IRIS

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Disclaimer

Executive Summary

This deliverable describes the foreseen demonstration plan for the TT#3 to be deployed in Nice and its associated use cases and functionalities. It gives an update of the current status of development and a projection of the work plan, based on the current status of knowledge.

The TT#3 demonstration activity in Nice is focusing on testing different potential business cases related to the implementation and coupling of dynamic management systems for both public and private Electric Vehicle Charging Infrastructures (EVCIs) and Electric Vehicle (EV) fleets. The latter should be capable of better forecasting the use of the EV and the turnover at specific charging stations, a prerequisite for a better operation of an EV fleet. This can in turn be used to better forecast the load generated by EV charging. The first will provide a better service to end users, while the second provides an overall exploitation performance for the EVCI owner. Based on V2G capability of a part of the EV fleet, EV battery energy capacity could be used to offer temporary energy storage to the local grid. In case the optimization strategies based on electric consumption peak shaving and shifting proof to be reliable, as well as loads forecasts and reserves capacity for flexibility services estimation, the demonstration will be enriched with the coupling among the energy market via an aggregator. The demonstration forecasts an additional measure to assess the feasibility to use smart charging as a means to provide services to reduce local grid imbalances on the public electricity grid. Although the benefit may be not bankable in the short term, this measure will allow at medium term the large scale-up of the EVCI in the LH city of Nice.

The activity is closely linked to other TT and specific IS and therefore, some content might be repeated even though already described in previous deliverables or in deliverables related to other TT (particularly D6.4). As this deliverable not only describes the planning, methodologies and technologies to be implemented, but also the expected impacts, it will give an overview of the KPIs that will be detailed in D9.5. D6.5 will be updated through D6.8 and D6.9 delivered respectively in M48 and M60. Those will however keep a more aggregated view on the demonstration activity.

Table 1 – Overview of the demonstrators in TT#3 – Nice LH

Demonstrator	In a nutshell
#1 Smart - Solar - V2G EVs charging	Brief summary: Measure #1 addresses the deployment of a smart charging infrastructure (hardware and software). Smart charging is a charging system where electric vehicles, charging stations and charging operators share data connections. It aims to monitor, manage, and restrict the use of charging devices to optimize energy consumption. By monitoring a large pool of charging stations equipped with fast charging points, belonging to both public and private networks, it is expected to provide more flexibility to the public electricity grid not only by implementing power shaving and shifting (V1G) but also other energy services as i.e. primary or tertiary reserves (V2G). The smart integration of such strategies should lead to the optimization of the total energy consumption, and possibly generate a new income stream for EVCI operators and owners.

Demonstrator	In a nutshell
	Expected impact: equivalent CO_2 from gas CHP plant saved [tCO_2eq/MWh] - Flexible volume/power of electricity [MWh - MW] (depending on the targeted energy service)
#2 Innovative Mobility Services for the Citizens	Brief summary: Measure #2 addresses the optimization of the operation of a shared EV fleet by coupling the booking and forecasting of the use of EVs to a smart charging management of the EVCI. The benefits are a higher utilization rate of shared EVs, thus an increased turnover of vehicles, a consequent reduction of the ratio between the number of required charging stations and the number of EVs. It is expected that such an enhanced car sharing exploitation system should favour the implementation of smart charging services in a more reliable and/or efficient manner.
	Expected impact: Vehicle utilization rate (# travel/day) – avg. battery load after trip (kWh) – avg. number of trips before charging (# trip/EV)

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List of Abbreviations and Acronyms

Abbreviation	Definition
API	Application Programming Interface
BESS	Battery Energy Storage System
BM	Business Mode
CHP	Combined Heat and Power (typically a gas plant)
CIP	City Innovation Platform
CISO	Chief information security officer
DA	"Day Ahead" market
DoA	Description of Action: Annexe 1 of the Grant Agreement
DPO	Data Protection Officer
DSO	Distribution System Operator
EMS	Energy Management System
EU	European Union
EV	Electric Vehicle
EVCI	Electric Vehicle Charging Infrastructure
GA	Grant Agreement
GDPR	General Data Protection Regulation
GHG	Greenhouse Gases
ID	"Intra-Day" market
IOT	Internet of Things
IRR	Internal Rate of Return
IS	IRIS Solution
LEMS	Local Energy Management System
LH	Light House City of IRIS
LV	Low voltage
NEBEF	Block Exchange Notification of Demand Response
NPV	Net Present Value
OCPP	Open Charge Point Protocol
O&M	Operation and Maintenance
PDS	Public Delegation of Service
PDG	Public Distribution Grid
PIA	Privacy Impact Assessment
POC	Proof of Concept
RES	Renewable Energy Sources
ROI	Return of Investment
SOC	State of Charge
TOU	Time Of Usage
TSO	Transmission System Operator
TT	Transition Track
UC	Use Case
V1G	Vehicle one Grid - one directional charging
V2G	Vehicle to Grid - reversible charging
WP	Work Package

1 Introduction

This deliverable describes the foreseen demonstration plan for the TT#3 to be deployed in Nice and its associated functionalities and use cases. It gives an update of the current status of development and a projection of the work plan, based on the current status of knowledge. It should be considered that the different actions related to the implementation of the IS have different levels of maturity and thus, of advancement in terms of implementation plan or development.

What is meant by smart charging is the dynamic management of the charging of the electric vehicles. The TT#3 is composed of two measures:

Measure 1 - IS 3.1: smart charging for peak load reduction on the public electricity grid by dealing with EV charging. This will be achieved through shifting the charging time or adapting the charging level of EV for optimizing the overall electric energy demand and the possibility to use EV batteries as temporary grid scale storage capacity (V2G mode). This will be done with the support of flexibility services to the grid via upwards monitoring and downward load control to the EVCI. This measure IS 3.1 is strongly interconnected with measure IS-2.1 and its LEMS demonstration and measure IS 2.3 and its stationary storage demonstrator.

Measure 2 - IS 3.2: Smart fleet management with real-time management of EV public fleet to optimize the utilisation rate of vehicles according to the forecasted rental. The approach is to minimize the time between EV bookings while considering EV battery load as well as the declared or forecasted use of the vehicle. This measure is closely linked to the smart charging measure IS 3.1 and partially related to the energy transition of measure IS 5.1 related to co-creating the energy transition in the everyday life environment.

The technical content of the current document will be structured around these two integrated solutions with, for each measure, a description of its objectives, scope, impact, technologies developed and methods with dedicated KPIs.

1.1 Scope, objectives and expected impact

Scope:

The scope of task T6.5 covers the demonstration of an integrated, resource efficient, urban e-mobility solution. This solution consists of the demonstration and testing of (i) two integrated solutions related to an EVCI – IS 3.1, and (ii) an EV fleet management platform – IS 3.2.

Within T6.5, the scope of measure IS 3.1 is the testing and demonstration of Smart Charging for an infrastructure of EV charging points. The targeted EVCI, owned by the city of Nice, is private and dedicated the city large fleet of electrical service vehicles. The aim of the demonstrator is to rely on many Fast Charging points as the most suitable assets for a smart charging management system. Fast charging points (>7 kVA) are requiring a big power demand and are enabling a higher turnover of EV thanks to a lower battery charge time. Charging stations of slow type (~3 kVA) are less relevant because they require long charging periods (>5 hours) as well as draining lower power from the grid with a consequent low potential for flexibility management of the grid.

As far as measure IS 3.2 is concerned, the main scope is the testing and demonstration of a car sharing platform capable of maximizing the utilisation rate of an EV-based public fleet for the benefit of car users. This platform relies on the city private fleet of shared EVs distributed over the Nice metropolitan area and encompasses in-vehicle control units called “Vubox” as well as a software mobility platform for booking management. The aim is to propose a seamless car sharing service in synergy with the smart management of the EVCI (IS 3.1) by matching the trip forecasted by the driver and the state of charge of the battery of the available EVs. Thus, the availability at all times of a maximum number of EVs through the car sharing platform will foster zero emission mobility and thereby will lower accordingly the GHG emissions for daily intra city trips.

Objective:

The overarching objective is broken down into two sub-objectives:

i) Demonstrate the capability of optimizing the energy consumption and the business performance of an EVCI operator using a smart charging management system and, beyond, the operator’s capability to contribute to grid flexibility services. Furthermore, a side objective is to show how the combined management of private and public EVCIs may strengthen the benefit of smart charging for the development of EV-based car sharing and the large-scale deployment of EVCI over urban areas with a minimum impact on the electric public network operation.

ii) Demonstrate the capability of optimizing the operation of an EV-based car sharing fleet thanks to the awareness of smart charging by the car sharing management platform. The goal is to maximize the turnover of the shared EV by reducing the idle time (i.e. time interval between two bookings) while taking into account the battery charge from a technical point of view (i.e. minimum battery load required to achieve the trip programmed) and from the social acceptability perspective (viz. which minimum range margin based on EV battery load is acceptable for a user to trigger the booking?).

Impact:

Smart Charging is expected to play a major role in a near future, i.e. when the EV penetration rate will be that high that local grid sizing and related constrains will need the adoption of more developed management system to avoid to impact negatively the local, but potentially also national, grid operation. The main expected impact, is to provide through the implemented measures, a pilot reference project to revamp the way current public (and private) call for tenders for EVCI operations are dealt with, showing the upper value that can be expected by a service amelioration via dynamic charging management, accompanied by a higher share of fast charging stations. The possibility to integrate also “private” EVCI, from public authority assets as well as private operators, bear a big potential of overall optimization towards grid flexibility and congestion management. Beyond, the supply of an efficient EV fleet management solution as a pilot reference is allowing users to participate to a new mobility paradigm based on car sharing in replacement of individual cars which is foreseen to become the standard of urban and peri urban mobility in a near future. The demonstrator will rely first on the city employees who have the possibility to daily borrow cars from the city EV fleet thanks to the municipality car sharing service.

1.2 Contributions of partners

EDF: coordination of activity related to IS 3.1 and ensuring the consistency with IS2.1 by leading the definition of the use cases to be considered among the different involved actors; document the content and planning of the actions; setting up of contractual arrangements and ensure their timely implementation and compatibility with IRIS; it will assess the requirements and feasibility for the deployment of a smart charging platform and ensure its subsequent developed and testing in the demonstration phase; in the upcoming implementation phase it will lead and monitor the process and ensure the advancement toward the set innovation objectives and maximization their impact; support with its know-how and expertise the implementation and achievement of all demonstration activities under IS 3.1. Due to the yet uncertain aspects of the nature of the flexibility service that will be deployed based the current case study infrastructure, it is not excluded that a subsidiary of the EDF Group will have to be missioned with its implementation and thus probably access the Grant Agreement as “Linked Third Party”.

NCA: Coordination and animation of the Nice demonstrations to ensure global consistency and to interface with the other related IRIS demonstrators of LHCs and FCs alike; support the definition of the IS-3.1 and IS-3.2 measures: involvement of the relevant city departments, respectively Sustainable Mobility Dpt., Auto Park Dpt., Public Buildings Dpt.; support the specification of the requested contractual arrangements to be put in place between the different public and private stakeholders. As part of its contribution to the project, the NCA metropolis is committed to open the access to its private fleet of 42 EV already equipped with VULOG in-vehicle control units “Vubox” as well as its software mobility platform provided by VULOG and supporting the shared cars booking system. Users will be any NCA metropolis employees registered on the city mobility platform. In addition, NCA will enable access for control and monitoring of a reduced fleet of 5 shared vehicles compatible with the V2G technology to experiment the contribution of V2G to the flexibility of the local micro grid.

VULOG: Collection of raw data from the electric vehicles of the car sharing city fleet including vehicle location, trip distance to destination, battery load, time of use. Collection of car sharing related data from the booking management platform provided and operated by contract by VULOG on behalf of NCA. Based on this big data collection, VULOG will analyse the users’ behavioural model in order to predict the typical booking profile and to better anticipate the availability of shared EV according to the day, the time, the location of the car, and any other relevant contextual information (i.e. weather forecasts, bank days). Booking forecasts and real-time information on EVs battery state will allow VULOG to send charging requirements to the energy suppliers to optimize the fleet EV charging versus current and forecasted user demand. As a summary, VULOG will provide the car sharing platform and operation services aimed at allowing an optimal turnover of a fleet of shared EVs in accordance with grid stability related requirements.

1.3 Relation to other activities

TT#3 is connected to TT#2 due to the link between IS 3.1 and IS 2.1 measures. When deploying IS 3.1, it must be ensured that the implementation of the UCs will be compatible with the development of IS 2.1. The monitoring scheme of the systems must comply with the definition of IRIS KPIs, as described in WP9.

In case the demonstrators are successful and reveal a viable business model, the activity will be integrated into a replication plan within the frame of WP8.

1.4 Structure of the deliverable

In the following paragraphs, the methodology is detailed, the baseline defined, the setup of demonstration activities and the related governance described as by current state of knowledge, the planning of demonstration activities detailed and explained and, finally, the defined KPIs and their monitoring overviewed. The document is concluded by inferring the first conclusions from the work done so far. All these topics are detailed per measure when relevant.

For the description of IS 3.1 measure and of the related work plan, and to ensure the consistency with IS 2.1, the “Use Case” methodology is used to describe Smart Grid relevant activities (see SGAM – Smart Grid Architecture Model). This methodology has therefore been lightened in order to allow non-expert readers to follow the discourse. To keep coherency with the other LH cities, the structuring based on “demonstrator” and “measure” definitions have been maintained (for more information please refer to D6.4).

2 Demonstration in a nutshell

2.1 Ambitions for TT#3

Although outlined in D1.4, in the section related to demonstrators, stated goals have to be updated with details provided in chapter 2.3 hereafter.

The demonstration ambitions are well defined by the DoA and GA related paragraphs which resume it as follows:

"*[…] An expert system using an optimisation strategy for EV public fleets charging in Nice will be developed to limit the impacts on the grid. The objective is to enable the managers of NCA EV fleets to reach economic, environmental and operational goals. Smart algorithms, […] will be specified for the charging infrastructure and the management of charging points of the different targeted sites, in order to make an optimal use of electricity grids, at optimal operating cost, and with an optimal choice of generation means (i.e. most economical energy / least CO_2 emissions).*"

The large-scale deployment of EVs in replacement of fossil fuel cars is one means to reduce air pollution from road traffic, especially in urban areas. Such massive deployment of EVs should consider both the requirement for upscaling the existing EVCI network, with a potential consequent pressure on the legacy grid, and the reduction of the overall cars number with the development of the car sharing paradigm. The initial objective of experimenting how free-floating car sharing would positively impact air pollution is altered to the study on how smart charging of shared EVs based on their use profile can increase their availability rate and thus the turnover of vehicles, reduce the number of charging stations and decrease the peak power requirement from the grid up to offering energy storage capacity to the grid for flexibility thanks to the V2G technology.

NOTE: Due to the unexpected termination of activity of the public car sharing service "Auto Bleue", the IS 3.1 and IS 3.2 measures will be based respectively on Nice metropolis privately owned EVCI and fleet of shared EVs used by city employees.

2.2 Demonstration area

The Nice metropolis public EVCI being spread all over the city and the shared EV cars being used for suburban trips, the experimentation area for IS 3.1 & IS 3.2 measures will not be limited to the original demonstration areas but extended to a wider perimeter defined by the broad distribution over the city of the charging points composing the city-owned private EVCI network (cf. Figure n°4 for locations of charging stations). Typical shared EV journeys will cover the whole metropolitan area and even beyond, with an average 30 kms trip.

Figure 1: Visualization of the perimeter of the city of Nice corresponding to the distribution of the city-owned charging stations.

2.3 Integrated Solutions in TT#3

The demonstration activities of TT3 are structured along the two integrated solutions IS 3.1 and IS 3.2. Each IS is translated into “measures” or “use cases” (UC) forming the demonstration activities and described in the following sections.

2.3.1 IS 3.1 - Smart Solar V2G EVs charging (PV // V2G // batteries // e-cars // e-buses // indoor structure)

IS 3.1 measure addresses the deployment of a “**smart charging infrastructure”**. Smart charging aims basically at optimizing the balance between EV charging needs and its availability for providing energy services. By monitoring a large pool of charging stations equipped with fast charging points, belonging to both public and private networks, it is expected to provide more flexibility to the public electricity grid not only by implementing power-shaving and shifting (V1G) but also other energy services such as i.e. primary or tertiary reserves (V2G). The smart integration of such strategies should lead to the optimization of the overall energy expenses, and possibly generate a new income stream for EVCI operators and/or owners.

