INSOC SYSTEM DESIGN

Report of INSOC system design

USER-CHI deliverable D5.1

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Abstract

INSOC- Integrated Solar DC-Charging for LEVs consists of easily replicable and scalable low-power DC-charging station for LEVs and e-bike sharing services, with integrated theft-proof parking, payment services and on-site produced RES through DC-Network interconnection. This integrated solution may incorporate INCAR (Interoperability Charging and Parking Platform) and SMAC (Smart Charging Tool) features in order to offer all services in a unique system: vehicle sharing, charging, parking, paying and clean energy, facilitating market acceptance due to the better user experience and the reduction of the final user price (GA pag 151/152). In more details:

1. INSOC will consist of a **software and hardware combined solution to solve charging needs of LEVs, <u>integrating on-site production of renewable energy, energy storage and theft-proof parking</u>**.
2. INSOC will be a standardized and replicable low-power DC-charging solution with on-site produced renewable energy through smart DC-Network interconnection. The standardized solution will allow **<u>a reduction of the price for final users and will facilitate market acceptance due to the integration of all services: vehicle sharing, charging, parking, paying and clean energy usage</u>**.

3. The INSOC system will address charging needs of LEVs in urban areas **with the objective of minimizing logistics and operation costs for e-mobility sharing service providers, avoiding the need to remove and charge batteries in an external hub.**
4. It **may** also integrate payment and billing services, making it especially convenient for new urban mobility modes, such as e-bike and e-scooter sharing service.
5. In addition**, it reduces the prices for the final users**, and improves their user **experience due to the integration of charge-park-pay services.**
6. Moreover, **energy suppliers and DSOs can also benefit from the system**, due to the smart integration with decentralised renewable energy that minimise the grid impact and offer flexibility to the grid (GA pag 155).

Keywords

RES, Renewable Energy, DC-charging, LEVs, e-bike, e-scooter, e-kickscooter

Copyright statement

Executive summary

The present document constitutes the deliverable D5.1 of the WP5, as defined in the GA, namely the document containing the INSOC system design.

The report is organized in 3 sections, namely:

1. **INSOC overview**: where a brief description of INSOC concept and of the requirements and the GAPs behind the case are provided, together with related use-cases and pilot tests.
2. **Evolution of contextual elements of INSOC**: aims to describe the overall contextual elements in which INSOC shell be integrated. In particular, given the socio-economic and health factors which occurred in 2020, the present sections aim to assess the changes in the context which occurred due to the LEVs technological and market evolution, the Covid-19 pandemic and the consequent economic crisis.
3. **INSOC system design**: explores, starting from the AMB experience, which can be considered as the baseline case, the design and technological characteristics to be declined to answer to the identified requirements and GAPS behind INSOC case.

Given these premises, in the present report important considerations and preliminary hypotheses are made. Nevertheless, some open points have to be clarified in the further reports, relating to **Intermodality, RES generation, battery storage and grid connection, User-friendly payment, Ancillary services, Interaction with other USER-CHI products.**

Table of contents

List of figures

List of tables

1.Introduction

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2. INSOC

2.1 INSOC Overview

2.1.1 INSOC Requirements

INSOC- Integrated Solar DC-Charging for LEVs consists of easily replicable and scalable low-power DC-charging station for LEVs and e-bike sharing services, with integrated theft-proof parking, payment services and on-site produced RES through DC-Network interconnection. This integrated solution may incorporate INCAR (Interoperability Charging and Parking Platform) and SMAC (Smart Charging Tool) features in order to offer all services in a unique system: vehicle sharing, charging, parking, paying and clean energy, facilitating market acceptance due to the better user experience and the reduction of the final user price (GA pag 151/152). In more details:

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2. INSOC will be a standardized and replicable low-power DC-charging solution with on-site produced renewable energy through smart DC-Network interconnection. The standardized solution will allow a reduction of the price for final users and will facilitate market acceptance due to the integration of all services: vehicle sharing, charging, parking, paying and clean energy usage.
3. The INSOC system will address charging needs of LEVs in urban areas with the objective of minimizing logistics and operation costs for e-mobility sharing service providers, avoiding the need to remove and charge batteries in an external hub.
4. It may also integrate payment and billing services, making it especially convenient for new urban mobility modes, such as e-bike and e-scooter sharing service.
5. In addition, it reduces the prices for the final users, and improves their user experience due to the integration of charge-park-pay services.
6. Moreover, energy suppliers and DSOs can also benefit from the system, due to the smart integration with decentralised renewable energy that minimise the grid impact and offer flexibility to the grid (GA pag 155)

Such requirements are based on a new urban mobility mode and addressed mainly to e-bike/e-scooter sharing services. By the former we mean public bike sharing services in Europe (400), and our target market is 2% of the actual market in the EU, which represents 50% public bike sharing services in the USER-CHI influence zone (two TEN-T corridors).

The commercial strategy will be based on partnerships with companies delivering public bike sharing services, delivering all-in-one provisioning, installation, fare collection and maintenance of the e-bike fleets.

