency. In general, two way communications are often required. In addition, functionalities are required to support node mobility and roaming situation.

- Data management support: Functions that realize data storage, data management and data update for the platform, including user data, infrastructure data, traffic data etc. In addition, the E-Mobility platform also needs to manage the access right of data towards users and application providers.

- Application support: Functions that realize basic application functionalities, such as navigation route search between an origin and destination position pair, taking into account the battery status and charging infrastructure availability. These common functionalities may be provided to multiple application providers.

E-Mobility platform architecture is designed to be technology neutral and vendor neutral in order to be suitable for different deployment scenarios.

3.10.2 Impact

Contributing to the uptake of electric vehicles by improved accessibility to personalized dynamic navigation services, charging services and to make easier and safer the travel;

Enabling new business opportunities and new E-mobility services, proposing accurate real time navigation and routing support for FEV;

Enabling new business opportunities by proposing data aggregation and data processing functions in order to improve social infrastructure operation;

Enabling flexibility for different deployment requirements such as centralized vs distributed architecture, different level of access rights management, data exchange via standardized interfaces;

Enabling easy integration for application providers via open API and via application support functions such as route search, dynamic navigation etc.

3.11 Result 11: E-mobility service, specification & implementation (Renault)

3.11.1 Overview

The objectives of the eCo-FEV project are to simplify the usage of the Full Electrical Vehicles (FEVs) and to appease range anxiety related to the full electrical powertrain concept. To achieve these objectives the eCo-FEV proposes to play the role of facilitator between travelers and all operators participating in planning and realization of trips involving FEVs.

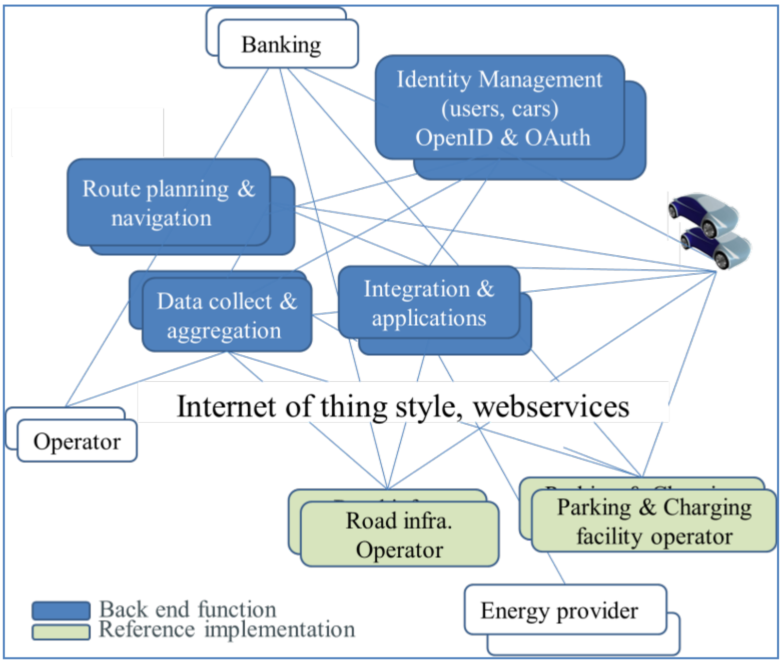

Figure 1: E-MOBILITY SERVICE

In other terms, the motivation of eCo-FEV project is to specify and to build the reference implementation of a backend based platform in order to provide high quality mobility services in different situations that may be encountered by FEV user in daily usage. Such backend mobility platform provides personalized dynamic navigation and trip assistance services for FEV users, thanks to multiple data collects and services delivered by various eCo-FEV operators.

One of the most important project proposed novelty concerns the eCo-FEV business model in which we separate the role of so called "identity provider" from that called "service provider". The "identity providers" are in charge of user subscriptions and CRM (Customer relationship management) and "service providers" deliver the services (e.g. charging or parking services) to the users recognized by eCo-FEV "identity providers". Some operators can play the both roles. Thanks to this approach we hope to limit the number of subscriptions the user has to accomplish and to simplify the payment processes.

3.11.2 Impact

The increasing market demand for electric vehicles implies the availability of standardized access to e-mobility services. The necessary IT standards have to be enough open to allow the implementation of different business models. Renault group wants to play different business roles depending on the business situation of the countries where the group operates. The roles can vary from the "eCo-FEV" compatible car seller to the "eCo-FEV" compatible car fleet operator.