At the time being, it seems that thanks to IRIS, the LH Nice could become the first (or one of the first) public authorities in France to be able to test V1G and/or V2G smart charging services on their EVCI and EV fleet.[1]

Moreover, seen from the city authority’s point of view, the expansion of EV adoption with the consequent integration of EVCI in the context of new real estate projects, is leading to a dramatic increase of the number of parking places equipped with charging points. This is possibly causing a significant impact on

[1] To our knowledge, no other Public Authority in France has engaged so far on testing V1G and/or V2G related smart charging services within the same scope as proposed in IRIS.

the electric power grid in terms of local peak power demand. To avoid the cost of oversizing the public distribution grid as an answer to the multiplication of urbanization projects coupled to this increase of the EVCI network density, flexibility management of EVCI seems to provide a part of the answer.

2.3.2 IS 3.2 – Innovative Mobility Services for the Citizens

Fleet management of public shared EVs is expected to pave the way to a new mobility paradigm where end users can benefit from a flexible solution for daily trips within the city instead of using their personal car. This approach is consistent with the ambition of the city of Nice to set up new means of transport (e.g. electric buses, bicycles, scooters) and to promote environmentally friendly solutions. Nice city has been an early adopter of EV mobility public service in France and intends to test EVCI load optimization and shared mobility solutions utilizing its own EV fleet and involving its public officials.

As a prerequisite for IS 3.2 measure, a clear picture of the journeys of city employees using shared EV of the city fleet must be defined within the metropolitan area. More precisely, this preliminary stage aims at establishing the from/to commuting map as well as identifying the rush hours with the biggest traffic peaks. Practically, this commute journey map will be built from data delivered by VULOG and from the city information platform (CIP).

From that map, VULOG will make a comparison between statistics of shared EVs versus the battery load of available vehicles in order to understand the willingness or reluctance of the users to effectively trigger the booking of a shared EV. Moreover, this information will be correlated to other context factors that are likely to influence the user on their decision to book the vehicle. At first sight, it is intuitive that the booking rate will be optimal provided that an EV is available at short distance of the user's location and with a fully charged battery to secure the forecasted journey. Linking the booking forecasts combined with other contextual data to the availability of shared EV located at the right place and with the right battery load should lead to increase significantly the utilization rate of shared EV. To achieve that, it is required to gather data from both VULOG car sharing platform and the EVCI operation platform.

2.4 Integration of Demonstrators

The integration of IS 3.1 and IS 3.2 demonstrators should lead to an overall optimization of the flexibility of the grid thanks to the combination of two areas of competences:

1. The forecasts and the optimization of Nice's shared EV fleet management, thanks to services offered by the car sharing platform designed by VULOG, which can provide important predictors and historical and real time data about users and vehicles, that are instrumental to improve smart charging.
2. The smart charging solution able to optimize the EVCI operation of Nice's private EVCI. All information delivered by the VULOG platform to the smart charging platform should lead to reliable forecast on the energy needed by the city owned EVCI from the power grid and its availability for providing flexibility services. Components of IS 3.1 demonstrator are described in document D6.4 as part of IS 2.1 demonstrator with the power grid flexibility managed by the Local Energy Management system (LEM) being partially based on a flexible operation of the EVCI. By coupling IS 3.1 measure to the use cases about aggregation and LEM of IS 2.1 demonstrator, the

market feasibility about operating flexibilities will be tested.

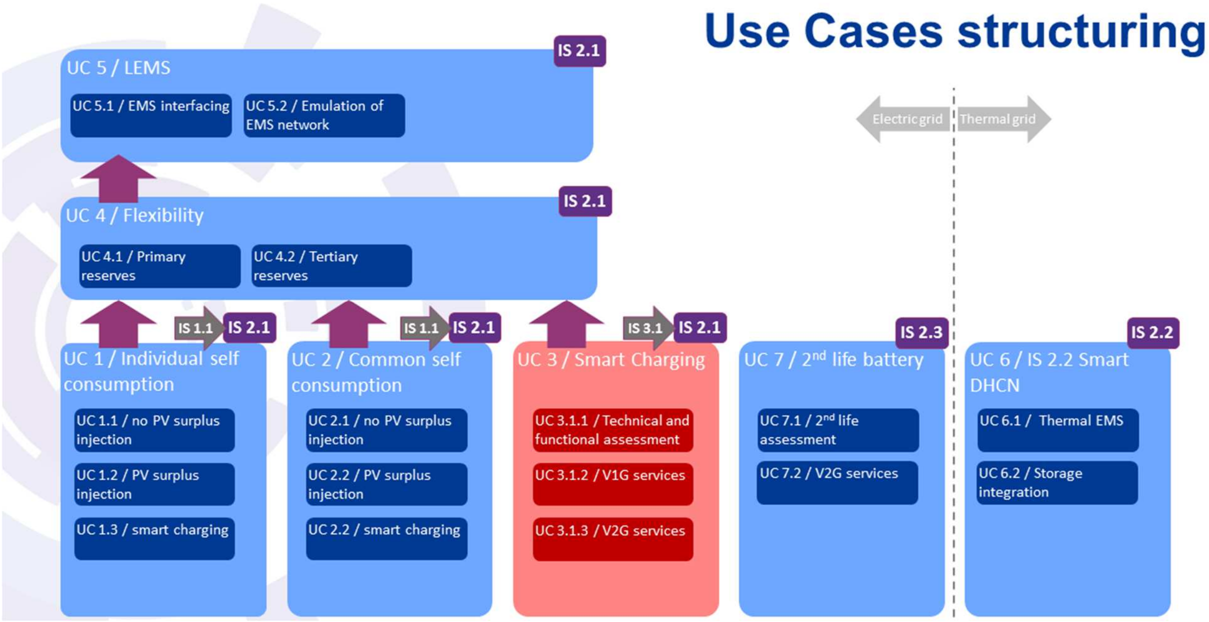

Figure 2 : Scheme of the relations and dependencies among the chosen Use Cases and sub Use Cases under IS 2.1 in TT#2 – see D6.4. The scheme highlights the positioning of IS 3.1 within the structure. It resumes the macro business UC – UC3 - and the underlying sub UC (source: EDF).

The scheme in Figure 2 illustrates the confluence of the different single actions towards the global objectives of TT#2. The demonstrator for IS 3.1 is contributing as shown to the overall assessment of the IS 2.1 proposed general business case.

As mentioned in D6.4, to ensure a correct articulation of the different actions during this first project period, priority has been set on ensuring the connection between measures IS 2.1 and IS 3.1. Thus, EDF has launched recently the dialogue between its subsidiaries IZIVIA (EVCI operator), AGREGIO (energy aggregator), DREEV (smart charging and V2G solutions) and with VULOG (car sharing solutions) and NCA (i.e. transport and sustainable mobility Dpt., building Dpt., fleet management Dpt., digital information systems Dpt.). The workplan is under development and the contractual and legal aspects under assessment.

2.5 Deviations according to the Grant Agreement

The termination of activity on January 1st, 2019 for business reasons of the delegated company operating the public car sharing service "Auto Bleue" based on electric vehicles (EV) and the related public EVCI, had a major impact on the original work planning of TT#3. First the scope and perimeters had to be overthought and reassessed towards the new situation and involved stakeholders. This context leads to a redefinition of the work scope and related responsibilities of the implied IRIS partners. Moreover, it had been necessary to await the different services to be implemented, which was completed by Q4 2019. This delayed the work reorganization and the overall planning of the demonstrator.

Moreover, the management of the situation has led to a complete shift of the work planning: current priority is to settle the UC and retrieve the needed agreement from the different involved stakeholder's management sphere and ensure the current proposed demonstration activities will be granted support and the needed means put in place to achieve them. The monitoring should then be possible to start as planned in Q4 2020, at least this hasn't been identified as a risk at the time being.

Moreover, the withdrawal of the existing fleet "Auto Bleue" of shared EVs and the late replacement by a new independent private car sharing operator Renault Mobility operating a reduced fleet of 57 EVs, but not committed to the IRIS project at the time being, led to the decision to select instead the private car sharing service self-operated by the city to the sole benefit of public officials and to use the related city-owned fleet of shared EVs as the base to experiment Smart Charging solutions. A direct consequence has been to consider from now as target EVCI for the demonstration the city-owned private EVCI network dedicated to the city-owned fleet of EVs.

The main deviations from the Grant Agreement concerning IS 3.1 are as follows:

- Already conducted - integration of Linked Third Parties to EDF: new linked third-party companies EDF S&F and AGREGIO have been included in the submission of the past 3rd Amendment to the IRIS Grant Agreement. *Potential change subject to conditions - integration of Linked Third Parties to EDF: DREEV.* This is all related to the fact that since 2019 the company has consolidated under the brand "EDF Local Energy Management" activities which are not anymore handled by the R&D departments or under a direct departments EDF corporation, but by dedicated subsidiaries. This internal restructuring of EDF implies to integrate officially these companies to the Nice consortium and to amend accordingly the GA in case this will be decided. The incorporation of these new companies must be seen as an added-value to the project with "nearer to market" companies driving the advanced solutions experimented within the demonstrator to a higher level of maturity in terms of technology (TRL) and in terms of business models, thus increasing the replication capability and thus potential impact of the action. DREEV is the subsidiary company of EDF created in 2019, in charge of developing V2G related activities in France. Therefore, in accordance to the GA with the consortium committed to explore V2G related services in terms of demonstration and impact, including DREEV seems one of the most probable solution for the consortium to realize V2G demonstration in the LH of Nice.
- Decision to replace the public delegation of car sharing service called "Auto Bleue" by the private EV-based car sharing service called "Auto Partage" self-operated by the city (NCA) to the sole benefit of its employees. The impact is a change of scale of the base of the demonstrator at the benefit of the city EVCI private network composed essentially of 150 fast charging points in replacement to the current EVCI public network only composed of ~280 normal and semi-fast charging points.

Main deviations from the Grant Agreement concerning IS 3.2 are the followings:

- Decision to replace on January 1st ,2019 of the public delegation of car sharing service called "Auto Bleue" by the Nice city private car sharing service called "Auto Partage" self-operated by the city (NCA) to the sole benefit of its public officers.
  The impact is a change of scale of the base of the demonstrator at the expense of a reduced 42 shared EVs fleet with ~1760 registered members and ~200 frequent users as of Dec, 2019 instead of the

original 140 shared EVs fleet from Auto Bleue with ~11,000 registered members at the termination of the service on Dec, 2018. However, because current “Auto Partage” private car sharing operation is based on VULOG car sharing platform similar to the one use by former “Auto Bleue” car sharing service, the system architecture for Smart Charging demonstrator remains unchanged with the additional benefit of the city EVCI private network and semi-fast charging points of the number of users as mentioned above and full-access to any information processed by the Nice city self-operated new generation car sharing platform “AIMA” from VULOG, including all vehicles and users related data.

- Because of using hereafter Nice city private car sharing service with a reduced fleet of EVs as a target base for the demonstrator and without any support of free-floating, the inferring of any data related to CO_2 emissions change at city-level in regards to the turnover of shared EVs is not relevant anymore, thereby preventing any analysis of KPIs related to carbon emissions. Consequently, new KPIs are specified to quantify how smart charging will impact 1) the availability rate of shared EVs, and consequently their turnover; 2) the peak current demand on the electric distribution grid for EVs charging; 3) the available V2G-based tertiary reserve to support grid flexible management.

3 Baseline / Drivers and Barriers

3.1 Baseline

3.1.1 Baseline IS 3.1

The IS 3.1 baseline for TT#3 is representative of today's French practices for public EV charging infrastructure management. The O&M (Operation and Maintenance) of the Nice city-owned EVCI called "Prise de Nice" is delegated to a private company (IZIVIA) and the car sharing service is based on a fleet of shared EVs owned and operated by a private company (Renault Mobility services).

From the point of view of EV charging technology evolution, all public EVCIs are gaining progressively higher shares of fast and semi-rapid charging stations to enable a higher turnover of EV fleets. Because Nice city was an early adopter in France of EV mobility services, its public EVCI is currently dominated by standard charging stations (3 kVA). However, an upgrade plan is set up over 3 years to complement the existing public EVCI with faster charging stations all over the city area.

Both private and public EVCIs currently deployed are usually managed by static operating systems which neither support dynamic charging schemes nor provide smart charging for optimizing energy peak shaving and shifting. It must be still demonstrated that such a technology-based functional upgrade can provide an economic benefit. Similarly, the private owner EVCI of NCA is not operated by any exploitation system and barely metered or connected to the Web. Nevertheless, fast charging is the basic equipment (> 7 kVA) for the considered EVCI and are thus a more representative baseline. More detail is provided in the paragraph "problem statement" of chapter 5.1.1.

Moreover, as mentioned in document D6.4, such EVCI assets are not considered today as flexibility assets to provide baseline flexibility services to existing energy markets or DSO.

In summary, the baseline we should consider for the French context is basically:

1) EVCI (V1G) being private or public, is mostly a passive asset seen from a grid point of view, as not contributing to the energy market in an active manner.
2) Overall EVCI sector and associated services are in an early stage of development, with a general political and industrial will to focus on boosting an adoption of the EV and EVCI, keeping "industrial" references as demonstrators or industrial pilots. Thus, profitability of such forerunning projects is not ensured, other decision-making factors than sole profitability are still preponderant as for e.g. related to environment and image.
3) Low user-awareness in the EV sector, with a customer pool which yet not reached the "early adopters" segment.
4) End users are facing and will still face in short to mid-term single or very simple pricing models regarding EV sharing systems.
5) V2G implementation in the French context is currently even less developed than the V1G case as presented in the points above.

3.1.2 Baseline IS 3.2

If most of car sharing fleet services are now based on free floating, the current car sharing service operated in Nice by a private company (Renault Mobility Services) is still based on a one-way rental mode.

As of today, VULOG car sharing platform is enabling the booking of vehicle as soon as the battery load is above a threshold enough for a trip. Moreover, the platform is computing multiple historical data to determine the most optimal locations as well as time periods for a car to be booked within Nice area.

This functionality could be used to maximize the turnover of shared vehicles. Therefore, an adaptation should be considered to address the sharing model of a private carpool instead of a public car sharing fleet.

Additional work shall be done to correlate data related to the load of the vehicle battery to the likeliness of rent of a vehicle when available. This issue is strongly related to IS 3.1 demonstrator focussing on smart management of an EVCI. Thus, IS 3.2 aims at establishing a car sharing management combined to smart charging in order to forecast an optimal battery charge for a vehicle at one time at one location. To achieve that goal, VULOG intends to develop a relocation process of vehicles from any free location to a charging station by involving end-users themselves and by offering incentives.

3.2 Drivers and Barriers

3.2.1 Technology

Drivers:

- Readiness level of the various hardware and software components of the ICT infrastructure required to monitor and control the various assets of the demonstrator. All technologies involved can be qualified as mature and available on the market.
- Charging technologies and related protocols are converging towards few industrial standards, leading to a possible combination of different EV charging technologies for a larger choice of EV providers, charging equipment providers and EVCI operators.
- The standardization of communication protocols between EV and charging stations and between charging stations and EVCI management systems should promote the emergence of replicable smart charging services.

Barriers:

- The legacy EVCI public network of Nice city was early deployed before the release of the OCPP (Open Charge Point Protocol) standard communication protocol and therefore is not compatible with current EVCI management platforms. Instead, a specific API was developed for a basic control and monitoring of the charging poles. The cost of upgrading the existing public EVCI for OCPP compliance would be prohibitive and of a same order of magnitude than the full replacement of all charging poles with new ones.

- The booking prediction of a vehicle at one time in one location may be altered by outstanding unexpected events. In this regard, risk assessment can be introduced in the prediction model based on historical data about such events and thanks to statistics.
- Because free floating operation is expecting end-user to drive EVs with low battery load to a charging station, or those cars parked in area with low probability for a next booking based on incentives, a back-up solution should be designed in case of low users' engagement.

3.2.2 Law and regulation

Drivers:

- French law n° 2015-992 of 17 august 2015 called "Energy Transition Law for a Green Growth"[2] integrates e-mobility as a key policy to achieve carbon emission reduction.
- Tertiary reserves of energy are market products defined, as follows: minimal bid size of 1 MW (upward and downward energy), based on 30 min hours blocks, limited to 4 hour per day and with an activation delay from 2 hours to 15 min. These criteria are believed to be achievable via Smart Charging operation.
- Similarly, as above for primary reserves.
- Current regulation for new parking space projects is imposing the pre-equipment of parking spaces for standard charging and semi-fast charging capabilities with various ratios according to the residential or tertiary area profile. The broad availability of charging points should reduce the barriers to EV adoption and thus foster the electric mobility market.
- Although data collected by the car sharing platform are compliant with GDPR, smart operation models for car sharing are relying on anonymized information.