2.1.1.1 INSOC requirements summary and related use-case

- The **GA business model is B2B**, and the focus is on the needs/requirements of bike/e-kickscooter renting companies. B2C business models may be evaluated too.
- The **intervention area** is limited to:
    - legal e-bike, means 250W electric engine with pedal assistance;
    - not for private use but through e-bike renting companies (one or more);
    - located in strategic place that can allow long range route through intermodality with public transport and parking
- The **innovation approach** will be based on three major items:
    - intermodality, intended as possibility for the end user (commuter, student, tourist, casual use) to plan and optimize his travel according its needs;
    - "user friendly" access, via app on mobile devices, credit card or ticket valid for everything, including, in case, the ancillary services;
    - INSOC infrastructure located in specific places. The e-bike renting companies will reduce their OPEX so it will be possible to share some savings with the final user.

2.1.2 Current GAPs solvable with INSOC development

Six GAPs, which can be addressed thanks to INSOC developments, have been detected and are described below:

- **GAP 1**: most drivers of LEVs use not-standardised charging plugs in private homes or offices, and there is a lack of standardised solutions offered to wider market segments.
- **GAP 2**: companies offering LEVs sharing services usually charge the batteries by removing them and bringing them to a recharging hub, which implies high operational costs (OPEX) and environmental impact.
- **GAP 3**: LEVs sharing services do not provide associated added-value services to their customers.

- **GAP 4**: LEVs charging systems do not incorporate on-site renewable energy production.
- **GAP 5**: inductive charging solutions are in very low maturity levels and need to be tested from usability and technical perspectives.
- **GAP 6**: M2M communication technologies need to be tested to demonstrate their potential in improving user acceptance, while assuring their technical reliability. (GA pag. 168)

2.1.3 INSOC TEST PILOTS

Original GA plan was focused only INSOC B2B infrastructure, means addressed mainly to e-bike/e-scooter sharing services. The test pilot is forecasted in four Cities and further clarification with them evidenced:

Table 1: Test Pilot summary

CITY	PV Charge	Anti-theft	E-bike	E-kick scooter	Private	Fleet	INCAR i/face	SMAC i/face
BARCELONA	✓	✓	✓	×	✓	✓	✓	✓
BUDAPEST	✓	✓	✓ (+cargo)	✓	✓	X	t.b.e	t.b.e
ROME	✓	✓	✓	✓	✓	✓	t.b.e	t.b.e
TURKU	✓	✓	✓	×	✓	x	t.b.e	t.b.e

2.1.4 INSOC Further assumption

The **first important consideration** is that, in a model of sustainable mobility in densely populated metropolitan areas, the term **"sustainability" is not synonymous with "ease".** The end user will be asked to organize their trips using different devices and infrastructures, and the simpler to use and integrate these devices and infrastructures the more they will be accepted and used by the end user.

The **second important consideration** is that, in densely populated metropolitan areas, **time is the most precious resource**, not technology or energy. Any mobility model that proposes an optimal use of time to the end user, also by exploiting innovative methods based on sharing and digitization, will be easily accepted if also obviously proposed with a view to economic convenience

2.2 Evolution of contextual elements of INSOC

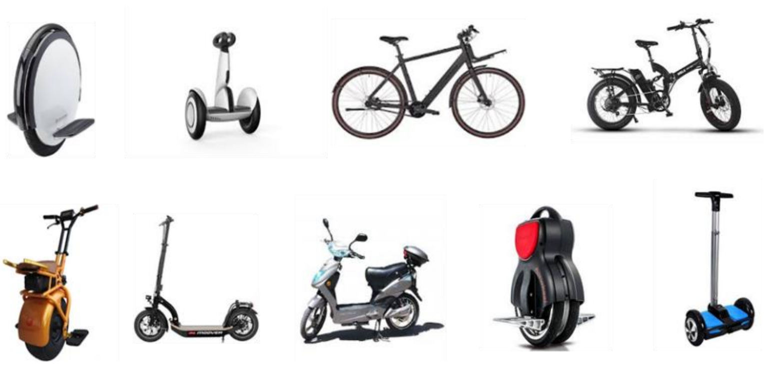
2.2.1 Overview on LEVs market evolution

The currents sections aim to describe the overall contextual elements in which INSOC shell be integrated. In particular, given the socio-economic and health factors which occurred in 2020, the present sections aim to assess the changes in the context which occurred due to the **LEVs technological and market evolution**, the **Covid-19 pandemic** and the consequent **economic crisis**.

2.2.1.1 LEV'S diffusion: universe or jungle?

The basic design and construction of a light electric vehicle, the ever-lower cost of batteries, the weight and the limited size that allow its use and parking with extreme simplicity have generated a proliferation of solutions that make the LEVs picture very heterogeneous.

Figure 1 - Different LEV products



There are light electric vehicles with one, two, three and four wheels, each with its own technical characteristics and manufacturing solutions, very few of them regulated according to current legislation.