Renault expects the eCo-FEV project to elaborate the global IT system model and the largely published interfaces between its components allowing the new operators to enter and develop the e-mobility service market. In particular Renault wants to make compatible its CRM and car services with the future eCo-FEV interfaces.

3.12 Result 12: Business Model Innovation: E-Mobility and ITS (IERC and facit)

3.12.1 Overview

The eco-FEV project enables a breakthrough in electric vehicles (EV) introduction by proposing a general architecture for integration of EV into different infrastructure systems cooperating with each other and by developing adequate business models.

The proof of functionality eases the introduction of EV´s similarly to urban and rural areas. The acceptance and the willingness of communities will be increased to integrate electric mobility in their development plans, because new mobility concepts with sustainable modal shifts to environmental friendly transport modes can be reached.

Introducing electric vehicles successfully will reduce both local and global emissions. The local emission reductions increase the quality of life, especially in urban areas and with that the urban planning process has a new possibility to increase the attractiveness of urban life. However, the overall concept guarantees that by integrating the rural areas in the infrastructure coverage no market barriers exist because of a low mobility range.

Establishing mobility solutions with fully electric vehicles contributes further to the overall competitiveness of the economy. Employment effects and productivity increases will be enabled, which will have positive effects to the economic growth. Creating a new infrastructure for electric vehicles increases the network density and the possibilities for technological spillovers are established.

3.12.2 Impact

Result clearly depends on further results within eCo-FEV, which are:

- E-mobility service
- CWD technical and economic feasibility
- E mobility services (electricity supply)

These results are an eminent input for the new theoretical approach of economic institutional role models. Traditionally, the implementation of E-mobility services follows the usual way of forming an operating company with the different stakeholders as shareholders. However, this kind of construction has inherent weaknesses, which result from the operational-organizational partner structure:

- Tendency to instability because short-term profit maximization hinders long-term oriented investments into new services, new infrastructure etc..
- Moral hazard and hidden action because each shareholder is more or less a (short-term) profit maximizing firm.

Therefore, the outcome of dependent results shows whether the new economic institutional role model approach is workable compared to the traditional operating company approach.

Further, the implementation of EV´s has a lot in common with the implementation of Intelligent Transport Systems (ITS) as both have similar shareholder, similar market barriers (for example externalities, subadditivity of costs, information failures due to asymmetric knowledge, legal barriers, risk aversion of management, bounded rationality of consumers). Furthermore, ITS and EV´s have significant indirect socio-economic effects (e.g. productivity, employment, GDP-growth) and direct (e.g. emission savings, efficiency gains). One of the most influencing factors is to provide a mature infrastructure, both for ITS and e-mobility. These analysed synergies can produce a powerful business model that can eventually put the gasoline-powered internal combustion engine out of business.

Additionally, the findings of eCo-FEV will importantly contribute to the multi-level perspective on social-technical transition. The multi-level perspective (MLP) is a middle-range theory that conceptualizes overall dynamic patterns in socio-technical transitions. “The analytical framework combines concepts from evolutionary economics (trajectories, regimes, niches, speciation, path dependence, routines), science and technology studies (sense making, social networks, innovation as a social process shaped by broader societal contexts), structuration theory and neo-institutional theory (rules and institutions as ‘deep structures’ on which knowledgeable actors draw in their actions, duality of structure, i.e. structures are both context and outcome of actions, ‘rules of the game’ that structure actions).”(Geels, 2002) eCo-FEV contributes to the transition towards sustainability.

3.13 Result 13: Demonstration of the first heterogeneous 4G, 802.11p road deployment with electrical vehicles and Ipv6 (CEA)

3.13.1 Overview

In recent published literature several studies demonstrate the potential benefits of connected vehicles. Applications ranging from on-board entertainment to traffic safety and emergency have been demonstrated in small and independent local settings. In some cases older cellular communication technologies were used (e.g. 2G, 3G) on the road, whereas in other cases 802.11p techniques have been used without TCP/IP. Few trials have demonstrated the combined use of cellular technologies and 802.11p on the road, and even less have involved protocols of the next-generation Internet – IPv6.

In the context of this project, a demonstration platform is planned on the CG38 site, which will need software development, hardware platform selection and configuration for roadside and for vehicle, as well as the construction of a local antenna system for the deployment of 802.11p. In addition, an external participant will provide a novel access technology (not yet sold to the public) for cellular connections using IPv6 over 4G.