Barriers:

- As of today, French energy regulation doesn't allow to connect V2G-based tertiary reserves "in front of the meter", namely tied to the Public Distribution Grid, but only "behind the meter" at the user's grid scale. This regulation hinders the proliferation of such a technology in the public space and consequently its adoption when operating public or private e-mobility services.
- Tax regulation mechanisms related to transport and distribution grid are offering a very minimal tax reduction related to the subscribed maximal power thus making power peak shaving and/or shifting of low interest for users' whose bill is mainly composed of the volume of energy consumed.
- Art. 199, from French Law n° 2015-992 of 17 August 2015, completed by the Decree n°2016-704 of 30 May 2016 related to the national « energy transition for green growth », is regulating the possibility to offer to a DSO local flexibility service. However, with current regulation, a project is eligible if and only if it can be demonstrated that the distribution grid infrastructure investment can be thus precluded (neither transferred nor postponed). Moreover, the regulation bounds the retribution level of such a service to the amount of the precluded infrastructure

[2] https://www.ecologique-solidaire.gouv.fr/loi-transition-energetique-croissance-verte

investments. These constraints imposed by regulation are hardly achievable within the current market conditions.

- The minimal bid size of 1MW of the market for tertiary reserves of energy has been set on purpose to hinder too small players and assets to participate to this market for better market liquidity. Consequently, only large EVCI network can match this requirement and are eligible.

3.2.3 Society

Drivers:

- Higher availability of shared EV for booking with the postponement of battery charge during typical booking idle time periods.

Barriers:

- Convince city employees to use shared cars from the pool instead of their personal vehicle for business trips.
- User acceptance of smart charging is today more a brake than a driver. End users have been rarely, if never, been confronted with such a service and their awareness about its causes, its consequences and the related impact is not a given. Smart charging is thus today focused on a smooth end user-experience without complexity such as dynamic pricing schemes due to energy related matters or the risk of impacting an EV battery's SOC at the time the EV has been booked for.

3.2.4 Finance

Drivers:

- Confer to the legal section as most of financial incentives are related to law and regulation.
- Decentralized flexibility assets are barely considered in the energy market while they can be exploited via direct contracts or aggregators.
- Optimization of EV fleet use rate due to higher vehicle availability and access to lower price energy with the possibility to postpone EV battery charging during relevant time periods.

Barriers:

- Current tertiary reserve service, as by the current NEBEF regulation, is valued between 20 and 60 EUR/MWh. This is little incentive for end users to adapt to flexible energy consumptions regarding the current electricity retail prices. This service brings a low benefit compared to a TOU (Time of Usage) energy retail model achievable by peak shaving and shifting. Consequently, this service should be part of a global model combining both optimization strategies for energy use.
- The prediction model for shared EV use is sensitive to contextual parameters such as environmental conditions.

3.2.5 Environment

Drivers:

- Energy efficiency, carbon footprint reduction and adoption of renewable energy sources (RES) are the main goals targeted by current regulations and reforms as mentioned in the “Law and regulation” section.
- The environmental impact of the daily life is becoming a dominant concern for urban population. Within such a context, the contribution of EV to the reduction of air-pollution might convince citizen to favour the adoption of electric mobility and shared transportation such as shared EVs.
- Smart charging is improving the turnover thus the availability for booking of shared EVs.
- Smart charging is offering flexibility to the grid and can reduce transient peak power demand usually supplied by peak load, fossil fuelled, power plants.

Barriers:

- Although European and national regulations have already made big improvements towards the promotion of RES and low carbon energy alternatives, the quite low carbon tax level and other tradeable related carbon bonds are not enough to produce a direct market impact. Consequently, the uptake of low carbon technological solutions is poor to significantly reduce the environmental footprint of local energy system.

4 Organisation of work

The roles and responsibilities of involved partner members have been already described in section 1.2. However, additional third-party entities must be involved such as illustrated in the organization scheme below.

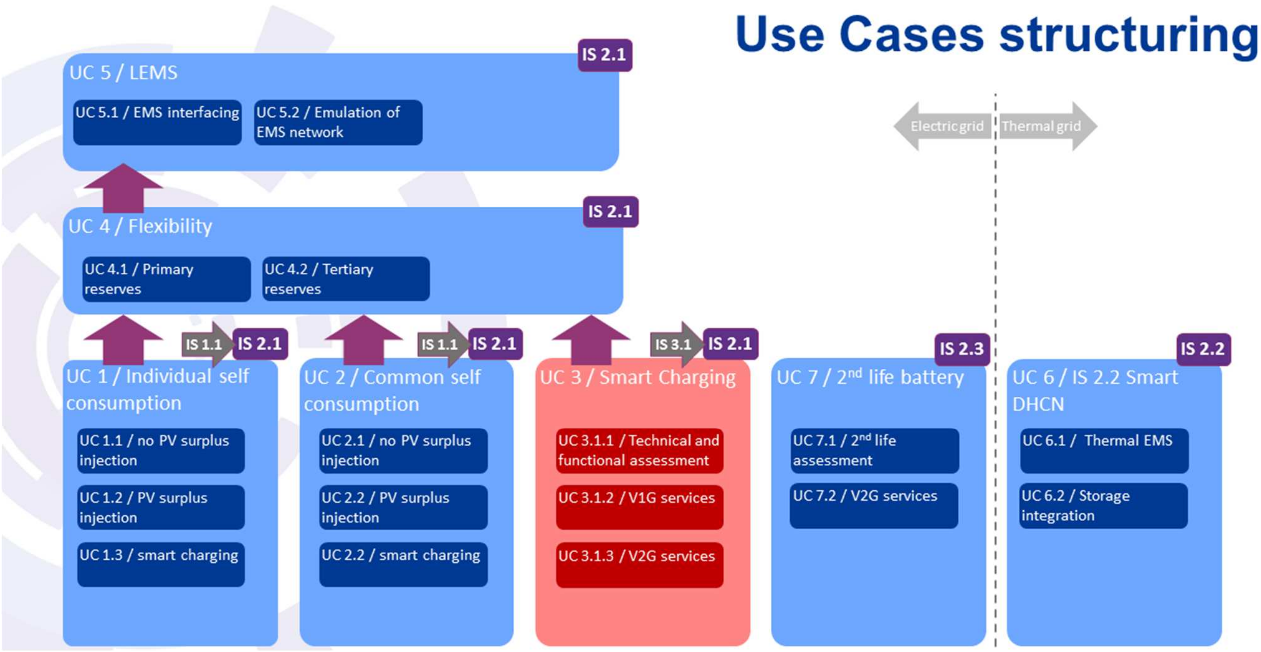

Figure 3 : UC structuring of IS. 2.1. In red, the UC related to TT#3 are highlighted (source: EDF)

<u>Remark</u>: The relationship and mapping between TT and IS are explained in the previous section 1.3.

In order to reduce the complexity of the integrated solution IS 3.1 and to enable an incremental implementation of the required tasks, the whole IS 3.1 action is structured into individual Use Cases (UC). This approach will be applied similarly at the semantic level to clarify roles and responsibilities of stakeholders and to structure the different tasks forming each UC for the sake of clarity of the scope and the timeline of each task. This work organization based on UC will be used in chapter 5 to describe the demonstrators forming the integrated solution n°3, namely IS 3.1 and IS 3.2.

While the definition of the UC of 1st level is not expected to be modified during the project, the definition of the UC of 2nd level might change as the project will gain in maturity (adapted, completed or even removed). At that stage, UC are defined as follows: *UC 3.1 – Technical and functional assessment; UC 3.2 – V1G services; UC 3.3 – V2G services.*

5 Demonstration activity TT#3

5.1 IS 3.1 - Smart Solar - V2G - EV charging

IS 3.1 has been divided into 3 sub-UC according to the three main measures that will be put in place to demonstrate the solution. These measures are detailed in this section.

5.1.1 UC 3.1 - Smart charging infrastructure (in relationship with IS 2.1)

5.1.1.1 Description of the Use Case

5.1.1.1.1 Goal, Objectives and Scope and of the use case

Goal: Improve the operation of EVCI towards Smart Charging, optimizing the economic performance of the operation of private and public EVCIs.

Objectives:

- Define the impact that an advanced EVCI management system such as Smart Charging has on the overall network O&M performance (OPEX)
- Implement peak shaving and shifting strategies to minimize the impact of the system on the grid and to optimize energy expenditures
- Demonstrate the activation of flexibility via an aggregation platform to support grid services.
- Implement Smart Charging without impacting local e-mobility value proposition
- Impact analysis for those items will be done first. In case those give positive results, tests under real conditions will be performed.

Scope: demonstrate that a dynamic operating system integrating Smart Charging is offering benefits versus a static operation without monitoring, forecast and optimization functionalities. In respect of the existing set of rules to connect to the electricity grid ("grid code") and of the financial and technical constraints and parameters set by the related business contracts, Smart Charging based operation will maximise the economic performance of the EVCI network. The demonstration is including the city owned private EVCI (NCA metropolis) integrating rapid and fast charging poles. The possibility to integrate a V2G based experimentation is under evaluation and discussed among the partners.

5.1.1.1.2 Narrative of Use Case

5.1.1.1.2.1 Short description

Coupling the operating conditions of an EV fleet to an EVCI operation platform can provide better forecasts for the use of charging stations to support load modulation or postponement of EV charging to take advantage of dynamic tariff of energy supply and to offer flexibility services to the electricity grid. The integration of optimization functionalities to the EVCI operation platform will enable real-time arbitration on connected assets from activation requests delivered by a local aggregator platform. The complexity of the demonstrated optimization strategies will increase during the project with the integration of more control variables and more connected assets (cf. sequence of Sub-Use Cases below).

5.1.1.1.2.2 Complete description

Motivation and problem statement

Most EVCI networks are not operating any Smart Charging to optimize the overall network operation performance because the actual expansion rate of EVs is not stressing the capacity of the current grids. Nevertheless, with French law now requesting new real estate projects to allocate up to 10% of their parking space for electric vehicle charging facilities, public authority and DSO have to worry about the sizing of the grid. Without a smart synchronization of EVs charging over the grid area to address potential peak current demand, heavy capital expenditure must be considered to rescale the grid infrastructure in order to avoid any potential subsequent failure.

Despite the possibility for the operator of the “Prise de Nice” EVCI to modulate EV charging based on the cheaper electricity tariffs at night, the billing model of the “Prise de Nice” EVCI for EV charging is still based on a time-of-use (TOU) flat rate with end-users unconcerned by a dynamic pricing of electricity. Similarly, the operation of the Nice Metropolis private EVCI is not relying on variable rate electricity tariffs.

As of today, most EVCI networks are dominated by slow and standard charging stations slowing down the turnover of shared EV fleets. Moreover, the limited power flexibility from such EVCI networks is of low if no interest in power markets.

Solution approach

Dynamic charging plans relying on the interoperability with shared-EV fleet operation platforms are expected to enable better forecasts of EVs availability and booking, based on EV battery load and EV location, which in turn enable the optimized modulation of any EV charging at any specific charging point. Time-of-charge (TOC) tariffs will be a first mean to steer energy peak shifting and shading measures and provide a first step to reduce the overall energy costs arising from the operation of an EVCI. This saving paradigm should be of equal interest for public and private EVCI operators, the latter, firms or administrations, noting the growing share of EVs in their car fleets.

Increasing the share of semi-fast to rapid-charging stations in an EVCI will maximize the potential for power flexibility with the capability of a significant shifting of power on demand. Under optimal conditions, controlling x50 fast charging points could lead to a 1 MWh of tertiary power reserve for flexibility services. To offer the same tertiary reserve capacity, an EVCI made up of standard charging stations only would need more than x300 charging points. The potential for an EVCI network to activate such flexibility power reserve should be of interest to aggregators when operated safely and in a reliable manner. Moreover, the optimization of the charging time of each EV is expected to dramatically increase the turn-over rate of an EV fleet.

OPF Objective Functions

The objective functions to be implemented can be summarized as follows:

1) Peak demand shifting and shaving: offer better EVCI operating performances by peak-load shifting on demand when TOU pricing is lower and thus reduce energy expenditures. However, the overall energy consumed from the grid will remain the same without any impact on energy efficiency but the improvement of the economic performance of the network operation.

2) Maximise the provision of grid-flexibility services to increase the reliability of grid operation thanks to a synchronous operation of both public and private EVCIs. Optimization will have to respect the needs and boundary conditions imposed by the operation of the linked EV fleet.

General sequence of actions

The implementation of the IS 3.1 is yet not completely settled and changes might apply. The sub-UC described below will be implemented in a sequential manner.

The private EVCI network of NCA will be from now on controlled by a supervision platform provided by EDF. The system will be configured to communicate with the subset of charging stations relevant to the demonstration.

Concurrently, VULOG will set up the new version "AIMA" of the car-sharing platform managing the EV fleet of NCA. By interfacing the new interoperable VULOG platform to the Smart Charging management platform, the exploitation of forecasts of availability and location of shared EV should significantly improve the Smart Charging plan. "AIMA" platform will make EV state of charge (SOC) available for Smart Charging management.

The two operators will define the type and format of information to be exchanged via the respective platform APIs, develop them and validate the interfacing between the two platforms. Data exchange will be performed at forecast and optimization layers of these platforms. The end-users will be the public officers registered to the car sharing system of the NCA metropolis.

The "Prise de Nice" application will be developed to integrate the data specified for the demonstrator: end-users' information, users' reservation details, charging pole occupancy time (times of connection/disconnection) and possibly the EV SOC if relevant.

Current contractual negotiation with Renault Mobility Services public car sharing operator, if positive, may give access to the public EV fleet information in a way like the interfacing with the VULOG "AIMA" platform.

Once the system is set up and tested, the optimization process will be deployed in 3 steps: 1| testing of peak shaving and shifting for tariff optimization; 2| interfacing with the energy aggregator platform as by UC 3.2 in IS 2.1 for provisioning tertiary services to the energy spot market.

In order to stimulate the participation of end users to the demonstrator, it is considered to apply a preferential charging tariff to users, either registered to the car sharing service or private EV owners.

5.1.1.1.3 Use case conditions

5.1.1.1.3.1 Assumptions

- The management solution of the private shared fleet of vehicles of NCA is based on the new interoperable version "AIMA" of the car sharing platform of VULOG which offers services to forecast and optimize the turnover of the shared EVs will be implemented.
- Both EVCI and EV platforms can be interfaced via open (at least royalty free) APIs.
- All charging stations of NCA private EVCI are OCPP compliant and can be made accessible via a dedicated communication network/system with reasonable expenses.
- The smart charging management system can interface directly with the energy aggregator platform and if relevant, also with the LEMS tested in IS 2.1 demonstrator.
- Flexibility services resulting from smart charging operation are believed to be tradeable on the energy market.
- A V2G component can be combined to the smart charging management system.

5.1.1.1.3.2 Prerequisites

- The subset of charging stations of NCA private EVCI dedicated to the shared EVs of the city fleet shall be controllable over internet and physically connected either to the city fiber-optic network or to a radio cellular network.
- An overall impact analysis, proving the feasibility of the undertaking must be done. Under current market conditions, EV must stay idle for a certain minimal time in order to make their use on energy market profitable and thus, justify the development and implementation of a smart charging platform.

5.1.1.1.3.3 Optional contributions

- RENAULT Mobility to provide the booking data of their shared EV fleet to complement the demonstration activity based on NCA shared EV fleet[3].
- EDF subsidiary company DREEV develops the vehicle-to-grid (V2G) component of the smart charging solution and consequently shall probably join the project as Linked Third Party of EDF. This has yet not been clarified and will be updated in a later point in time accordingly.
- NCA includes its fleet of five (5) V2G compliant vehicles in the demonstration to experiment the contribution of shared EVs as a source of tertiary energy reserve to the grid. NCA installs accordingly five (5) bidirectional charging points in its premises.

5.1.1.2 Technical details

5.1.1.2.1 Private EVCI configuration

The EVCI privately owned and used by the local public administration is composed of ~150 fast charging points compliant with the OCPP protocol. A subset of these charging stations is dedicated to the shared EVs of the NCA private fleet. The internet connection of the charging stations relies either on the city fiber-optic network or on a radio cellular network.

[3] This is optional to possibly get complementary data from the Renault Mobility fleet of EVs (mileage per car, use ratio per car, residual battery load before booking, etc.) to extend the data collected from the sole NCA private share EV fleet.