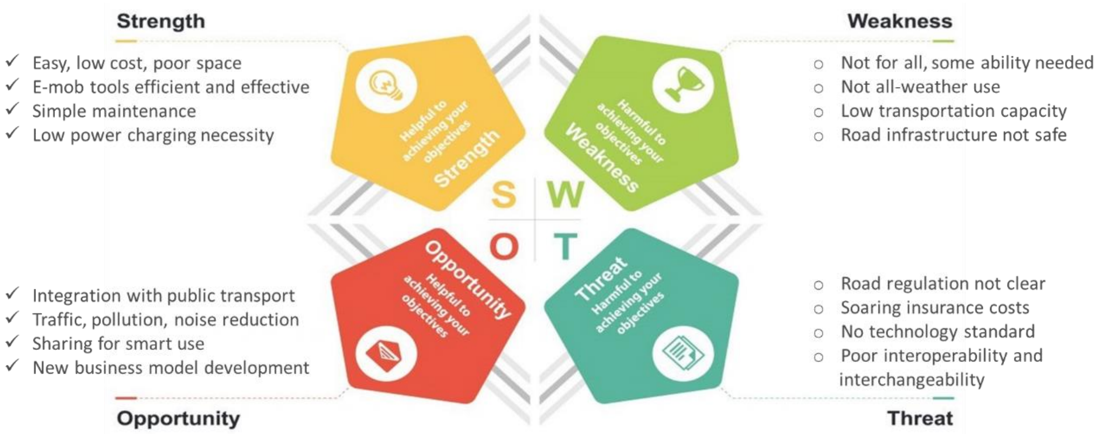
For example, the phenomenon of high-performance electric kick-scooters that have flooded the centres of large metropolitan areas, and whose use, especially due to growing accidents, even serious ones, has not yet been regulated in a uniform and coherent manner.

In addition, the hundreds of different LEV manufacturers have dozens of different standards regarding the electrical parameters of the batteries and the consequent charging modes, making interoperability difficult. Finally, the low weight and bulk of LEVs make it easier to steal them, so a real need for end users is theft protection.

2.2.1.2 LEV'S diffusion SWOT

The LEV's diffusion can be analysed borrowing from the business since the famous SWOT analysis. Indeed, Strength and Weaknesses, but also Opportunities and Threat can be associated with the rise of the light electric vehicle diffusion.

Figure 2 - LEV's diffusion SWOT



The figure above summarizes the output of the SWOT analysis performed on LEV's diffusion.

2.2.2 Covid-19 effects on INSOC design

To better address the INSOC design, the preliminary concepts already formulated should be updated with actual considerations relating to the COVID-19 pandemic and with some probable consequences.

The interoperability between different transport systems (intermobility) in densely populated metropolitan areas, especially the integration between e-bikes and local public transport, has been discussed and defined as one of the best options for the end user in terms of optimization between travel times and costs incurred.

Now new important variables are coming into play, in particular **social distancing and public hygiene measures.**

Since the use of e-bikes is individual by definition, intrinsically allowing social distancing, and the sanitization of the means is in itself a very simple operation, transport through this means becomes per se much more attractive.

In addition, urban public transport (buses, metro, trains) will see their capacity limited to 30% - 40% of the current ones, having to scrupulously comply with the prescriptions of the authorities.

<ins>It is clear that the interoperability of mass transports with fleets of individual vehicles will probably be the best option to avoid the danger of logistic paralysis if mass use of private cars is returned</ins>.

Uncertainty is on everyone's minds and things won't be the same, but **change can offer an opportunity to reset and accelerate**.

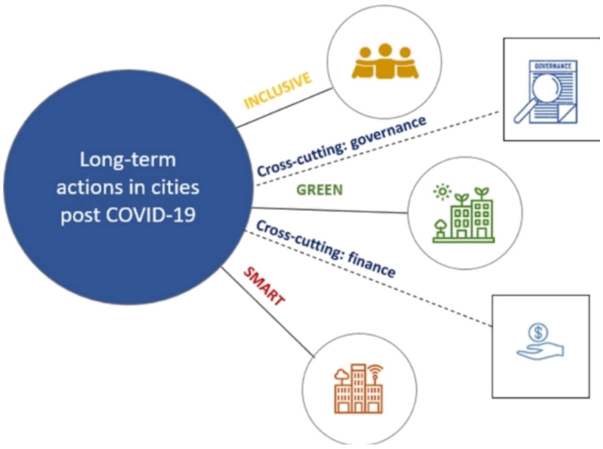
In particular, some aspects have to be explored:

1) **The Government's approach and the consequent limitation/regulation in mid-long term**

2) **The social transformation related to the pandemic (rush hours, smart working, school and public offices openings hours...)**

3) **The economic crisis and liquidity crunch**

Figure 3 - LT actions in citys post Covid-19



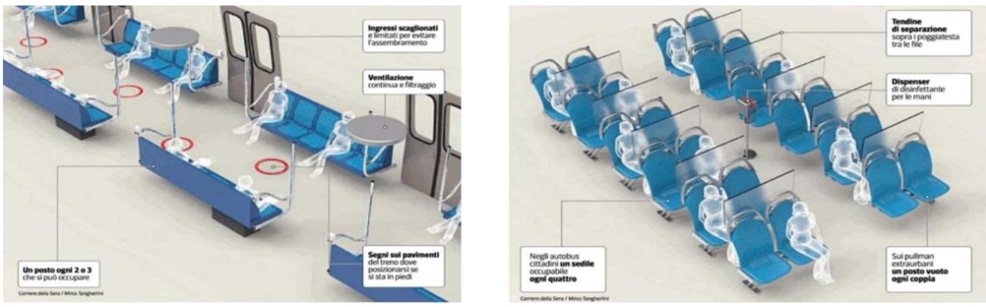
By now the prescriptions to guarantee the minimum essential services in the public transport are:

1) the integration between the various methods,

2) the one with the least possibility of contact between people

The aim is to guarantee maximum safety for users and operators

Figure 4 - Example of social distancing measures on public transport facilities



Among the most suitable solutions to guarantee sufficient transport services, the one that allows the greatest surface available for travellers and in any case at least one meter of distance between passengers.