Whereas the demonstration of the first heterogeneous 4G, 802.11p road deployment with electrical and IPv6 will be realized at the CG38 site, the CEA partner will deploy a similar software and hardware platform for vehicle and road-side, as well as an antenna pole and multi-standard system (802.11p, 4G, TNT/radio, GNSS) at the CEA Nano-Innov site in France.

3.13.2 Impact

Develop infrastructure and on-board networks for experimentation with the next-generation of protocols for vehicular communications.

3.14 Result 14: POLITO research output (POLITO)

For the involved areas of the Politecnico di Torino in the Engineering context (Electric/energy and transport systems), possible future outcomes might concern the research usual progress, related publications, educational aspects, educational contents and, according to a number of variables that are not foreseeable at present, commercial outcomes, which are anyhow outside academic interests and aims.

3.15 Result 15: Project Management (EICT)

EICT is a private-public partnership aiming at the promotion of ICT innovations. Expertise gained from the results of eCo-FEV will be used for consultancy and especially for advances in innovation management and the creation of new businesses.

EICT will approach the eCo-FEV activities using background experience while at the same time gaining more insight into electric vehicle innovative concepts. The knowledge and experience will directly flow into further elaboration of project management expertise.

EICT will make use of its wide network to support exploitation of the eCo-FEV results. This includes facilitating important contacts with stakeholders such as European and national projects, and experts from non-automotive application fields to increase the innovation impact.

4 Analysis

4.1 Economic background

The economic background is one important factor to be considered, by each consortium partner, when defining their exploitation plan with project outputs. Therefore, the economic background is indirectly reflected in the partners' exploitation plan of the present deliverable. In addition, study on the economic analysis of the eCo-FEV system is realized in D502.3 "Potential business model". The growth of the EV and the smart grid market are not being part of the Exploitation plan analysis.

Nevertheless, it is our belief that the introduction of the eCo-FEV platform may help to increase the user acceptance, thus facilitating to get access to the EV, and helping to stimulate the EV market growth. Meanwhile, the eCo-FEV system estimates the user energy demand in real-time basis. This information may be useful for energy provider for smart grid management. Therefore, these two aspects (EV sale growth, integration to the smart grid) are indirectly reflected in the Exploitation plan.

It is worthy noted that the overall economic slowdown may indirectly contribute to the delay of the large scale take-up of electric mobility in Europe. For example, based on a comparable market study realized in D502.3 with wireless services, it has been concluded that the economic situation is not significantly relevant in the market introduction phase and market growth phase of emerging markets, including e-mobility market. However, the market growth of e-mobility is impacted by factors such as oil prize, user willingness to pay, or national strategy or regulations etc. These aspects are dependant and impacted by the overall economic background and threfore may impact as well on the business potentials of eCo-FEV project outputs.

The joint effort of consortium members is focused indeed on contributing to the removal of some barriers that may lay behind such uptake delay, for example, lack of interoperable standards. It is the belief of eCo-FEV consortium that the interoperable standards is one pre-requisite to overcome the over-fragmentation of the e-mobility market (e.g. roaming between infrastructure, billing etc), which is also a key impacting point to the user willingness to pay and access to the e-mobility services.

4.2 Value chain and exploitation plan

The high level eCo-FEV value chain is illustrated in Figure 2. Currently, there is no joint Exploitation plan being identified between project partners. However, consortium members represent main stakeholders along the value chain of E-Mobility services. Therefore, the main effort is to check that the Exploitation plan of different partners should be consistent with each other to enable a realistic market instruction.