NUMBER OF CHARGING STATIONS	NUMBER OF CHARGING POINT	MANUFACTURER	EQUIPMENT TYPE	OUTPUT POWER	LOCATION	CITY	SHARED FLEET	INTERNET CONNECTIVITY	OWNER	OCPP PROTOCOL
1	1	SCHNEIDER	ELVINK PARKING	22 KW	LA CITADELLE	VILLEFRANCHE		IPVPN	NCA	YES
1	2	SCHNEIDER	ELVINK PARKING	22 KW	26 AVENUE DU TRAIN DES PIGNES	COLOMARS		Optic Fiber	NCA	YES
2	2	SCHNEIDER	ELVINK WALBOX	22 kw	107 ROUTE DE CANTA GALET	NICE	X	Optic Fiber	NCA	OUI
4	8	LEGRAND	?	?	107 ROUTE DE CANTA GALET	NICE	X	Optic Fiber	NCA	NO
4	8	SCHNEIDER	ELVINK PARKING	22 KW	ALLEE DES GEOMETRES	ST LAURENT DU VAR		Optic Fiber	NCA	YES
6	12	SCHNEIDER	ELVINK PARKING	22 KW	85 ROUTE DE TURIN	NICE		Optic Fiber	NCA	YES
1	1	SCHNEIDER	ELVINK WALBOX	22 KW	85 ROUTE DE TURIN	NICE		Optic Fiber	NCA	YES
1	2	SCHNEIDER	ELVINK PARKING	22 KW	DECHETERIE	VENCE		IPVPN	NCA	YES
1	2	SCHNEIDER	ELVINK PARKING	22 KW	20 TRAVERSE DES ARBORAS (DECHETERIE OUEST)	NICE		Optic Fiber	NCA	YES
1	1	SCHNEIDER	ELVINK PARKING	22 KW	NEGOCIANTS SARDES	CARROS		IPVPN	NCA	YES
1	2	SCHNEIDER	ELVINK PARKING	22 KW	2 CHEMIN DES MAUBERTS	CAGNES SUR MER		Optic Fiber	NCA	YES
2	4	SCHNEIDER	ELVINK PARKING	22 KW	6 AVENUE DE LA GARE SUBDI	CAGNES SUR MER		Optic Fiber	NCA	YES
1	1	SCHNEIDER	ELVINK WALBOX	22 KW	214 ROUTE DE TURIN	NICE		Optic Fiber	NCA	YES
1	2	SCHNEIDER	ELVINK PARKING	22 KW	20 AVENUE ESTIENNE D'ORVES	NICE		Optic Fiber	NCA	YES
2	4	SCHNEIDER	ELVINK PARKING	22 KW	229 ROUTE DU TURIN HY60	NICE		Optic Fiber	NCA	YES
2	4	SCHNEIDER	ELVINK PARKING	22 KW	13 AVENUE SAINTE MARGUERITE	NICE		Optic Fiber	NCA	YES
2	2	SCHNEIDER	ELVINK WALBOX	22 kw	44 BOULEVARD GAMBETTA	NICE		IPVPN	NCA	YES
1	1	SCHNEIDER	ELVINK WALBOX	22 KW	26 AVENUE DIABLE BLEU	NICE		Optic Fiber	NCA	YES
2	2	SCHNEIDER	ELVINK WALBOX	7 kw	PARKING DE LEVENS	LEVENS		Rien, préciser l'ad	NCA	YES
1	1	SCHNEIDER	ELVINK WALBOX	22 KW	CHEMIN VERS LA GUMBA SUBDIVISION CENTRE	LEVENS		IPVPN au 877, RTE	NCA	YES
1	1	SCHNEIDER	ELVINK WALBOX	11KW	SUBDIVISION CENTRE (Borne Kilométrique 9)	GILETTE		IPVPN	NCA	YES
1	2	SCHNEIDER	ELVINK PARKING	22 KW	3 RUE JOSEPH REVELLI	NICE		Optic Fiber	VDN	YES
1	1	SCHNEIDER	ELVINK WALBOX	11KW	SUBDIVISION CENTRE	SAINT ANDRE DE NICE		IPVPN préciser l'adres	NCA	YES
1	1	SCHNEIDER	ELVINK WALBOX	11KW	LES AVELINES SUBDIVISION VESUBIE	ROQUEBILIERE		adresse précise ?	NCA	YES
1	1	SCHNEIDER	ELVINK WALBOX	11KW	SEIGE SUBDIVISION VESUBIE	ROQUEBILIERE		est-ce au 39, aver	NCA	YES
1	1	SCHNEIDER	ELVINK WALBOX	7 KW	LAZISOLA SUBDIVISION LA TINEE	ISOLA		IPVPN	NCA	YES
2	1	SCHNEIDER	ELVINK WALBOX	22 kw	79 BOULEVARD GAMBETTA	NICE		Optic Fiber	NCA	YES
1	2	SCHNEIDER	ELVINK PARKING	22 KW	66 BOULEVARD FUON SANTA	LA TRINITE		Optic Fiber	NCA	YES
1	2	SCHNEIDER	ELVINK PARKING	22 KW	39 BOULEVARD FUON SANTA	LA TRINITE		Rien au 39, est-ce le	NCA	YES
16	16	SCHNEIDER	ELVINK WALBOX	22 kw	15 Boulevard Georges Buono	LA TRINITE		Rien à cette adress	NCA	YES
1	1	SCHNEIDER	ELVINK WALBOX	22 KW	14 BOULEVARD ESTIENNE D'ORVES	NICE		IPVPN	NCA	YES
1	1	SCHNEIDER	ELVINK WALBOX	22 KW	50 Avenue Denis Séméria	NICE		Optic Fiber	VDN	YES
1	2	SCHNEIDER	ELVINK PARKING	22 KW	1440 CHEMIN DE LA SINE	VENCE		IPVPN	NCA	YES
1	2	SCHNEIDER	ELVINK PARKING	22 KW	229 ROUTE DE GRENOBLE	NICE		IPVPN au 233 RTE	NCA	YES
3	6	SCHNEIDER	ELVINK PARKING	22 KW	59 RUE BEAUMONT	NICE		Optic Fiber	NCA	YES
1	1	SCHNEIDER	ELVINK WALBOX	22 KW	PARC PHOENIX	NICE		Optic Fiber	VDN	YES
7	14	LEGRAND	GREEN'UO	4,6KW	BOULEVARD RENE CASSIN - STREET LEVEL	NICE	X	Optic Fiber	NCA	YES
1	2	SCHNEIDER	ELVINK PARKING	22 KW	8 RUE TONDUTI DE L ESCARENE	NICE	X	Optic Fiber	NCA	YES
1	1	SCHNEIDER	ELVINK WALBOX	7 KW	8 RUE TONDUTI DE L ESCARENE	NICE	X	Optic Fiber	NCA	YES
1	1	SCHNEIDER	ELVINK PARKING	22 KW	HOTEL DE VILLE	NICE		Optic Fiber	VDN	YES
4	4	SCHNEIDER	ELVINK PARKING	7KW	PARKING CORVESY	NICE		Optic Fiber	VDN	YES
1	2	SCHNEIDER	ELVINK PARKING	22 KW	23 Rue Professeur Delvalle	NICE		Optic Fiber	VDN	YES
1	1	SCHNEIDER	ELVINK WALBOX	7 KW	8 IMPASSE AUGUSTA	NICE		IPVPN	NCA	YES
10	10	SCHNEIDER	ELVINK PARKING	22 KW	1-3 ROUTE DE GRENOBLE - CONNEXIO BUILDING	NICE		Optic Fiber	NCA	YES
5	10	SCHNEIDER	ELVINK PARKING	22 KW	BOULEVARD RENE CASSIN - PLAZA BUILDING	NICE	X	Optic Fiber	NCA	YES
TOTAL	TOTAL									
102	**148**									

Figure 4 : Characteristics of the charging stations composing the city-owned private EVCI network dedicated to the pool of EVs of NCA, including its fleet of 42 shared vehicles used for IS 3.2 (Source: NCA).

5.1.1.2.2 System architecture, stakeholders and tools

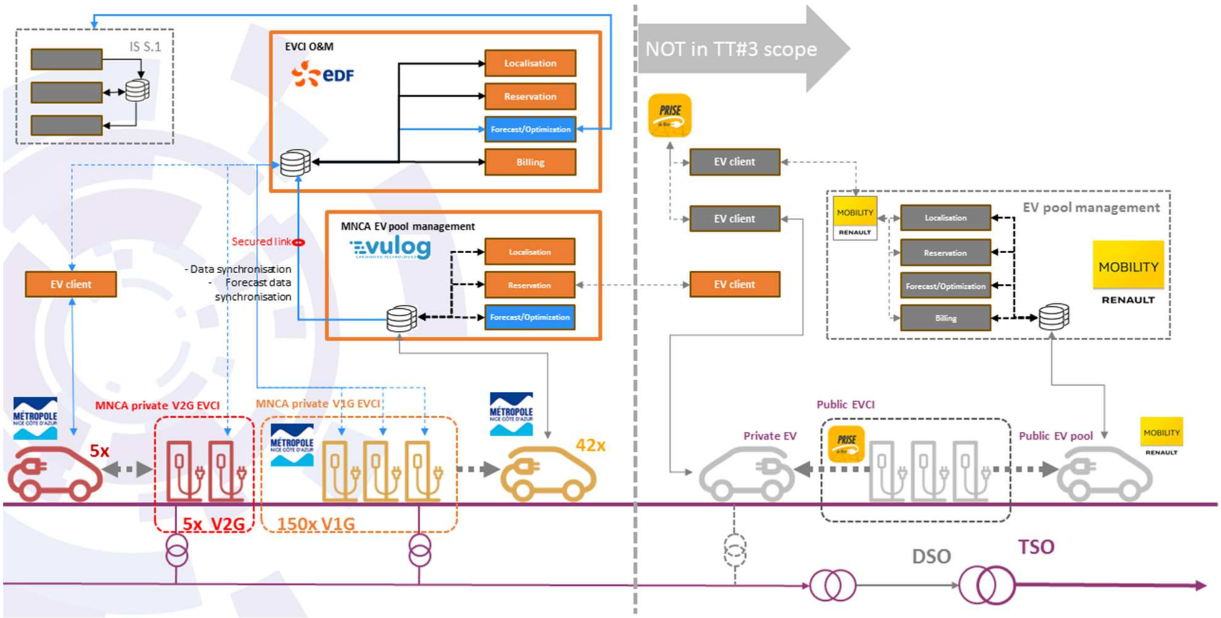

Figure 5 : General system interconnection between the different platforms directly impacted by the smart charging to be implemented in IS 3.1 – left half of the figure; Grey boxes and lines symbol infrastructure which is out of the measure's scope; the highlighted blue rectangles, corresponding to forecast and optimization layers, are those focused on by IS 3.1; blue lines correspond to additional interconnections to be done via specific APIs or protocols (Source: EDF)

As can be inferred from the figure above, smart charging is integrating various EVCIs and EV car fleets and, consequently, different profiles of users. This must be considered while implementing the demonstrator of IS 3.1: EV clients, both public officers and private individuals, shall be assured about the right state of charge of their EV, with the choice to deny their participation to this service and ideally get an incentive such as a lower charging fee for private individuals. Within the scope of TT #3 activities, the scope of the demonstrator will be restricted to the sole NCA's private EVCI and EV fleet, as highlighted in the figure above.

5.1.1.2.3 Control variables

From charging stations:

- Active power
- Reactive power
- Maximal power charge and discharge
- State of Charge (SOC) of connected vehicles

From car sharing system(s):

- Parking time forecast of an EV connected to a charging station (nb. Inferred from EV battery charge, EV parking location and other contextual data)
- Forecasted turn over

- Time of reservation of the EV (start time & end time)

From Aggregator/Market platform:

- Bid acceptance/activation
- Power-level, energy volume, activation timeslot, number of activations of flexibility services

5.1.1.2.4 Sub Use cases

5.1.1.2.4.1 UC 3.1 1: Technical and functional specifications and evaluation

The objective function of smart charging must be specified under the current sub-UC. Based on metering and historical data, the potentiality to implement smart charging measures will be evaluated from a technical and functional point of view. The models to be explored encompass both peak shifting towards optimization of load allocation based on electricity tariffs as well as flexibility provision for energy services. The purpose of this UC is to validate the technical implementation of this functions.

5.1.1.2.4.2 UC 3.1.2: V1G services

Based on the requirement defined in the previous sub-UC, the smart charging platform will be developed/adapted accordingly. As a first step, the platform will be interface with the EVCI to enable the management of the charging of EV. As second step, interfaces to the other implied systems will be set: with VULOG car sharing platform to retrieve operation data or predictions and, if proven feasible, with the aggregator platform, through relevant APIs. The aim is to build up a protocol to ensure that bidding on electricity spot-markets can be reliably forecasted, placed and activated. This should allow the demonstration of such function under real market conditions.

5.1.1.2.4.3 UC 3.1.3: V2G services

In case the possibility to implement V2G EVCI reveals to be feasible, this sub-UC will be realized. Different from the previous one, the set of services to focus on are of a wider spectrum because primary services can be targeted. This sub-UC will probably be developed separately and not connected under the same smart charging platform.

5.1.1.3 Societal, user and business aspects:

5.1.1.3.1 Business model

Smart charging should become a mainstream component of both public and private call for tenders: smart charging services should be entailed in the overall evaluation of the tendering requirements. Delegation/exploitation/operation contracts (being public or private) should entail technical and functional requirements related to dynamic operating systems (smart charging) and should consider related fixed fees retribution to the operator or other type of retribution scheme.

Extra costs could also be distributed over the whole value chain and this could happen with different mechanisms: ideally costs should be equally supported by end-users by applying dynamic charging tariff similarly to the TOU; or, they could also be rewarded with lower financial charges for the EV charging, if the EV has participated to flexibility services. However, either of such scenario is very unlikely to happen in the short- to mid-term, as public and private policies are still prioritising the growth of EV adoption and are not yet ready to directly charge more costs on end-users.

More specifically, in the private sector (tertiary), the “smart charging” service could be part of additional licencing fees scheme (fixed or variable), scaled to the connected charging points and thus, be licensed to third party operators. Means to bundle properly such different services and operators/stakeholders for realizing such a business model (BM) is yet not clear. Still systems must gain maturity in terms of interfaces and protocols and automation on one side, and operator and clients alike familiarize with such new sector and gain knowledge and REX.

5.1.1.3.2 Governance

EDF will lead the demonstration activity and monitor the project progress, ensure timely achievement of goal and objectives and coordinate the different involved stakeholders and support contractual arrangements needed for the implementation of IS 3.1; support with its know-how the planning and achievement of the demonstration; bridge the activities towards the other UC and ensure the overall coherency between IS3.1 of TT#3 and IS 2.1 and IS 2.3 of TT#2. EDF (through its related departments) will pre-evaluate first the opportunity to use the EVCI pool of NCA to implement a Smart Charging platform and based on such study’s results, design and test the algorithms developed for the smart charging platform in cooperation with the operator(s) of the local private EVCIs, namely VULOG with NCA’s private car sharing fleet; it will cooperate with the different involved stakeholders for the achievement of the demonstration; in case necessary, it will proceed to the formal integration of a possible subsidiary to the GA.

VULOG will deliver, operate and monitor the EV fleet management system for the shared-EV private fleet of NCA; it will develop associated APIs and possible end-user interfaces; as TT#3 leader, it will guarantee the overall coherency between IS 3.1 and IS 3.2.

NCA will participate directly to the demonstrators of IS 3.1 and IS 3.2 by making available its private EVCI network and it private car sharing EV fleet. As the coordinator of the Nice ecosystem of partners and of the overall demonstration activities, NCA will ensure the overall coherency across the different demonstrators and the coordination with other LH and follower cities.

5.1.1.4 Commissioning Plan

No commissioning plan can be disclosed so far. The specification of the scope of the demonstrators and the identification of the exact demonstration perimeter are still in progress and cannot be formalized yet among the relevant stakeholders. The delivery of an implementation plan is the next priority of TT#3 activities.

5.1.1.5 Implementation plan

5.1.1.5.1 Planning of activities

As stated previously, yet negations are underway and key decisions are yet attended. A preliminary planning of the activity could be as follows:

1) UC 3.1
    a. *Milestone*: GO-NO-GO decision by 07/2020
    b. *Launching of UC 3.1.1*: 09/2020
    c. *Monitoring start:* to be defined if 10/2020 can be achieved.
    d. *Milestone:* GO-NO-GO decision to launch UC 3.1.2 and 3.1.3 by 03/2021
    e. *Launching of UC 3.1.2:* Q2 2021

f. *Operation of EVCI under Smart Charging platform:* 10/2021

5.1.1.5.2 Risk management

1. Limitations of experimentation activities due to contractual limitations
    a. The contractual implications of the activity implementations are not yet settled among the involved parties and leave the risk of bringing delays or limitations in the demonstration's scope. Impact of this on the metering activity is not clear yet.
    b. Mitigation: backup option for NCA to subcontract on its own the operation and maintenance of its private EVCI for the time period of the project.