The question is: how long? To date no one can answer, the scenarios on the evolution of the pandemic are still too different and not converging, if a vaccine is found it will take at least two to three years for the majority of the population to be immunized. In this context, people's behaviours are likely to change profoundly and social distancing will become an acquired habit, as has been the ban on smoking in public places.

Some municipalities already reacted promoting feasibility study to adapt their cities and make them more resilient to pandemic occurrences. Below a few examples.

Figure 5 - Development of bike lane

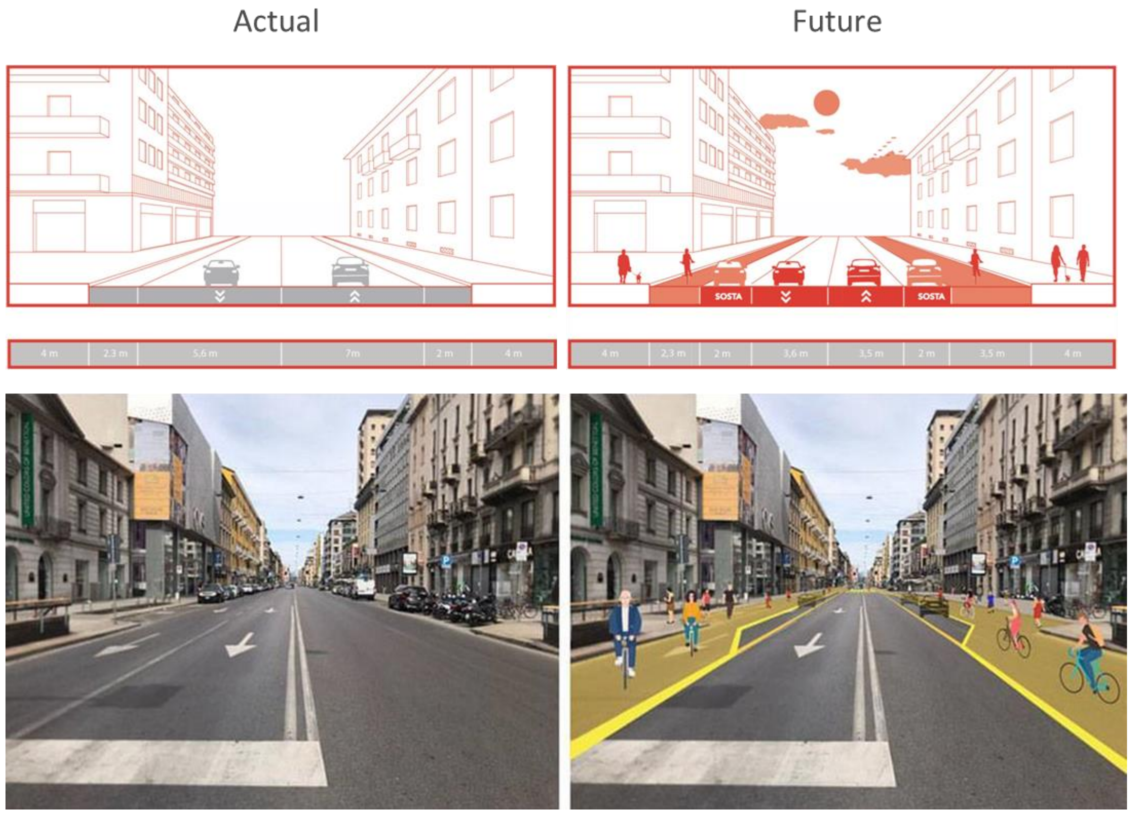
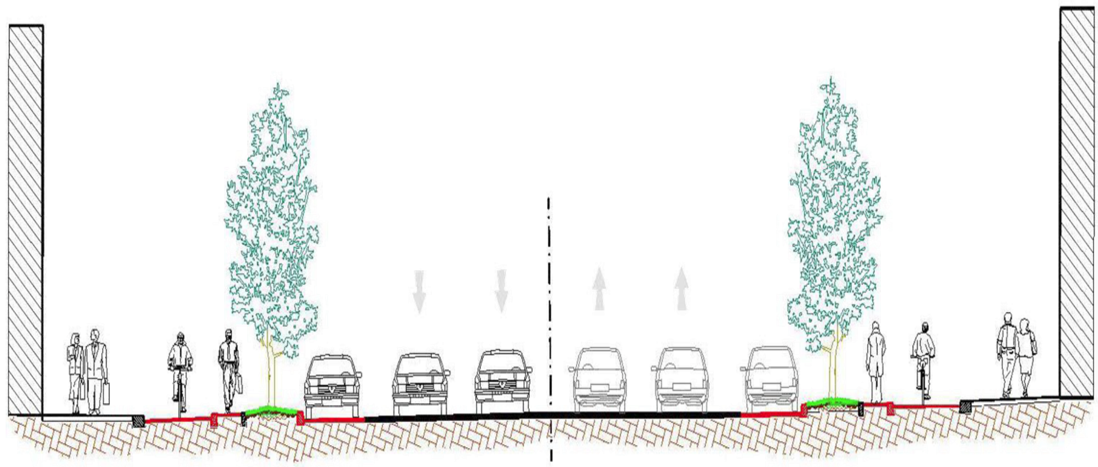