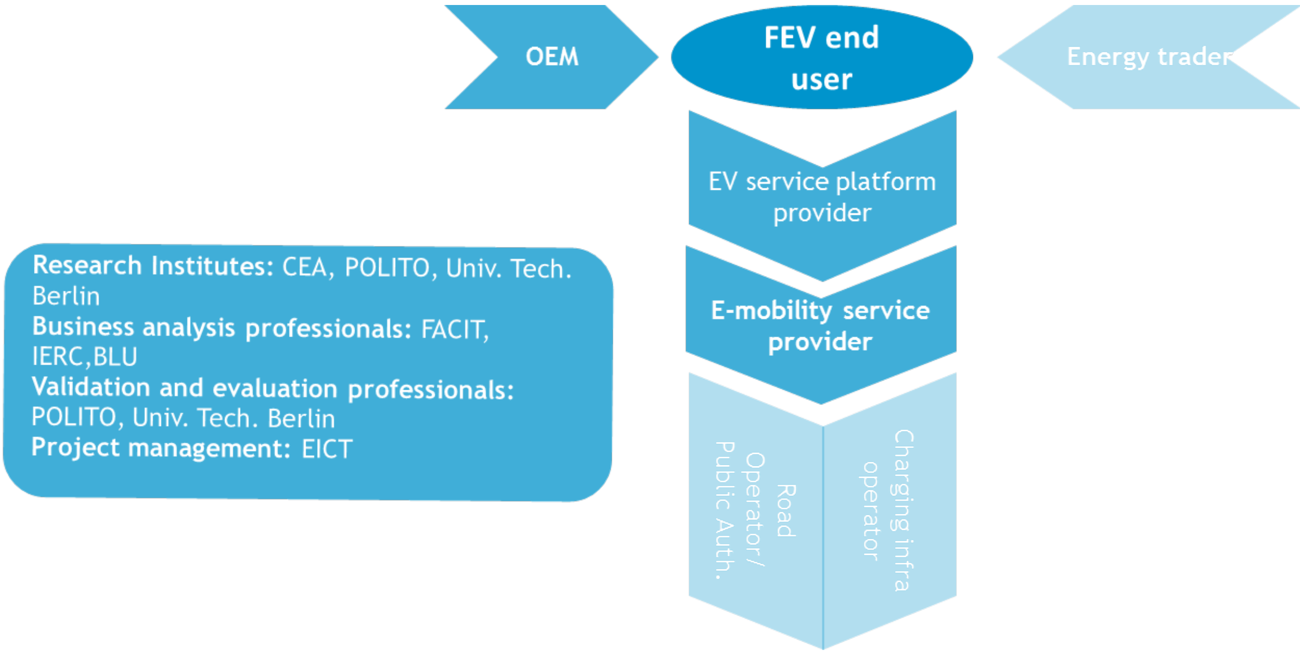

Figure 2: eCo-FEV value chain

4.3 Roadmap analysis

Figure 3 gives an overall summary of exploitation plan for all eCo-FEV partners as described in section 3. It classifies the project outputs into several technical components of the eCo-FEV E-Mobility platform e.g. on-board applications, charging infrastructure etc. In addition, the national strategy is not a technical component, nor a direct project output (marked as red text), but important factors mentioned by partners in the impact analysis.

These components are considered as main building blocks for cloud-based E-Mobility services provision, identified as main business target of the eCo-FEV system (end point of the eCo-FEV value chain as illustrated in Figure 2). Therefore, the roadmap of this business target is directly scaled by the roadmap of the building blocks, as illustrated in Figure 3. We can observe that according to eCo-FEV estimations, the pan-EU take up would be around 2020, mainly due to the difficulties encountered by the large scale deployment of charging infrastructures. As for charge while driving, it would remain at research phase for the coming years, until the technology is technically validated in terms of performance, liability, safety etc. On the other hand, it is clear that local implementations and small scale deployment are already in place mainly in urban environment of EU countries.

As mentioned in clause 4.1, this roadmap does not include EV and Smart Grid roadmap, also considered as key building blocks for E-Mobility. This is because these two aspects are not within the scope of the project. However, D502.3 "Potentail business study" includes some analysis of the EV market growth.