2. System and/or protocol incompatibility can affect the feasibility and/or development costs related to the planned measures:
    a. The choice of the target EVCI to be included in the measure 1 demonstration activity has been restricted to the sole charging stations used for the shared EV fleet of NCA. Despite these charging stations are supporting the OCPP protocol, the technical feasibility of the dynamic control of these charging stations has still to be confirmed and the number of controllable stations might be reduced in case of incompatibility. The connection to internet of NCA private EVCI is planned but not yet completed: any data accessibility issue could be a risk for the demonstration realization.
    b. Mitigation: Optional use of 3G cellular connectivity (M2M SIM) when the connection of a charging station to the city optic-fiber network reveals technically complex.

3. Provision of flexibility services is relying on forecast performances which may not fulfil the requirements for flexibility, or the level of flexibility could be too low for market integration
    a. The project is so far focusing only on fast charging technology to maximise the impact of the demonstration on flexibility.
    b. The dynamic supervision of the pool of fast-charging stations of the private EVCI network correlated to the predictive usage of the city shared EV fleet is expected to provide significant flexibility volumes which would deserve to be integrated in an aggregator's flexibility portfolio. However, this technical assumption has still to be validated as part of the demonstration activities under sub-UC 3/1/1.

5.1.2 Impact Assessment

5.1.2.1 Expected impact

As detailed in the DoA and the GA, here are the main expected impacts targeted by IRIS for the whole demonstration under TT#3. Most significant impacts for Measure 1 of IS 3.1 are:

- IMPACT 1: Put in practice a bankable solution for a challenge identified by the city
- IMPACT 2: Increase the energy efficiency on district scale
- IMPACT 3: Increase significantly the share of renewable energies, their integration into the energy

system, stimulate self-consumption, reduce curtailment to the minimum
- IMPACT 4: Increase local air quality.
- IMPACT 5: Reduce the technical and financial risks in order to give confidence to investors for investing in large scale replication.
- IMPACT 6: Make the local energy system more secure, more stable and cheaper for the citizens and public authorities.
- IMPACT 8: Reduce transport-based CO_2 emissions, based on CO_2 intensity of the European electricity grid of 443 CO_2/kWh (coherent with TEST format - available on the Participant Portal)
- IMPACT 9: Create stronger links and active cooperation between cities in many Member States with a large coverage of cities with different size, geography, climatic zones and economical situations

The first impact of Measure 1 is to be the first time in French industry of such an implementation which could serve as a role model for further developments and replication. The demonstrator should bring confidence to stakeholders and decision makers, foster further development and accelerate the adoption of such a solution. This relates directly to impact #1 and impact #5.

The operation of an EVCI aiming at peak shaving and shifting, is contributing to assess how Smart Charging can bring flexibility to the electric grid (nb. at TSO and DSO levels), and further to the efficient integration of variable RES. This relates directly to impact #2, #3 and #6.

Measure 1 is indirectly contributing to impact #4 and #8 by potentially providing new services to EV users and owners. The demonstrator may fuel new business models to be considered for the commercial operation of public and private ECVI networks as well as EV fleets.

The results from Measure 1 will contribute further to the impacts of IS 2.1 Measures as explained in D6.4.

5.1.2.2 KPIs

Table 2. Summary-list of KPIs and related parameters for Measure 1 of IS 3.1

KPI	Parameter(s)	Baseline	Target (as described in DoW or declared)	Comments
CO2 savings	REF electricity CO2 CHP plant [tCO_2eq/MWh] REF electricity CO_2 [tCO_2eq/MWh] Flexibility volume [MWh] **This provides Electricity CO_2 savings from flexibility provision via the "replacement method" so, expressed as the electricity CO_2 saving between producing the same service volume with a gas CHP plant as compared to low/zero-carbon solution as EV charging management.**	The baseline is the retro calculation of the volume of carbon emission that would have been produced by Gas fired CHP plants to provide the same power and volume of flexibility services as under IS 3.1	This indicator will further contribute to the assessment of IS 2.1.	Flexibility can be considered as replacing fossil fuel based peak load power plants (e.g. gas CHP).
Peak load reduction	MAX elec peak [MW] REF elec peak [MW] **By dividing the measured peak load by its reference electricity peak load, the % of peak load reduction can be calculated**	The reference electricity peak load shall be most likely estimated. Moreover, the question is pending on how to deal with an uneven charging poles distribution in the demonstration area. An "average peak load" value might apply.	This indicator will further contribute to the assessment of IS 2.1.	

Activated useful storage capacity	Cumulative V1G/V2G BESS capacity activated [kWh] **This will give the total cumulative volume of energy that has been stored, thanks to the smart charging.**	A reference case would not be meaningful as there's actually no smart charging operation to refer to.	This indicator will further contribute to the assessment of IS 2.1.	The objective of this KPI is to provide a more meaningful KPI than a sole "installed BESS capacity". The latter would just give an indication of the nominal capacity in which it has been invested in (EV). With this KPI, it is intended to show the operational impact that has been achieved with the demonstration activity to activate and combine different BESS means.
Increased system flexibility	**Number of activations per year** **Average Power flexibility [kW]** **Average Energy flexibility [kWh]** **Average activation duration** **Flexibility load ratio can be evinced by the Average Power flexibility divided by the reference Peak Load.**	A reference case would not be meaningful. Therefore, the indicator should simply disclaim capacity, volume, frequency and duration of provided services. For the latter the reference value for "Peak load reduction" applies	This indicator will further contribute to the assessment of IS 2.1.	This is actually the central KPI to be accounted for within IS 3.1. It is a collection of KPIs. These measures are instrumental to the evaluation of the action and may be the most valuable information to share with all stakeholders in the energy value chain.
Energy costs reduction	REF Expenses electricity [EUR] Electricity bill [EUR] Income energy services [EUR] **Thanks to this indicators, the reduced energy costs incurred by the reduced energy expenses via peak load shifting and shaving will be accounted for. Moreover, the potential revenue stream from flexibility services can be accounted for.**	The reference value is the previous year annual energy expenses for the EVCI operation for involved stakeholders.	This indicator will further contribute to the assessment of IS 2.1.	This will be a direct indicator of the value proposition that can be achieved by this IS.
Supervised fast charging poles	**Number of charging poles which have been connected to the smart charging platform.**	N/A		A new KPI which describes the number of charging poles that are considered for the experimentation. It is specified that charging poles of semi-fast and beyond types are accounted while slow/standard-charging poles (3

				KVA) are not considered as explained in the previous chapters.
Investment cost	This indicator is less clear yet, as the definition of the scope and perimeter of this KPI is yet not harmonised among the LH cities.			The main matter here is that the costs entailed by the project are cumulated cost for a system development, which would result in a too high cost related to "reality". System or technology development is not an expense to be reversed into a "one shot" project, but should be part of a business development plan and divided into a target number of replication/follow up projects and thus, reduce the costs for the first client. The KPI might thus maybe result from the replication and business modelling activity that a direct value that can be reported by the demonstration activity

5.1.2.3 Monitoring plan

The overall monitoring of the achievements of the actions will be mainly granted by the centralization of information by NCA via EDF and VULOG management platforms and its post processing for nourishing WP9 tasks. The details about the monitoring period of the different measures, are given by the implementation plan described for the sub-UC.

For the overall volumes and peak energy consumption and injection metering on the electric grid, ENEDIS could provide the aggregation of the information stored in their data centers. For a fine grain aggregation level, the authorization from the users of shared vehicles shall be granted to use of the personal data related to their bookings and trips. To assess all detailed information “behind the meter”, only NCA should be involved to grant access to ENEDIS for the same reasons as mentioned previously.

5.1.3 Progress achieved up to M24

The main achievement during this period has been the rapid response to the change of the local market conditions with NCA retrieving the ownership of the city public EVCI (O&M contract signed between new owner NCA with IZIVIA) in January 2019 and the coordination of all IRIS partners involved to reassess and redefine the scope and objectives of IS 3.1 demonstrator (namely several departments of NCA, EDF, VULOG, and some other local stakeholders). The execution of the demonstration activity is leading to a deep modification of the contractual framework originally stated for these parties and the new contractual setup requires to well define the new roles and responsibilities of each stakeholder. The decision was to target for IS 3.1 demonstrator the private fleet of shared EV of NCA in replacement to the former public shared-EV fleet “Auto Bleue” and, consequently, to select the private EVCI of NCA in replacement of the city public EVCI “Prise de Nice”.

The situation has been explained, discussed and is monitored under WP6 and straight-forward communication with the Coordinator have been initiated.

5.1.4 Conclusion

This preparatory phase revealed the complexity of such multi-stakeholders type of approach which needs much coordination and cooperation among the parties for converging towards clear technical and functional requirements and inferring the related contractual arrangements. These are also related to short and mid-term uncertainties about a clear customer promise, due to the many uncertainties related to the early development stage of the proposed solution developed in IS 3.1.

To reduce the complexity and potential risks of a non-sustainable business model for the LEMS in general and more specifically for this Smart Charging solution, the action has been broken down into individual business UCs which can be then integrated in a sequential manner. Thus, by gradual steps from the individual sub UCs of IS 3.1, the value proposition can be ensured at every step. While increasing the complexity of the management system, this process should enable to decide when the threshold for bankability is reached and to arbitrate between a follow up or a termination of the sub UC implementation and demonstration, so to avoid to implement non-added value actions according to the impact and objectives of the project.

5.2 IS 3.2 – Innovative Mobility Services for the Citizens

IS 3.2 has been divided into 3 sub-use cases (UCs) according to the 3 main measures that will be put in place with the demonstration of this integrated solution. These measures are detailed in the following paragraphs.

5.2.1 UC 3.2 / Smart management of EV car sharing

5.2.1.1 Description of the Use Case

5.2.1.1.1 Goal, Objectives and Scope and of the use case

Goal: Improve the management of a Fleet of shared EVs by optimizing the economic performance of the operation of car sharing.

Objectives:

- Define the impact of an advanced car sharing optimization platform on fleet management. A point of focus is the link between the mobility practices of users in respect to the shared electric vehicles' availability, autonomy and the car sharing value service.
- Implement fleet management optimization while offering a smart charging related value proposition. Charging EVs must be done at the optimal time to satisfy both the booking demand and the distribution grid energy requirements (peak shading, grid services, etc.)
- Interface a car sharing platform with a smart charging platform aiming at optimizing fleet management.

Scope: demonstrate that the integration of Smart Charging into a shared-EVs fleet management is possible and beneficial. This demonstrator ambitions to validate the advantages of charging the electric cars during off-peak hours, possibly offering additional grid services, without impacting the quality of services offered to end-users within the constrained context of a pool of professional users belonging to a public administration.

5.2.1.1.2 Narrative of Use Case

5.2.1.1.2.1 Short description

Coupling the operation of a fleet of electric vehicles governed by a management platform to the operation of an EVCI based on a supervision platform can provide both savings for charging costs of electric cars and a flexibility to the public distribution grid. The Smart Charging is consisting , on one hand, of the charging of electric cars during the off-peak periods to allow a better levelling of the amount of energy consumed at city level and, on the other hand, to guarantee the right battery load of each vehicle for its maximum availability according to the predicted use of the vehicle.

Built-in optimization features within the EV supervision platform are required for a real-time management of the charging of shared EVs. Optimization strategies will be gradually developed during the project to take into account more data and assets based on interim results.

5.2.1.1.2.2 Complete description

Motivation and problem statement

As already mentioned, the current market does not systematically integrate energy management into the overall fleet management. This is mainly due to a relatively slow growth rate of EVs penetration and similarly associated EVCIs and operating practices which don't yet create a stress on the current public distribution grid. However, with all new local real-estate projects now obliged to follow rules to dimension and pre-equip a part of the new parking lots with the convenient charging infrastructure, the subsequent impact of the size increase of the local EVCI in terms of energy demand on the public distribution grid is worrying public authorities and DSOs.

Thus, the development of car sharing as an alternative to the use of personal vehicles for local trips as a step towards to sustainable mobility is claiming to adopt a business strategy integrating the EV charging service to the global value offer from the car sharing service, namely a smart charging solution, aiming at an efficient consumption of energy from the public distribution grid by EVs and a potential asset for grid flexibility.

Solution approach

Dynamic charging plans, leveraging the interconnection between the EVCI supervision platform with the operating platform of the electric cars fleet, shall better predict the requirements in terms of availability, location and revenue of each vehicle of the fleet to allow a better balancing of the charging of the vehicles. Considering a dynamic pricing of energy, it is possible to determine the optimal time and duration, thus charging speed, to charge any vehicle according to its predicted uses. This smart charging solution should be of interest for the operators of EVCIs and, beyond, for the owners of the electric cars to reduce their energy bill.

Implementing smart charging requires, for each charging station, to correlate the time of charging and the charging duration of the vehicle at that location, its probability of use, its residual battery load, in order to provide the electric fuel load necessary to achieve the subsequent trips forecasted for this vehicle in due time before a new charging. Producing this information requires to make predictions at different time scales.

OPF Objective Functions

The objective functions to implement can be summarized as follows:

1) Interaction between fleet management and smart charging. An optimal fleet management must increase the booking probability as well as the average trip for each shared electric vehicle. The mobility platform must ensure that the battery of each EV is loaded properly. In order to achieve this function, the "AIMA" car sharing management platform will have to provide vehicle location information as well as the state of charge to the smart charging platform.

Year 2019	Number of reservations	Number of users	Average booking time of a vehicle (in mn/day)	Average distance traveled (in km/day)	Total distance traveled (in km)
January	956	196	300	26	25 357
February	874	191	290	28	24 638
March	902	200	370	32	29 059
April	817	188	397	32	26 746
May	925	178	390	34	32 031
June	935	207	356	36	34 521
July	990	198	360	33	32 796
August	692	144	332	33	23 199
September	970	198	325	36	35 583
October	1 068	208	346	31	33 852
November	923	195	306	32	29 696
December					
Yearly Total	**10 052**	**2 103**	**3 772**	**353**	**327 478**
Monthly Average	**838**	**175**	**314**	**29**	**27 290**

Figure 6 : year 2019 car sharing statistics for the fleet of 42 shared EV of NCA (Source: NCA)

2) Communication by the smart charging system of the information relevant to the optimal time of charging time and charging at a charging station to the car sharing management platform. The synergy between the two platforms and the efficiency of their interfacing is a critical issue with regards to car booking and overall vehicles management.

IRIS project aims to increase the use rate and the efficiency of a car sharing system based on EVs, including the cross-use of different fleets of vehicles, public as well as private, and the use of the EV charging infrastructure networks of the city of Nice, once again public as well as private. This study will focus on the car sharing / sharing of electric vehicles.

General sequence of actions

The implementation of the IS 3.2 is not yet finalized with still some possible changes. However, the sub-UC described below will be implemented in a sequential way:

- Collection of all information about shared electric cars, booking statistics and calculus of probability of booking.
- Compute for each vehicle the optimal time when charging the battery and the necessary amount of energy to charge in the battery.
- Exchange of information with the smart charging platform.

The carsharing platform AIMA being hosted in NCA IT centre, all data will transit through the CIP.

5.2.1.1.3 Use case conditions

5.2.1.1.3.1 Assumptions

- Charging stations are controlled from the smart charging platform via the EVCI supervision platform operated by EDF.
- NCA dedicate its private fleet of 42 shared electric vehicles for the project lifetime.
- The car sharing of NCA private fleet is managed by VULOG via the car-sharing platform provided by VULOG. The newest interoperable version “AIMA” of this platform will implement the car sharing forecast and optimization functions.
- The VULOG platform can interface with a third-party Smart Charging Management Platform via open APIs (free of charge).
- End-users (EV drivers) booking data are used for the sole optimization of the operation (i.e. default contract between users and the operator of the car sharing service), with all usage related data anonymized for external use.
- The Smart Charging management system can interface directly with the local energy management system (LEMS) experimented in IS 2.1.
- Shared electric vehicles related data can be collected by the car sharing platform either directly or via a third party.

5.2.1.1.3.2 Prerequisites

- NCA shared electric vehicles are equipped with on-board connected boxes (VuBox) which are used to retrieve useful data to fuel VULOG car sharing optimization algorithms.
- Data acquisition is possible from any vehicle regardless of its location.
- All charging stations use to charge a vehicle of the fleet must be able to transfer its operating status and conditions using a standard communication protocol (i.e. OCPP)
- DREEV is accepted as a third party of EDF for the implementation of V2G component of the demonstrator.