Figure 6 - Development of bike lane: sectional view of the project



2.2.3 Economic Crisis

Although technology offers productivity solutions by decreasing travel, especially in the service sector, (smart working, e-learning, web meeting and web conferences ...), however, people will have to move using possibly flexible and economically convenient systems.

The interoperability between conventional public transport systems and LEVs organized in fleets operating from well-defined bases (e-BiciBox) and offered for rent with all-inclusive fees (bus / metro ticket + e-bike) can certainly represent an effective and efficient solution to respond to the challenges posed by the pandemic in terms of public health and the consequent economic fallout.

Finally, once pre-crisis conditions are re-established, new habits to approach and rational use of transport services can be consolidated, thereby contributing to the macro-processes of decarburization and contrast of climate change.

2.3 INSOC system design

2.3.1 **Infrastructure**

Supporting **public transport with shared e-bike fleets supported by INSOC infrastructures can be an excellent solution**, especially if, integrating points *4. payment and billing services*, *5. Reduction into the prices for the final users, 6. Generation of services for energy suppliers and DSOs* holistically, the end user is offered a cost of daily, monthly or annual subscription that is extremely convenient.

This solution also becomes convenient for the e-bike renting companies because since they would have a **significant reduction in the OPEX and upfront costs** as the delivery and release points of the e-bike would be well-defined and not random and at the e-BiciBox it would be possible and immediate to recharge the e-bikes electrically to make the vehicle available in the shortest possible time.

Thus, the INSOC starting point will focus not on all the existing LEV technologies and their possible applications, but **on the standard allowed e-bike (250 W pedal assisted) normally used by the e-bike renting company.**

This is why:

I. It is possible to share different means of transport (trains, buses, e-bikes), of different characteristics, without having ownership of them;

II. It is possible to share different transport infrastructures (railways, roads, cycle paths), of different characteristics by optimizing their use according to the distances to be covered, loads to be transported, weather conditions;

III. it is possible through the current digital technologies and applications on "personal mobile devices" the proposal of "tariff plans for movement" independent of the means or infrastructure chosen;

IV. it is possible to equip the logistics interchange nodes (for example railway station + e-bike parking) with ancillary infrastructures designed not only for the needs of the vehicle (e-bike recharge), but also and above all for the needs of the end user (shelter rain protection, toilet, snack and water vending machines, more ...).

Given the aforementioned premises, it is clear that the **business model is B2B** rather than B2C. We must therefore focus on the needs of the **"customer" intended as an e-bike rental company**.

These companies have immobilized substantial equity to acquire an important e-bike fleet, and also have the problem of high operating costs related to recharging the batteries.

Therefore, **to protect their CAPEX, these companies should avoid the risk of theft and vandalism, to minimize their OPEX they should encourage the end user to release the e-bike rented not randomly but at an adequately equipped location for charging.**

Obviously, the "e-bike charging stations" will potentially have to serve several e-bikes at the same time, therefore a connection to the electric grid will be necessary. To minimize the grid imbalance and optimize consumption, it will therefore be appropriate to study photovoltaic-based self-production solutions with compensatory storage systems.

Figure 7 - BiciBox Barcelona

<u>**The starting point of the project will be the BiciBox infrastructure in Barcelona**</u>, which has been installed for several years and has demonstrated ease of installation even at logistic exchange points, good security against theft and vandalism, ease of use and good acceptance by end users.

2.3.1.1 AMB experience *(Source: AMB)*

BiciBox

Mobility needs on the outskirts are very different from those in the centre of the metropolis. While the Biking service expanded in the centre of Barcelona in 2011, the potential demand for a parallel service in the medium-sized municipalities on the metropolitan outskirts was insufficient.

In the urban areas surrounding Barcelona, many people travel to Barcelona and to nearby economic activity development areas on a daily basis, or travel for business or pleasure to neighbouring municipalities, and mostly do so in private vehicles.

In order to encourage bicycle use in these areas, at that time the decision was taken to address one of the major obstacles: the safety of bicycles parked next to a railway or Metro station, in a business park or at the gates of a hospital. As a result, July 2011 saw the launch of the metropolitan secure private bicycle parking service: **BiciBox**.

Figure 8 - Bicibox portrait

AMB established the BiciBox service as a complement to the metropolitan public transport system.

The BiciBox service is a closed parking system for private bicycles, with user registration and access controlled using an RFID card. This not only increases security, but also improves the quality of bicycles' parking conditions (as they are much more sheltered than in an open and unprotected parking space).

The BiciBox parking modules are made of metal and are energy-autonomous thanks to their built-in solar energy system. They come in two sizes: with 7 spaces and 14 spaces.