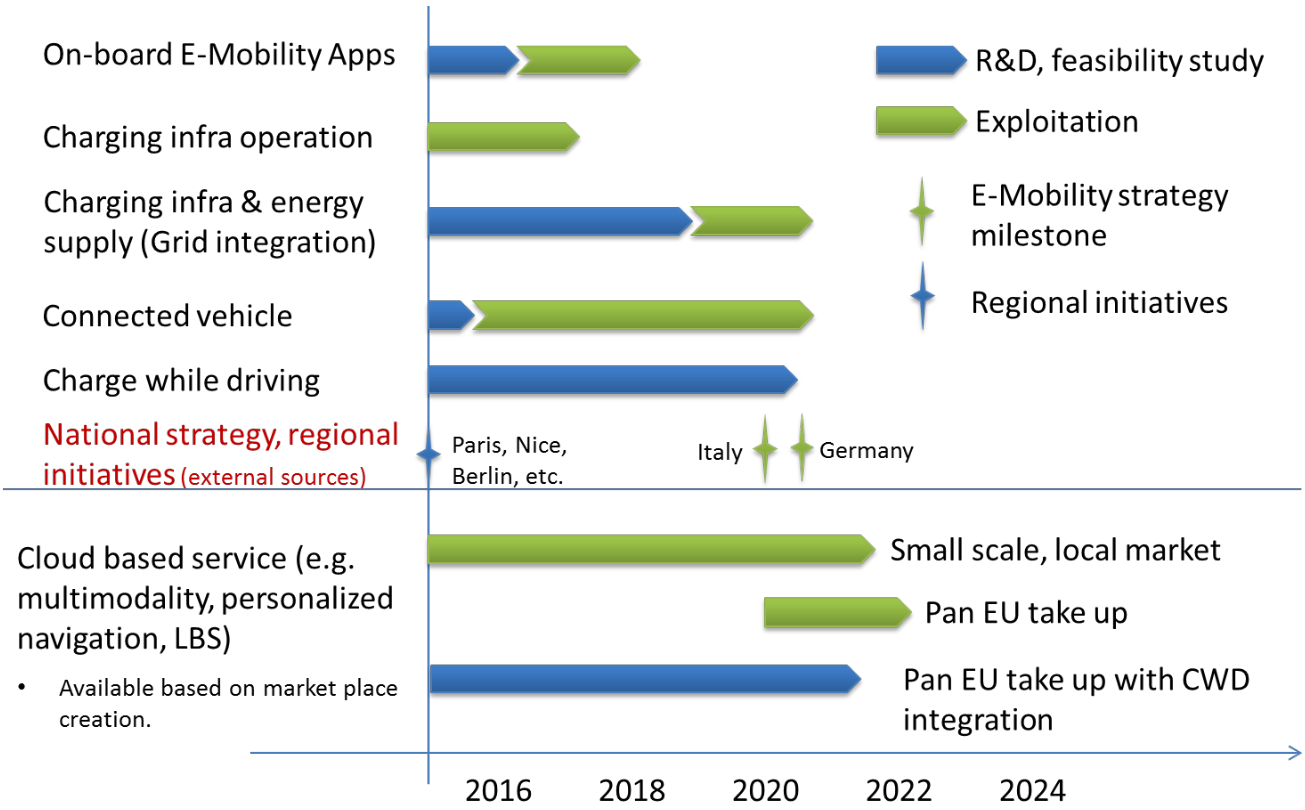

Figure 3: Summary of eCo-FEV exploitation plan

Barriers analysis identified by the partners is:

1. Needs to create a common market place supporting the roaming between infrastructures,
2. Needs of feasibility and economic studies,
3. Needs of open data and standardized data exchange interfaces.

Other potential challenges not relevant to project scope but identified by partners are summarized into:

1. Grid integration,
2. Battery technologies,

3. Regulations.

4.4 Collaboration with external stakeholders, projects

Regarding the collaboration with external stakeholders and projects, a clustering group is established with two E-Mobility projects i.e. moblity2.0 (http://mobility2.eu/), Mobincity (www.mobincity.eu/). One of the main outputs of this clustering group is to define a common architecture of the E-Mobility as well as to identify the potential interfaces that require standardisations to further support the E-Mobility take-up. This joint work further facilitates the joint stakeholder viewpoint for E-Mobility platform exploitation. In addition, joint efforts have been realised by clustering group to develop an ETSI standard on Reservation of EV charging spot via wireless communications. This standard (ETSI TS 101 556 – 3) has been published late 2014. Finally two joint clustering workshops have been organised to facilitate stakeholder discussions.