5.2.1.2 Technical details

5.2.1.2.1 Systems and associated actors/tools

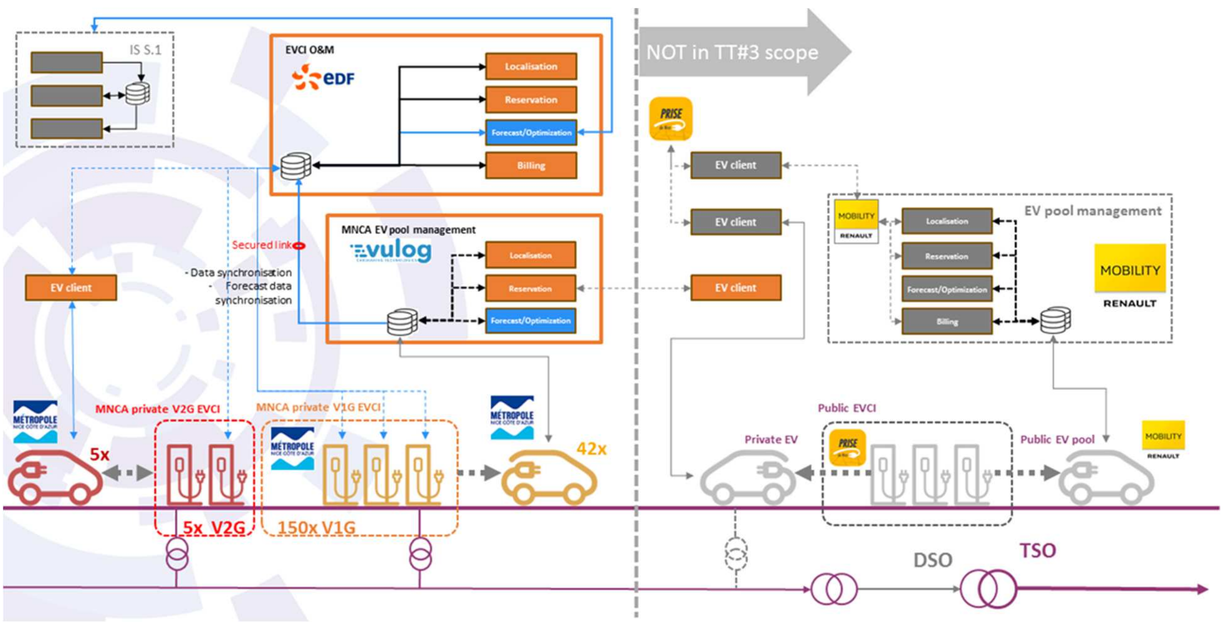

Figure 7 : General system interconnection between the different platforms directly impacted by the smart charging to be implemented in IS 3.1 – left half of the figure; Grey boxes and lines symbol infrastructure which is out of the measure's scope; the highlighted blue rectangles, corresponding to forecast and optimization layers, are those focused on by IS 3.1; blue lines correspond to additional interconnections to be done via specific APIs or protocols (Source: EDF)

As shown in the figure above, the optimization of fleet management aiming at smart charging is impacting the different sub-groups of the demonstrator, namely EVCIs and EV fleets, and beyond the level of car sharing service delivered to the different categories of customers. This must be considered when implementing the IS 3.2 demonstration by offering a level of availability of vehicles from both private and public shared fleets as good as or better than the level of availability offered without any optimization.

5.2.1.2.2 Control variables

From the vehicle:

- Location
- Battery load

From the Car sharing platform

- Lease Probability (vs. the location of the vehicle and the time)
- Forecasted trip mileage
- Forecasted lease duration

From the charging system

- Location of the charging stations
- Charging point availability (i.e. vehicle connected or not)
- Charging point operating modes (i.e. charging speeds offered)

These data will be dynamically exchanged across the different platforms. In addition, VULOG will provide an historization of all data collected from users of car sharing based on their profile of consumption of such a service.

5.2.1.2.3 Sub Use cases

5.2.1.2.3.1 UC 3.2.1 Data collection

This task aims to retrieve the data from shared EVs using an on-board connected box (VuBox) in order to gather their location, their booking profile and the state of their battery load. VULOG will develop data analytics algorithms to build prediction models.

5.2.1.2.3.2 UC 3.2.2 Predictive information computation

Based on the data collected, mobility and booking trends will be computed to identify and forecast the peaks of reservation of vehicles. Conversely, the trends for low points of reservations will be similarly identified in order to schedule the right time and duration to recharge the battery of EVs. In addition, by correlating statistics on the average trip mileage and the forecast of next to come bookings of a vehicle at a specific location, VULOG will be able to compute the right amount of energy to recharge the battery of the car.

5.2.1.2.3.3 UC 3.2.3 Interfacing with the smart charging platform

All information collected or inferred from the EVCI, from the vehicles and the scheduled or forecasted bookings of these vehicles will be used to compute and transfer to the smart charging platform the list of vehicles to be recharged, the mapping of the charging stations to whom they are plugged in, the amount of required energy, and the time and the maximum duration to charge these vehicles.

5.2.1.3 Diagrams of the use case

5.2.1.3.1 Context diagram per sub use case

5.2.1.3.1.1 UC 3.2.1 Data collection

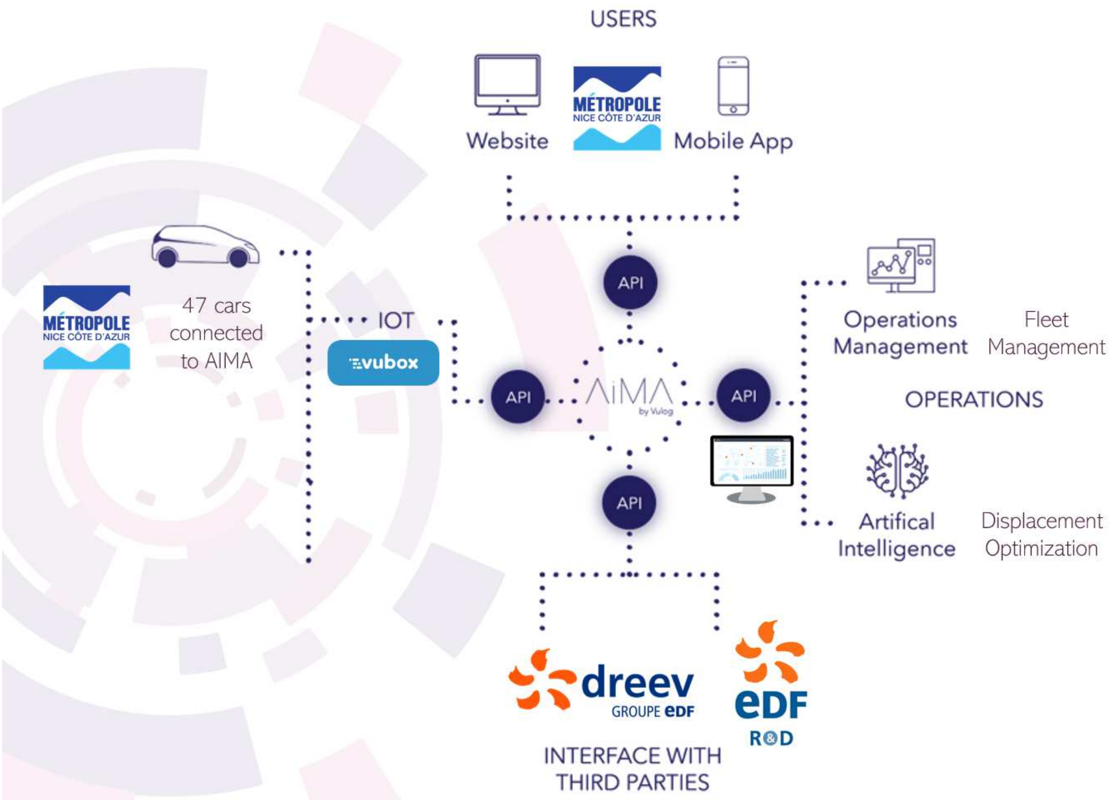

Figure 8 : AIMA platform interaction

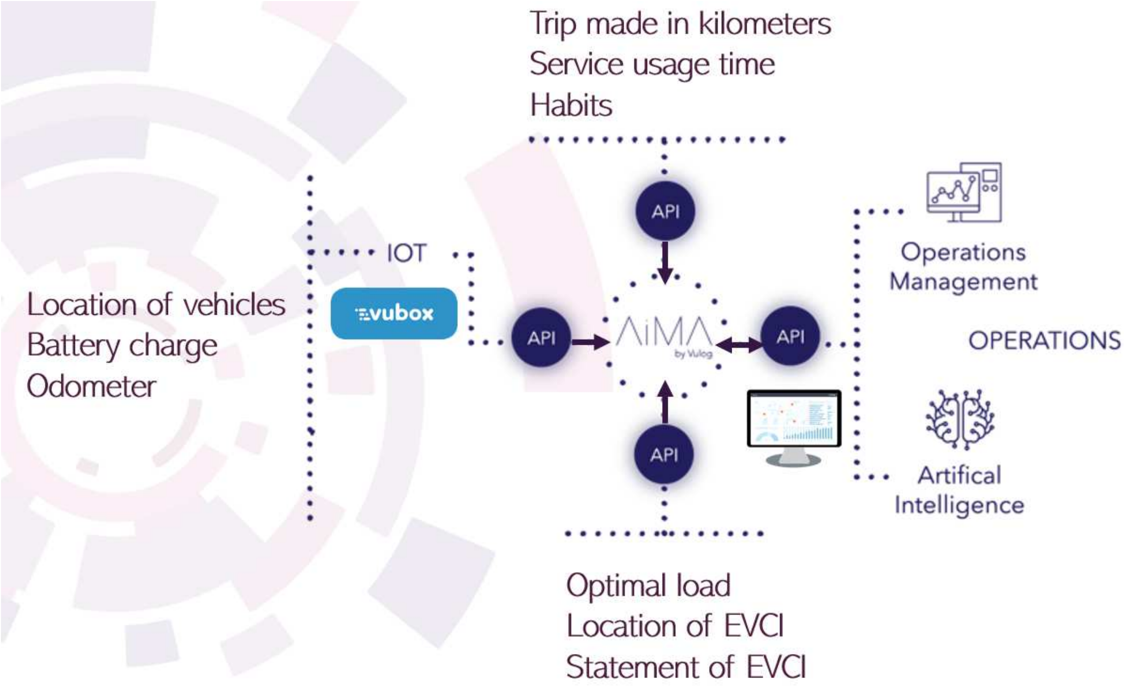

Figure 9 : Typology of data collected by AIMA

5.2.1.3.1.2 UC 3.2.2 Predictive information computation

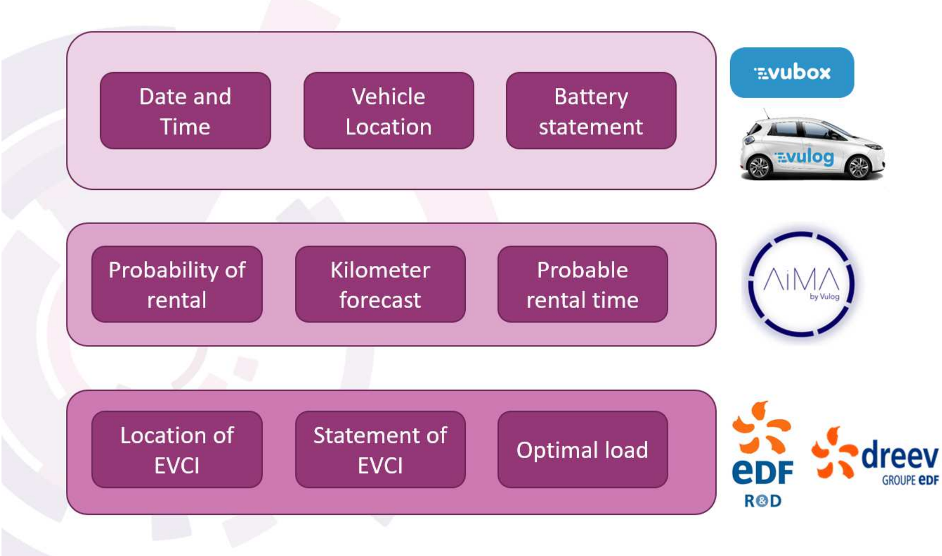

Figure 10 : Source of data useful for prediction

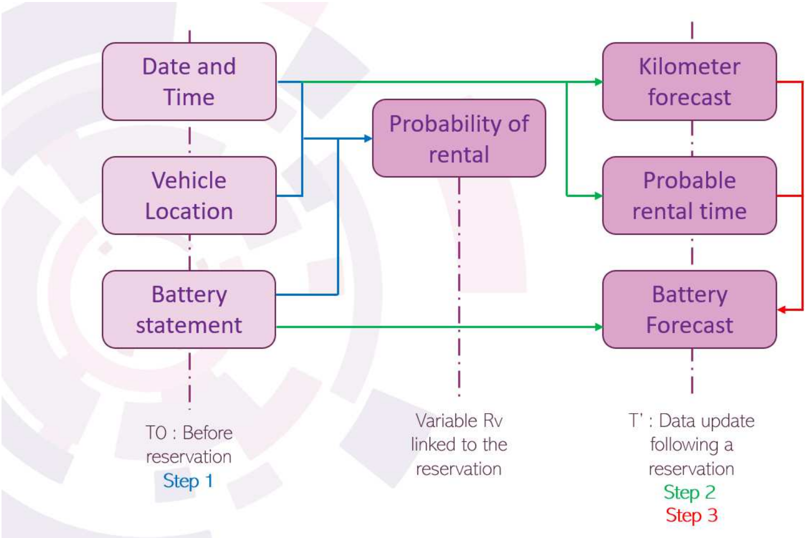

Figure 11 : Data orchestration for prediction

Step 1 makes possible the definition of a rental probability using data from the IOT. Indeed, in a second step, thanks to the rental, the time and the models generated by the many algorithms of VULOG, it is possible to determine the probability of rental, the likely journey as well as the estimated rental duration.

The 3rd step makes possible to forecast, from the trip predictions, the new battery load as well as the next rental of the car (i.e. booking time and trip).

5.2.1.3.1.3 UC 3.2.3 Interfacing with the smart charging platform

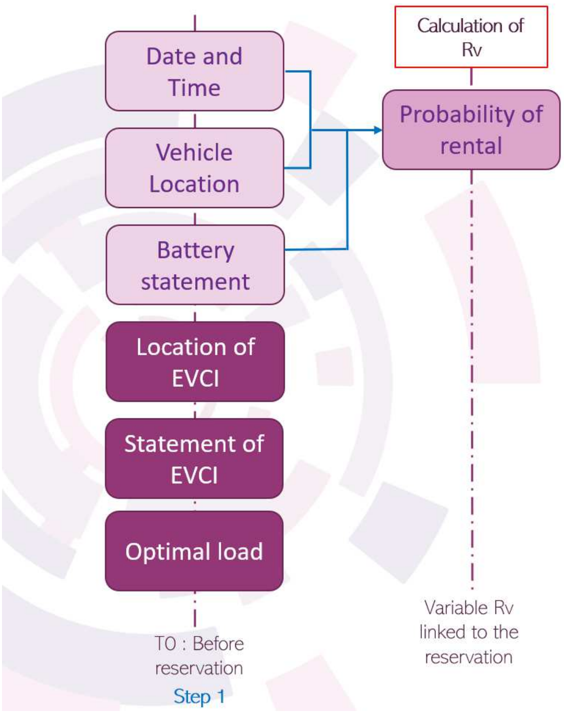

Figure 12 : Estimated probability of rental

When adding variables from EDF platforms, the rental probability calculation does not change.

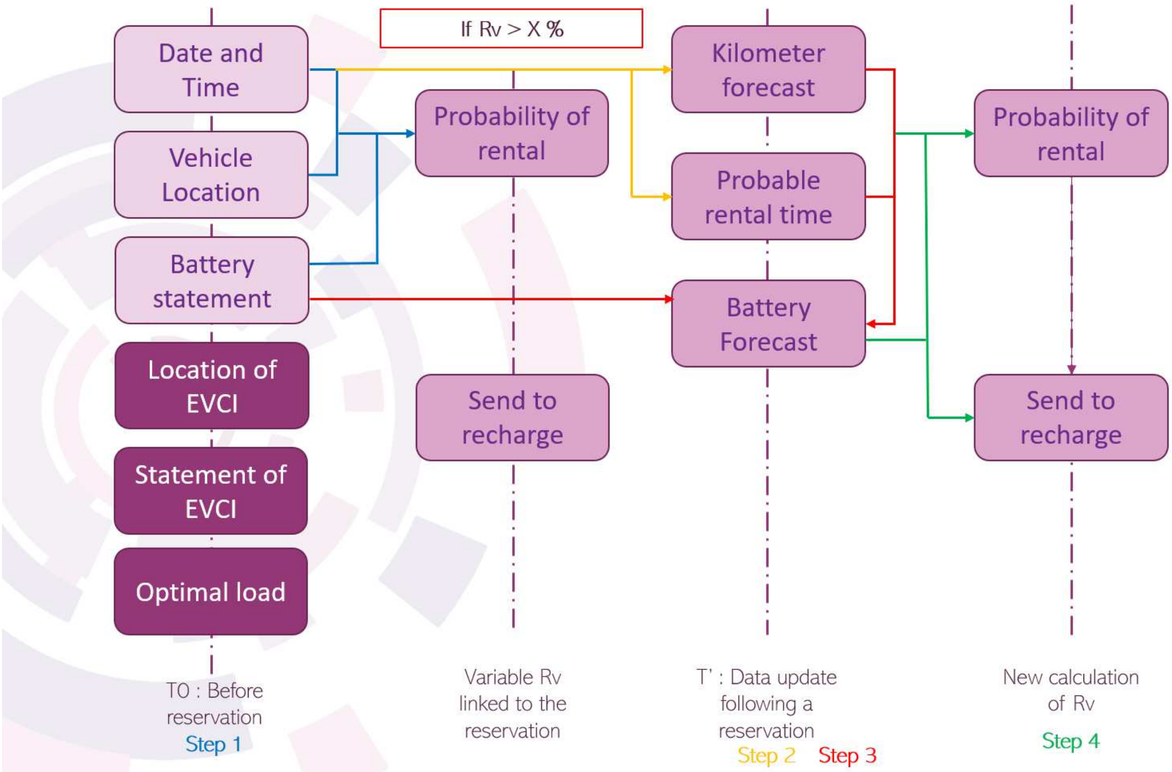

Figure 13 : Large probability of reservation

In case the vehicle is actually booked, the probability of rental is important. In this context, the vehicle will be enabled for rental and, in a third step, the battery load will be assessed against the energy needed for the next forecasted trip in order to anticipate or not a recharge of the battery.

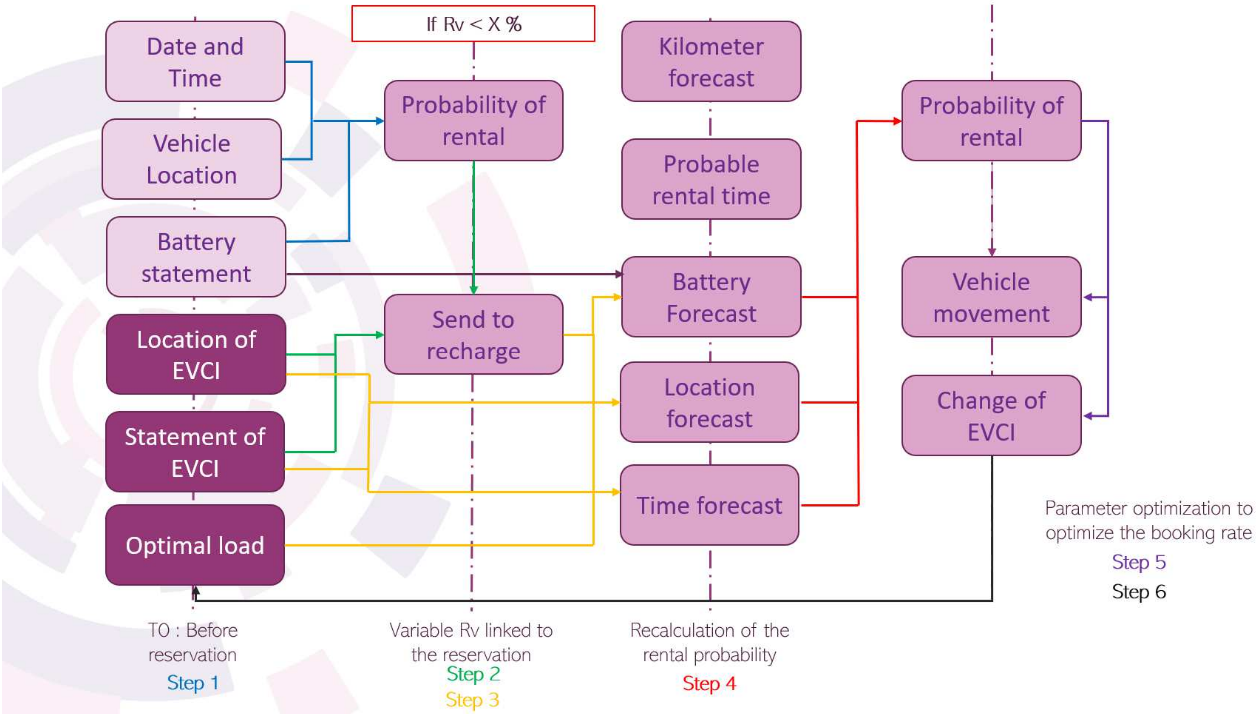

Figure 14 : Low probability of rental or insufficient charge

In the case of low rental probability, it will be chosen whether to charge the vehicle or not. However, it is possible, considering the state of the grid and possible flexibility requirements, to charge the car even if the level of the battery load doesn't require it.

If the load level of the battery of the car is critically low, it will be then decided to recharge the battery (step 2). Then the selection of a charging station will be needed in step 3. The goal being, during the following steps, to anticipate the distance to the charging station in order to choose the most relevant location for rental probability, when possible (step 6, if there is not enough fuel to move the car, it will have to be moved once it is recharged).

5.2.1.4 Societal, user and business aspects:

5.2.1.4.1 Business model

Smart charging should become a mainstream component of both public and private call for tender specification. Delegation/exploitation/operation contracts should entail related technical and functional requirements towards dynamic exploitation systems and consider related fixed fees retribution to the operator. Extra costs could also be affected on the whole value chain, so be sustained by end-users, by applying dynamic charging tariff similarly to the TOU, and also, they could be rewarded with lower charges if flexibility has been activated. The latter is however yet less probable in the short- to mid-term, as overall public and private related overall policies are supportive towards the EV adoption and yet not ready to reverse more costs on end users.

5.2.1.4.2 Governance

VULOG will lead the demonstration activity and monitor the project progress, ensure timely achievement of goal and objectives and coordinate the different involved stakeholders and support contractual arrangements needed for the implementation of IS 3.2.

In addition, VULOG will operate, manage and monitor the private shared EV fleet of NCA thanks to its car sharing management platform "AIMA" ; it will develop the necessary APIs to interface with the Smart Charging management platform or with any other platforms if required; if required it will develop or adapt end user interfaces. As the TT#3 leader, it will ensure the overall coherency among IS 3.1 and IS 3.2.

EDF will deliver, operate and monitor the smart charging management system; it will develop the APIs to interface with the car sharing management platform and the public and private EVCI supervision platforms; it will cooperate with the different involved stakeholders for the achievement of the demonstration.

NCA will participate directly to the demonstration of IS 3.2 as the owner of the private EVCI and of the private shared EV fleet which operation is based on the car sharing management platform "AIMA" developed by VULOG. As the manager of the IRIS French site and as the coordinator of all Nice site demonstration activities, NCA will ensure the overall coherency among the different demonstrators and the coordination with the other lighthouse cities (LHC) and follower cities (FC).

5.2.1.5 Commissioning Plan

No commissioning plan can be disclosed so far. The identification of the exact scope and perimeter is still in progress and cannot be formalized yet among the involved parties. The delivery of an implementation plan is the next priority of activities related to TT#3.

5.2.1.6 Implementation plan

5.2.1.6.1 Planning of activities

Work package	Task	Sub task	Entity concerned	Start	End	Milestones		Typology of data
Development of the car-sharing platform of the IRIS project and assimilation of dedicated cars	Assimilation of MNCA vehicles	Vehicle equipment by VUBOX, if necessary	VULOG MNCA	Mi	Mi +1	Mi+1	Successful vehicle integration	Location of vehicles Service usage time Battery charge for each vehicle Trip made in kilometers
		Connection with the AIMA platform		Mi	Mi +1			
	Assimilation of Nissan vehicles	Vehicle equipment by VUBOX, if necessary	VULOG EDF R&D	Mi	Mi +1			
		Connection with the AIMA platform		Mi	Mi +1			
	Creation of the car-sharing platform dedicated to the IRIS project	Data collection and qualification	VULOG	Mi +1	Mi +2	Mi+2	Gathering of information, mapping of habits (energy) and probability of booking.	
		Organization of input data		Mi +1	Mi +2			
		Simple implementation of algorithms		Mi +1	Mi +2			
		Adaptation of the car-sharing model		Mi +2	Mi +2	Mi+2	adaptation to address the sharing model of a private carpool instead of a public carsharing fleet	
Connections between carsharing and energy charging platforms	EDF R&D platform	Creation of the data lake	VULOG EDF R&D	Mi + 2	Mi+3	Mi+3	Exchange of information with the smart charging platform	Location of vehicles Optimal load Location of EVCI Statement of EVCI
		Contribution of VULOG data to the data lake		Mi+2	Mi+3			
		Contribution of EDF R&D data		Mi+2	Mi+3			
		Organization of data		Mi+2	Mi+3			
		Sends data to the AIMA platform		Mi+3	Mi+4			
		Sends data to the EDF R&D platform		Mi+3	Mi+4			
	DREEV platform	Creation of the data lake	VULOG DREEV	Mi+2	Mi+3			
		Contribution of VULOG data to the data lake		Mi+2	Mi+3			
		Contribution of DREEV data		Mi+2	Mi+3			
		Organization of data		Mi+2	Mi+3			
		Sends data to the AIMA platform		Mi+3	Mi+4			
		Sends data to the DREEV platform		Mi+3	Mi+4			
	Creation of algorithms related to load and displacement optimization	Data collection and qualification	VULOG	Mi +1	Mi+3	Mi+4	Set up ideal charging time with the necessary amount of "reloading".	
		Organization of input data		Mi+1	Mi+3			
		Simple implementation of algorithms		Mi+2	Mi+4			
Continuous integration into the car-sharing platform	Big Data architecture	Data collection and qualification	VULOG	Mi + 1	Mi+3	Mi+5	Study of the costs related to free floating with an optimization of energy load	Location of vehicles Service usage time Battery charge for each vehicle Trip made in kilometers Optimal load Location of EVCI Statement of EVCI
		Organization of input data		Mi + 2	Mi+2			
		Algorithm integration in carsharing plateform		Mi + 2	Mi+3			
		Tests		Mi +1	Mi+4			
		Development of displacement optimization algorithms		Mi+3	Mi+5			
		Prioritization management and conflict optimization		Mi+4	Mi+5			

Figure 15 – planning of activities

5.2.1.6.2 Risk management

1. Limitations of experimentation activities due to contractual limitations. The mitigation measures are:
    a. A revision of the current O&M contract is underway, and discussions engaged towards the definition of an experimentation agreement as IRIS activities have to be integrated into the specifications of existing contracts
    b. Definition of the experimentation contract with all involved parties: VULOG, EDF, IZIVIA, NCA, DREEV.
    c. System and/or protocol compatibility issues can affect the feasibility and/or the development and integration costs related to the IS. The mitigation measure is related to the proposed functional architecture of the proposed system solution is relying on communication APIs between respectively the smart charging, the car sharing and the EVCI management platforms.

2. Commitment to always connect the shared EV to a charging point of the EVCI when back from a trip. The mitigation measure consists of the smart charging solution that requires the full control on the battery charging of an EV between two booking periods.

5.2.2 Impact Assessment

5.2.2.1 Expected impact

As detailed in the DoA and GA, the following are the main targeted impacts to be achieved by IRIS for the whole demonstration under TT#3 (most significant impacts for IS 3.2 are):

- IMPACT 1: Provide a car sharing service, ensuring vehicles availability at peak demand periods and with the minimum battery load for the next scheduled or forecasted booking.
- IMPACT 2: Increase energy efficiency when charging a vehicle.
- IMPACT 3: Significantly increase the share of renewable energies, their integration into the energy system, stimulate self-consumption, reduce reductions to a minimum
- IMPACT 4: Increase local air quality, through an electric car integration
- IMPACT 5: Reduce technical and financial risks to give confidence to investors who want to invest in large-scale replication.
- IMPACT 6: Make the local energy system safer, more stable and cheaper for citizens and public authorities.
- IMPACT 8: Reduce transport-related CO_2 emissions, based on CO_2 intensity, by reducing the car fleet by increasing the number of users of VULOG
- IMPACT 9: Create stronger links and active cooperation between the cities of many Member States covering many cities of different sizes, geographical areas, climate zones and economic situations

The first benefit of IS 3.2 solution is the increase of the rate of rotation of shared EVs of the fleet thanks to a smart charging strategy to recharge EV batteries. With a higher turnover of shared vehicles, the EV fleet can offer more daily trips in favour of a reduction of the noise and air pollution thanks to the replacement of the equivalent number of fossil fuel powered cars.

5.2.2.2 KPIs

Table 3: Summary-list of KPIs and related parameters for Measure 2 (IS 3.2)

KPI	Parameter(s)	Baseline	Target (as described in DoW or declared)	Comments
CO_2 saving	Emission factors of a fuel car (average) $KgCO_2eq$/year/vehicle $KgNO_2eq$/year/vehicle KgPM2.5/year/vehicle KgPM10/year/vehicle	The baseline is the retro calculation of the quantity of air pollutants that would have been produced by fossil fuel vehicles to provide the same car rides than the shared EV fleet.	This indicator will further contribute to the assessment of IS 3.2.	Promotion of the use of electric cars thanks to car sharing.
Mobility efficiency	Number of subscribers to the car sharing service Number of users of the service Number of booking per user of the service	Number of booking per subscriber to the service	This indicator will further contribute to the assessment of IS 3.2.	Impact of smart charging on the rate of booking by the pool of users of the service
Mobility efficiency	Number of car sharing subscribers Number booking/EV/day mileage/EV/day in km	Use ratio of shared EVs before the operation and total mileage per day	This indicator will further contribute to the assessment of IS 3.2.	Impact of increased cars availability on the booking rate
Fleet availability	Number of vehicles of the fleet available at any time for booking	Number of vehicles available before the operation	This indicator will further contribute to the assessment of IS 3.2.	Impact of smart charging on vehicle availability for booking

KPIs: success is measured in terms of (by 2022): (i) EV: 47 EV, (ii) EV charging stations: 100 (iii) Free Floating subscribers (NCA employees): 200, over NCA Metropolis area for this three KPIs.

5.2.2.3 Monitoring plan

The monitoring of the execution of the actions will mainly rely on the information collected by the CIP from the supervision platforms of IZIVIA ("Prise de Nice" public EVCI operation), of EDF (NCA private EVCI operation + smart charging platform) and of VULOG (car sharing management). It will be based on the post processing of this information for nourishing WP9 tasks. The details about the monitoring periods for the different measures are specified within the implementation plans of the sub UC.

All data from the car sharing operation such as listed in paragraph 5.2.1.2.2, including any statistics related to vehicles and booking, will be provided by the car sharing management platform. For a fine grain aggregation level preventing anonymization, the authorization from the users of shared vehicles shall be granted to use the personal data related to their bookings and trips.

5.2.3 Progress achieved up to M24

The main achievement during this period has been the rapid response to the change of the local market conditions with NCA retrieving the ownership of the city public EVCI (O&M contract signed between new owner NCA with IZIVIA) in January 2019 and the coordination of all IRIS partners involved to reassess and redefine the scope and objectives of IS 3.2 demonstrator (namely several departments of NCA, and VULOG partner). The execution of the demonstration activity is leading to a deep modification of the contractual framework originally stated for these parties and the solution of this major contractual issue requires to well define the new roles and responsibilities of each stakeholder. The decision was taken to target for the IS 3.2 activity the private fleet of shared EV of NCA in replacement to the former public shared-EV fleet “Auto Bleue”. Relying on the NCA private fleet of shared EV to operate a car sharing service aiming at smart charging management has been proven feasible thanks to NCA already using a car sharing platform supplied by VULOG partner to operate its car sharing, at the price of an upgrade to the last generation interoperable version called “AIMA” of the platform.

5.2.4 Conclusion

This preparatory phase revealed the complexity of such multi-stakeholders type of approach which needs much coordination and cooperation among the parties for converging towards clear technical and functional requirements and inferring the related contractual arrangements.