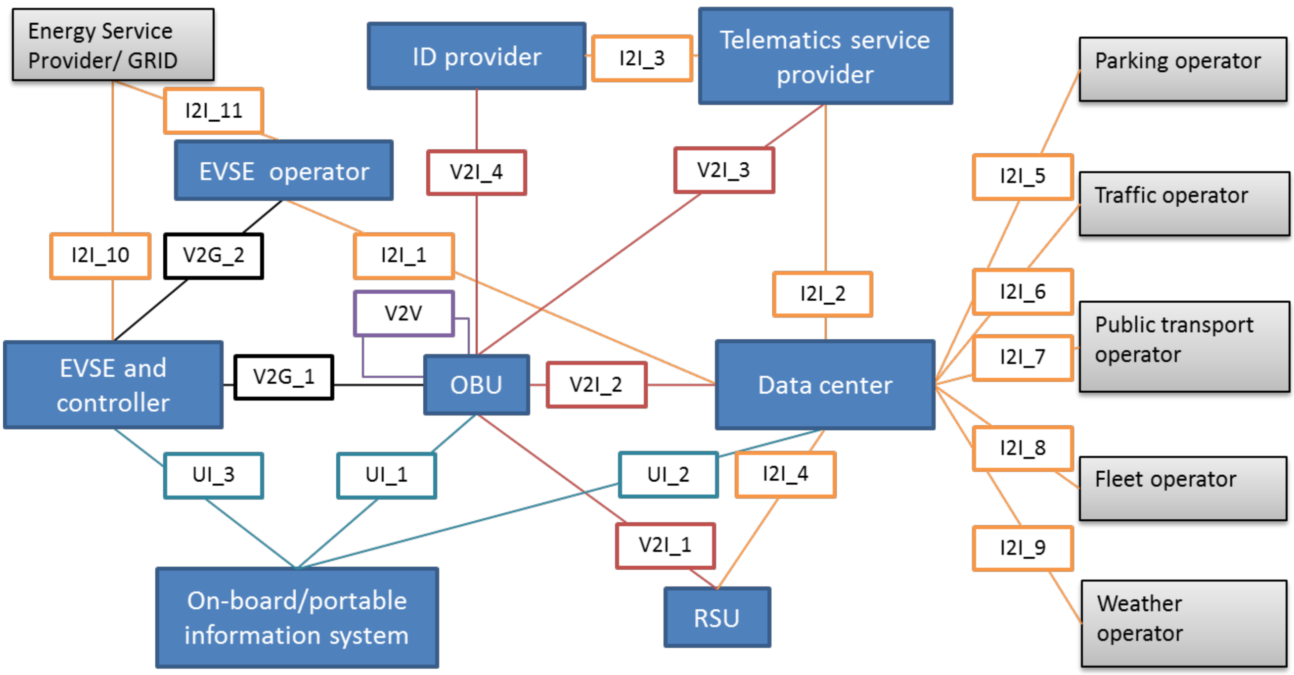

Figure 4: eCo-FEV, Mobility2.0, Mobincity defined common architecture

5 Conclusion

The present deliverable provides an overview of the expected outputs by consortium partners. In summary, the outputs of the eCo-FEV project may be categorised as follows:

- E-Mobility platform with modular architecture design. Such platform highlights the separation of roles that may be played by different stakeholders, and a set of standardised interfaces enabling data exchanges between stakeholder systems and with FEVs end users. The modular architecture is a key technical factor that would stimulate the uptake of cloud based E-Mobility service in future smart mobility and smart city service domain. The E-mobility platform can be regarded as a big data platform, a service support platform for secondary service providers, or used by operator to create a common market place for E-mobility market introduction and particular B2C services.
- E-Mobility services: by aggregating data from end users and different IT infrastructure systems, advanced E-Mobility services may be developed upon the platform, further adapted to local mobility requirements and to FEV user needs. On the other hand, enhanced Ipv6 protocol improves the FEV connectivity even during mobility and dynamic connectivity conditions. Last but not least, on board HMI and applications are developed to support friendly human machine interactions.
- Innovative charging mode: as one long term research output, eCo-FEV implements and validates the technical feasibility of new charging mode, more suitable for remote area FEV usage.
- New business model: combing contributions and efforts from stakeholders present in the eCo-FEV project, carefully constructed to cover the value chain for E-Mobility services, variable new business model is possible to be established. However, barriers are also present to enable such business mode e.g. cost effectiveness, infrastructure availability and maturity, legal framework etc. Therefore, business related studies are also conducted by eCo-FEV partners as one research challenge.

It may be observed that the identified project results reflect the stakeholder role in the value chain of an E-Mobility platform. The Exploitation plan of these outputs includes short/mid-term results to long term research outputs.

6 References

[1] Mobility2.0: www.mobility2.eu/
[2] Mobincity: www.mobincity.eu/
[3] eCo-FEV, Mobility2.0, Mobincity Clustering Activities Common Deliverable;
[4] ERTRAC, EPoSS, SmartGrids: European Roadmap Electrification of Road Transport 2nd Edition