The upgrade of the car sharing management platform of the private EV fleet of NCA with the new generation interoperable platform of VULOG called “AIMA”, should ensure the interfacing of this platform with the smart charging platform of EDF thanks to the support of open APIs. The integration of smart charging in the management of shared EVs, while increasing the management complexity of the car sharing operation of the fleet of EVs, should enable a source of profit, thus a bankability, from the possibility to modulate battery charging according to the periods of time when energy cost is lower and to offer a capacity for flexibility to the public distribution grid, up to tertiary energy reserve from V2G vehicles when such technology will be widely deployed.

6 Summary on monitoring of KPIs

6.1 Expected impact

TT#3 has great potential to showcase and put into practice bankable solution tailored to the EV industry. The context of an ever-growing share of EV and of a constant deployment of EVCIs seems to settle the right premises to offer more advanced services as dynamic EVCI management via Smart Charging.

More integrate management systems as IS 1.3 and its wider integration in IS 2.1, bear the promise of increasing the overall efficiency through better exploitation of the various connected energy assets and infrastructures. This is accompanied by the expectation in terms of technology adoption and better environmental performances as energy efficiency and carbon emission reduction. Nevertheless, the business models implication in such multi scale and multi-stakeholder type of environment, are a major challenge towards achieving the chose impact.

In case the flexibility provision results as a feasible UC, the demonstration of IS 3.1 will participate to the energy markets and thus contribute to the overall decarbonisation of the electricity grid. Furthermore, the assessment will also focus on the possibility for EVCI to be managed in a more efficient way in tightly coupling the EV cars battery charging based on predictive usage such as demonstrated with IS 3.2. This will provide a relief supply to demand imbalances to local branches of the public distribution grid. This will thus globally foster a better adoption and a more energy efficient operation of EVs, and the integration of decentralized variable RES. In other words, the coupling of IS 3.2 to IS 3.1 will demonstrate how BESS based on an EV fleet is a technology can be applicable to the energy market to provide peak load shaving and shifting and to contribute to the balancing of the local grid.

6.2 Aggregation of KPIs for each LH city

Each LH city has its own set of KPIs that can be related to the IRIS KPI house; the top level of the house containing the IRIS level KPIs (IL) is however the same for all cities. On solution level (STT#1-5), the KPIs may vary between the cities since different solutions are implemented in each city and the cities have different objectives, but in many cases the same KPIs can be found in all cities, thus allowing comparison between the Transition Tracks of the cities. For some Transition Tracks the evaluation of integrated solutions cannot be separated and the KPIs are hence calculated at Transition Track level (TT#1-5). The KPIs for each transition track and possibilities to aggregate them are presented in Table 4.

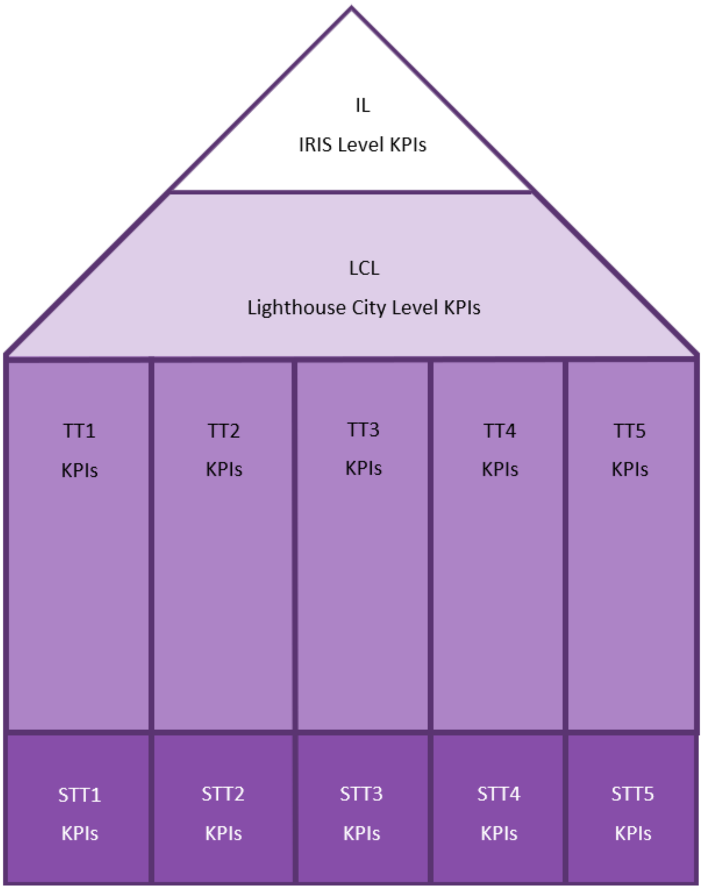

Figure 16 IRIS KPI-house. The KPIs presented in Tables 4-6 are, if possible, aggregated to transition track level (TT#1-5) or higher.

6.2.1 Nice

Table 4. Relation and possible aggregation of KPIs to solutions and the IRIS KPI-house in Figure 16.

KPIs	Solution	Proposed position in IRIS KPI-house
Fleet availability (Nice)	Electric vehicles available in the area	LCL
Electric vehicles available in the district -Gothenburg		
Measures 1 (V2G e-cars) and 2 (V2G e-buses) - Utrecht		
EV charging stations (Nice)	Charging stations available in the area	LCL
New charging stations available in the district - Gothenburg		
Mobility efficiency - Nice	Mobility efficiency service in the area	LCL
MaaS - Gothenburg		

7 Ethics requirements

Taking into consideration that personal data from users will be used in TT#3, this will be achieved with respect to GDPR regulation.

7.1 Overall lighthouse approach

The Data Protection Officer (DPO) of NCA is Mrs Karine CHOMAT. In compliance with GDPR law, she is addressing the ethical, data protection, confidentiality and privacy aspects related to the processing of personal data collected by Metropole administration, or by its delegates, for the purpose of public services or research and development projects such as IRIS project.

The Chief information security officer (CISO) of NCA is Mr Patrick CHAMBET. In accordance with the ISO/CEI 27001 standard, he is coordinating all the activities related to securing the digital information and managing risk including safeguard measures.

Within the scope of the IRIS project, all data collected by partners and aggregated in the CIP operated by NCA must comply with the Metropole cyber security and data privacy rules.

7.2 GDPR compliance

NCA administration has produced a Personal Data Charter related to the processing of personal data in compliance with GDPR rules. This charter encompasses personal data protection rules, application principles, governance, IT usage.

All personal data processed by NCA administration must be registered on the Data Protection Delegate file of the Metropole (DPD). For each personal data profile, a reference questionnaire is filled which determines if a Data Privacy Impact Assessment (DPIA) must be made. DPIA is based on an application tool called PIA from the French national agency for information technology and liberty CNIL (Commission Nationale de l'Informatique et des Libertés).

The following table shows the GDPR related elements per measure of TT#3.

Demonstrator	Element and description	
Measure 1 (IS 3.1): Smart charging infrastructure	Data controller:	EDF and its subsidiaries Metropole Nice Côte d’Azur (NCA)
	Personal Data:	No personal data (charging infrastructures only)
	High risk involved:	No restricted use of collected collective data
	DPIA:	No DPIA is required

Demonstrator	Element and description	
	Informed Consent Procedure	Not applicable
Measure 2 (IS 3.2): Smart management of EV car sharing	Data controller:	VULOG Métropole Nice Côte d'Azur (NCA)
	Personal Data:	Yes: user related data about vehicle booking (departure time, return time, trip destination, start location)
	High risk involved:	No: collected data are only used anonymously for the purpose of computing physical information related to energy or producing statistics related to shared vehicle.
	DPIA:	No DPIA is required.
	Informed Consent Procedure	Personal data collection is part of the registration agreement to the booking service (NCA with VULOG as subcontractor) and is not communicated to other external parties as part of the demonstrator.

Table 5 table of GDPR topics per measure

7.3 Ethical aspects

A privacy impact assessment (PIA) form will be filled for each personal data processed within the frame of a measure which fulfils at least 2 criteria of a DPIA questionnaire produced by NCA public administration including ethics risks and individuals' profiles involved. This PIA form is inferred from the capture of all data profile and processing information thanks to the eponym PIA software tool provided by the CNIL French national agency in accordance to the GDPR rules.

All PIA forms are periodically reviewed by an ad hoc DPIA ethic committee of NCA which is coordinated by the DPO. The committee can validate, restrict or invalidate the use conditions of the related personal data for the targeted activity.

The personal data profile is described, and all latter processing of this data are captured, in an activity log monitored by the DPO to guarantee the respect of the related PIA and the conformance with the GDPR rules.

In terms of taking measures to prevent malevolent, criminal or terrorist abuse, some of the data collected for the Smart Charging application could be data that should be made available on a need to use basis. The data collected will be classified and some data should only be made available to those authorized. Access control and security for Smart Charging related data is handled using the containers called Wilma, Keyrock and Authzforce, configured on the City Innovation Platform.

8 Links to other work packages

The relation among the TT#3 activities and the other work packages and TTs or ISs, has been fully outlined in chapters 1 and 2.

The Smart Charging management system can interface directly with the local energy management system (LEMS) experimented in IS 2.1 in order to contribute to the flexibility of the public distribution grid.

9 Conclusions and next steps

As for D6.5, this statement is also valid for IS 3.1: "*In the work progress so far, the complexity of the implementation of such multi actor and multi scale type of developments has come to light. The related commercial and contractual coordination requirements are very resource intensive and generally, ad-hoc arrangement with no reference towards previous work, have to be put in place. The openness of the involved parties to participate to such pilot solutions, is the main driver for the achieved progress so far, more than a clear value proposition.*

This is on one side a very good indicator of the innovation degree of the proposed demonstrations, nevertheless, they are a big challenge for the whole value chain among technical, legal and financial aspects, and this for all involved parties, not only IRIS relevant partners. The capitalization of the learnings from each of the stages towards a standardized approach, has to be considered towards the scalability and replicability of the proposed demonstrations".

The collaborative work on grid deployment strategy between NCA, as a territorial administration, and EDF (DSO) and ENEDIS (TSO) energy companies emphasized how sizing EVCI is a key component of any urbanization projects : EVCI requirements for a large scale deployment, driven by national regulation and enforced at local level, shall not be overlooked in the operation of the local grid. The urban development of the new district of "Nice Meridia", a demonstration area of the IRIS Nice site, is highlighting how oversizing the electric grid to support a large scale EVCI can put at stake the maximum subscribed power foreseen. In that respect, Smart Charging technology is considered as a means to address peak energy demand on the PDG by activating peak shaving and peak shifting at EVCI level with a smart modulation of EVs charging. This underlines the benefit from the IS 3.1/IS 3.2 demonstrator on urban planning. It may be mentioned that this demonstrator is the first of a kind experimentation for the LH city of Nice.

Due to the restructuring of the target EVCI and shared EV fleet to implement respectively IS 3.1 and IS 3.2 as explained in the previous sections, the scope and the objectives of the TT#3 activities have been refined and shall get the agreement of all involved parties with the extension or amendments of existing related contracts and the possible need for additional agreements to be still concluded before starting to interface the different management platforms used in IS 3.1, IS 3.2 and IS 2.1.

10 ANNEX

10.1 List of monitoring parameters for IS 3.1

No	*Parameter*	Flexibility volume	Max elec peak	Activated useful storage capacity	Number of activations per year	Average Power flexibility	Average Energy flexibility	Average activation duration	Expenses electricity	Income energy services	Supervised fast charging poles
1	*Data Variable Name*	Total activated flexibility volume	Maximal electricity peak	Cumulative V1G/V2G BESS capacity activated	Number of yearly flexibility activations	Average capacity of flexibility activations	Average volume of the capacity provided during activation	Average duration of activation	Electricity bill	Income generated by flexibility activations	Number of charging poles which have been connected to the smart charging platform
2	*Measure Number*	IS 3.1	IS 3.1	IS 3.1	IS 3.1	IS 3.1	IS 3.1	IS 3.1	IS 3.1	IS 3.1	IS 3.1
3	*KPI Number*	1	2	3	4	5	6	7	8	9	10
4	*Units of measurement*	kWh or MWh	kW or MW	kWh or MWh	number	kW or MW	kWh or MWh	hours	EUR	EUR	number
	Baseline (of data variable)	Calculated	Calculated	N/A	N/A	N/A	N/A	N/A	Previous energy bills	N/A	N/A
6	*Meter*	Server	Server	Server	Server	Server	Server	Server	Energy bill	N/A	Server
7	*Location of measurement*	Nice, France	Nice, France	Nice, France	Nice, France	Nice, France	Nice, France	Nice, France	Nice, France	Nice, France	Nice, France
8	*Data accuracy*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

9	*Collection interval*	At least yearly	At least yearly	At least yearly	At least yearly	At least yearly	At least yearly	At least yearly	At least yearly	At least yearly	At least yearly
10	*Start of measurements*	Depending on charging stations availability	Depending on charging stations availability	Depending on charging stations availability	Depending on charging stations availability	Depending on charging stations availability	Depending on charging stations availability	Depending on charging stations availability	Depending on charging stations availability	Depending on charging stations availability	Depending on charging stations availability
11	*End of measurements*	End of project	End of project	End of project	End of project	End of project	End of project	End of project	End of project	End of project	End of project
12	*Expected availability*	Confidential	Confidential	Confidential	Confidential	Confidential	Confidential	Confidential	Confidential	Confidential	Public
13	*Expected accessibility*	Offline	Offline	Offline	Offline	Offline	Offline	Offline	Offline	Offline	Offline
14	*Data format*	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
15	*Data owner*	MNCA or EDF	EDF or MNCA or ENEDIS	MNCA or EDF	EDF	EDF	EDF	EDF	MNCA	EDF or MNCA	EDF or MNCA
16	*Comments*	To be updated once demonstration plan and related legal arrangements are settled	To be updated once demonstration plan and related legal arrangements are settled	To be updated once demonstration plan and related legal arrangements are settled	To be updated once demonstration plan and related legal arrangements are settled	To be updated once demonstration plan and related legal arrangements are settled	To be updated once demonstration plan and related legal arrangements are settled	To be updated once demonstration plan and related legal arrangements are settled	To be updated once demonstration plan and related legal arrangements are settled	To be updated once demonstration plan and related legal arrangements are settled	To be updated once demonstration plan and related legal arrangements are settled

10.2 List of monitoring parameters for IS 3.2

No	Parameter	Value
1	Data Variable Name	**Access to vehicle sharing solutions for city travel**
2	Measure Number	Measure 3 : IS 3.2 Innovative mobility services for the citizen
3	KPI Number	2
4	Units of measurement	Number of trips per week
5	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	Number of booking persons
6	Meter *i.e. smart meter, survey, energy bill, etc.*	AIMA (VULOG platform)
7	Location of measurement	France, Nice
8	Data accuracy *How accurate is the measurement*	100%
9	Collection interval	daily
10	Start of measurements	Depending on charging stations availability
11	End of measurements	Date + 3 months
12	Expected availability *i.e. open data, public, confidential, no data available*	confidential
13	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	*online, but requires authentication*
14	Data format *i.e. csv file, json…*	CSV
15	Data owner	MNCA

16	Comments	

No	Parameter	Value
1	Data Variable Name	**Number of efficient vehicles deployed in the area**
2	Measure Number	Measure 3 : IS 3.2 Innovative mobility services for the citizen
3	KPI Number	27
4	Units of measurement	Number of trips per week
5	Baseline (of data variable)	Use ratio of shared EVs before the operation and total mileage per day
6	Meter	AIMA (VULOG platform)
7	Location of measurement	France, Nice
8	Data accuracy	100%
9	Collection interval	daily
10	Start of measurements	Depending on charging stations availability
11	End of measurements	Date + 3 months
12	Expected availability	confidential
13	Expected accessibility	*online, but requires authentication*
14	Data format	CSV
15	Data owner	MNCA
16	Comments	

No	Parameter	Value
1	Data Variable Name	**Number of free floating subscribers**
2	Measure Number	Measure 3 : IS 3.2 Innovative mobility services for the citizen
3	KPI Number	28
4	Units of measurement	Number of trips per week
5	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	Number of booking persons
6	Meter *i.e. smart meter, survey, energy bill, etc.*	AIMA (VULOG platform)

7	Location of measurement	France, Nice
8	Data accuracy *How accurate is the measurement*	100%
9	Collection interval	daily
10	Start of measurements	Depending on charging stations availability
11	End of measurements	Date + 3 months
12	Expected availability *i.e. open data, public, confidential, no data available*	Confidential
13	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	*online, but requires authentication*
14	Data format *i.e. csv file, json…*	CSV
15	Data owner	MNCA
16	Comments	