After operating for seven years, the service has been rolled out to 19 metropolitan municipalities, with 1,800 spaces available in 160 modules.

As the BiciBox service became consolidated and was expanded, AMB considered further initiatives to promote the use of bicycles in the metropolitan municipalities.

These included promoting e-bike use and helping municipalities to complete local bicycle lane networks.

Since 2014, AMB has subsidized the purchase of more than 3,000 e-bikes by individuals and companies, simplify the e-bike usage for anyone (not only young people) making any journey (including longer journeys and those with hills, as is common in the metropolitan region). In addition, to highlight the bicycles' utility, AMB has provided more than 300 e-bikes free of charge to municipal workers, who use them to travel to work and for moving about while they work.

This successful experience with municipal councils has been passed on to businesses located in industrial development areas in the metropolitan area, with AMB temporarily loaning e-bikes (for a maximum period of three months) to workers asking for them, with the sole conditions of (a) daily usage and (b) maintenance responsibility.

Figure 10 – Users

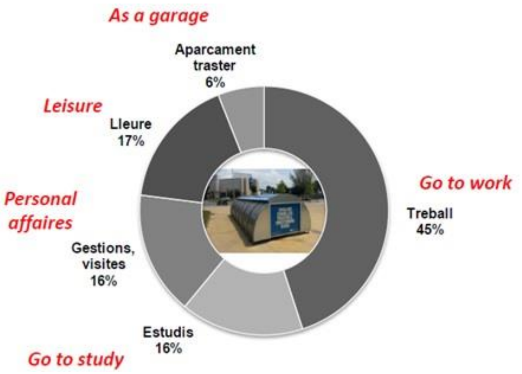


Figure 11 - Intermodality

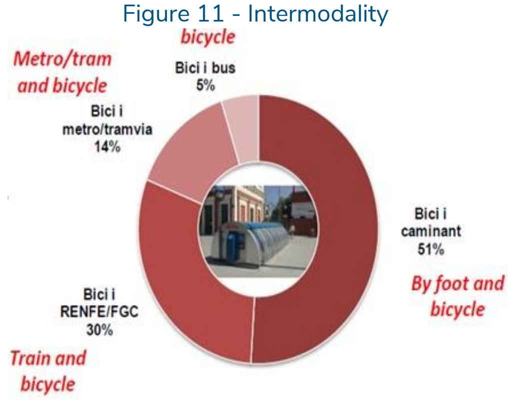
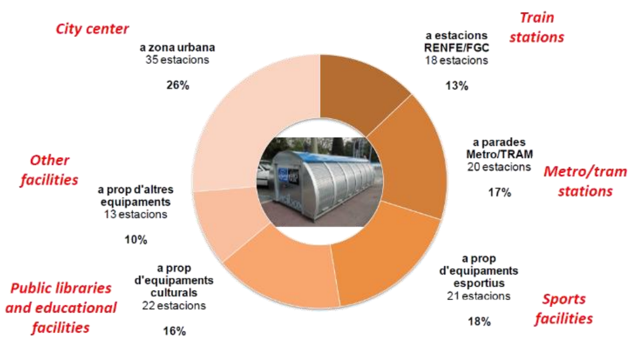


Figure 9 - Bicibox location



After the bicycle has become a means of transport within the metropolitan mobility model, thesis experience must consolidate it and turn it into a primary means of transport, reducing the harmful effects of private vehicles to an even greater extent. The upcoming Metropolitan Urban Mobility Plan (PMMU) is the instrument that will define and coordinate future initiatives.

BiciBox next steps

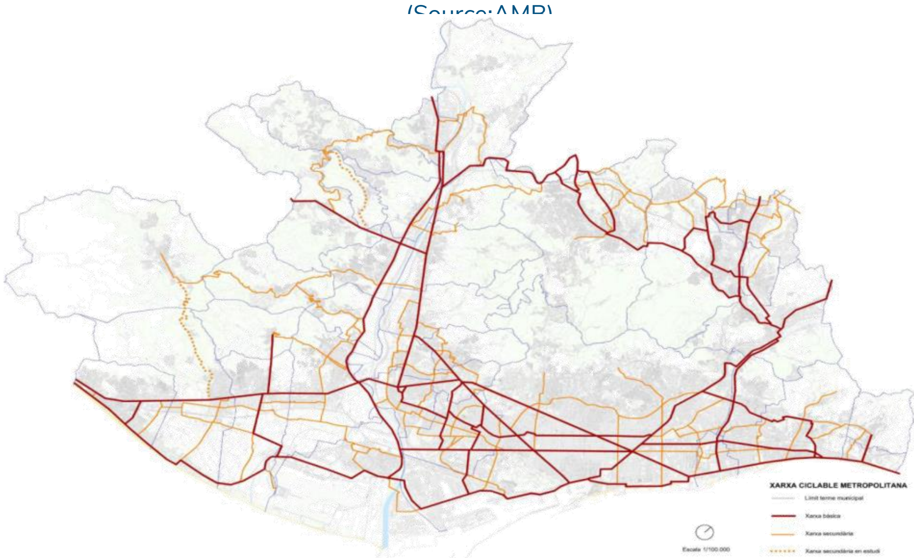
Looking towards the future, AMB's promotion of bicycle use will be defined by three challenges:

- Defining a new large-capacity bicycle parking infrastructure, after the capacity of the current parking modules in the BiciBox service has been exceeded. **This new infrastructure must be able to meet the high levels of demand created by public transport interchanges, educational facilities and economic activity development areas.** Several solutions have been studied on collective bicycle parking facilities (metal structures) and enclosed areas in the halls of railway and Metro stations.
- Adapting high-capacity bicycle lanes to the major Bicivia structural routes.
- Integrating the bicycle into the metropolis of the future. Providing an accessible, safe and comfortable public space for everyone in all urban areas, specifically designed for walking and cycling, with easy access to the public transport network. In addition, establishing a functional organisation of the territory (housing, workplaces, commerce, facilities, and services) that favours short journeys (suitable for bicycling) around a central area, structuring them at the metropolitan level by means of public transport networks.
- The e-BiciBox service: a new metropolitan service offering a public pool of e-bikes available in a series of exclusive parking modules (the same ones as those used for the

BiciBox subscription). Only registered users who have paid the established usage fees can use this service.

Bicivia network

Figure 10 - Bicivia network (Source:AMB)



The Bicivia network: defining a metropolitan bicycle lane network for inter-urban journeys. In other words: a continuous and direct network, wide enough for travel in each direction, off the pavements and effectively and uniformly signposted. This connects all the metropolitan urban centres, with 400 kilometres of bicycle lanes – half on the main network and the other half on the secondary network. Between 20 and 30% of this network is already in place.

BiciBox services

CURRENT:

- *24h service*
- *User registration*
- *Magnetic card to access any BiciBoxBiciBox*
- *48 hours free parking (72 in the week-end)*
- *One bike per user and per place*
- *App on mobile for location and availability*

FUTURE:

- *Service extension to all AMB train station*
- *Service extension all metropolitan municipalities*
- *New design based on experience*
- *Charging facilities for e-bike (e-BiciBox)*
- *Improved app with new functionalities (reservation)*

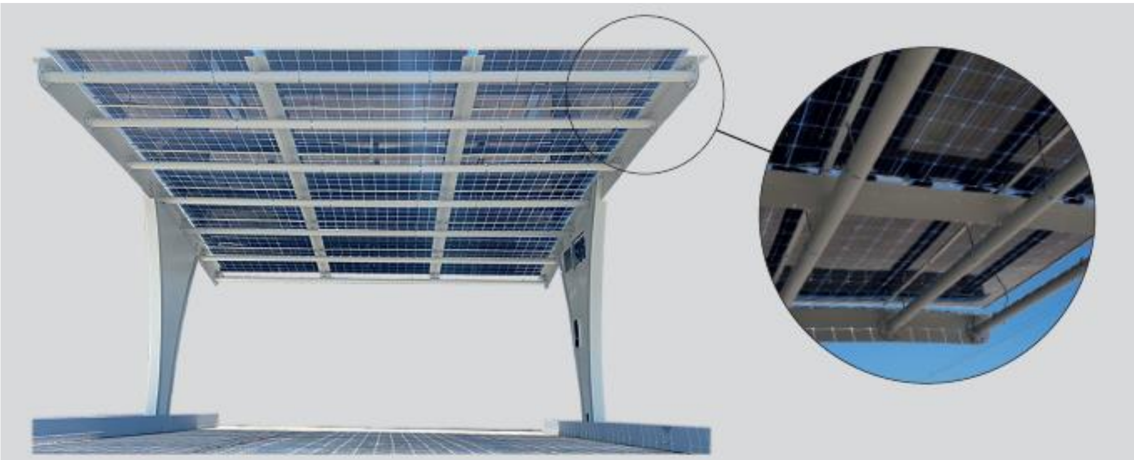
2.3.1.2 RES design and Technological specifications

To be consistent with the e-bike charging possibility through RES some open points should be clarified in order to step forward with the design:

- BiciBox technical specification (dimension, material, structural design);
- BiciBox qualification report to be installed in public space;
- Required power per installation and how many bikes per box;
- PV localization (insulation);
- Grid connection possibility and required LV power;
- Standard battery specs (voltage, amps, recharging cycle);
- Required security specs (short circuit breaker, environmental protection etc).

Given that, below the **design and technical specification** for the RES generation canopy:

Figure 11 - PV canopy proposal



INPUT:

- *Location: Barcelona*
- *Database: PVGIS*
- *Modules: Bifacial*
- *PV installed: 6.66 kWp (eighteen 370Wp PVs per canopy)*
- *System loss: 14% (conservative)*
- *Dimensions:*
  - *Length: 5,96m*
  - *Front height: 3,45m*
  - *Back height: 2,45m*
  - *Depth: 6,03m*
- *Inverter for ESS: 2, 3, 4 and 5kW available*

OUTPUT:

- *Slope angles:* ***30°***
- *Azimuth angle:* ***0°***
- *Yearly in-plane irradiation: 1958 kWh/m^2*
- *Yearly production:* ***9313 kWh***
- *Y2Y variability: 224,99 kWh*

Energy comparison

An energy comparison exercise can here be performed leveraging the gained experience and information of the Barcelona case:

		Assumption	Proposal
RES GENERATION			
kWp installed			6
kWh generation per year (est.)			9.312
E-BIKE CONSUMPTION			
standard battery Wh (max est.)		720	
daily use (km)		80	
range (km)		40	
charge/day		2	
energy/day (kWh)		1,44	
km/year (50% use)	50%	14.600	
energy/year (kWh)		263	
E-BICIBOX CONSUMPTION			
slot per Bicibox		7	
yearly energy per Bicibox (kWh)		1.840	
n. Bicibox supplied			5
E-BIKE FLEET			
e-bike total number (t.b.c.)		210	
necessary Bicibox		30	
necessary energy/year (MWh)		8	
RES installation			6

- Base hypothesis of a standard e-bike with a 36V battery, with an autonomy of 40 km and a daily use of 80 km. In such cases, the e-bike will consume 1.44 kWh per day, equal to 263 kWh/year considering a 50% use.
- In such cases, a standard 7 slot BiciBox, transformed into an e-BiciBox, will have an estimated annual consumption of 1,840 kWh
- The solution is widely sized to meet the electrical demand for a standard (7slot) or double (14 slot) e-BiciBox. The hypotheses are rather conservative in terms of battery power of the e-bikes and annual mileage.
- The energy generation forecast from photovoltaic is by definition unpredictable and a function of many factors (weather, maintenance, panel cleaning etc.). So, to have maximum reliability on the energy produced and its optimal use it will be necessary to provide an electrical storage system based on static batteries and obviously a connection to the grid.

Further than the case of Barcelona, the energy comparison will be analysed along the course of the project for each Municipalities and the other areas which will be used as test case.

Station design

Three options are under evaluation for the final design of the e-bike stations, as described below:

Option 1:

Option 1 can be viewed through renderings that develop the concept by integrating the BiciBox, (invisible in the images) with a support structure of the photovoltaic panels that includes a:

- canopy for protection from the elements,
- automatic vending machines for snacks and water,
- Wi-Fi,
- recharge for mobile devices and quick smart working positions.

Figure 12 - Draft rendering Option 1

Option 2:

Option 2 is a modular design which, in the presence of adequate spaces, for example near large metro or railway stations, combines the ability to serve different e-BiciBox in terms of available power and at the same time accommodate a series of diversified services, from basic (wi-fi, video surveillance, toilet, vending machines) to more sophisticated services, such as technical assistance for e-bikes.

This service could be of interest to the e-bike rental companies as it would be a complete service hub where to convey the maximum possible traffic of users through a commercial policy that makes the end user part of the savings achieved by the company in terms of optimization of the OPEX.

Figure 13 - Draft rendering Option 2

<u>Option 3:</u>

Option 3 is the one potentially supporting a double BiciBox, therefore with 14 slots.

The rendering illustrates half the structure (to be imagined double as in the previous slide), equipped with some essential services.

Figure 14 - Draft rendering Option 3

3. Conclusions

In this document important considerations and preliminary hypotheses have taken place. Some open points have to be clarified:

a. **Intermodality:** are the transport operators, no matter if public (metro/bus) or private (taxi/car renting): interested in co-develop an interoperability model with the e-bike model that is individual by definition? In which terms?

b. **RES generation, battery storage and grid connection:** are the e-bike renting companies interested in the investment in such infrastructure? In this case are considered a sort of CPO?

c. **Lack of standardization**: will LEVs connectors and battery in use be following any electric standard? In the absence of electrical standards for connectors and voltage levels of the various types of batteries in use into LEVs, the power delivered to the LEV by INSOC will be in AC and not in DC, so the LEV must use the battery charger, supplied by the manufacturer with the vehicle, for the connection (analogous to charging your laptop in public spaces).

d. **Anti-theft measures**: the “anti-theft” requirement will be initially planned as the existing BiciBox structure in Barcelona. Nevertheless, other municipality could have specific public space regulation. Indeed, the “anti-theft requirements will be further developed on a case-by-case basis.

e. **User-friendly payment:** payment via mobile app or credit card is a financial service, the final user pays according to the T&C contract in which there are different objects (transportation services, insurance, electricity use, ancillaries in case). Who will be the contractual partner?

f. **Ancillary services:** from basics (Wi-Fi, toilet, automatic snack & water distributors) to the more sophisticated (smart working station, e-bike service, others), commercial partners have to be investigated. Who will be the main contractor?

g. **Interaction with other USER-CHI products:** *INCAR* (Interoperability Charging & Parking Platform), *SMAC* (Smart Charging Tool) product managers will have to define the requirements for the integration with INSOC.

Acronyms

Acronym	Meaning
AMB	Àrea Metropolitana de Barcelona
B2B	Business to Business
B2C	Business to Client
CAPEX	Capital Costs
CPO	Charging Point Operator
DSO	Distribution System Operator
EC	European Commission
ESS	Energy Storage System
GA	Grant Agreement
INCAR	Interoperability Charging and Parking Platform
INSOC	Integrated Solar DC-Charging for LEV
LEV	Light Electric Vehicles
OPEX	Operative Costs
PMMU	Metropolitan Urban Mobility Plan
PV	Photovoltaics
PVGIS	Photovoltaic Geographical Information System
RES	Renewable Energy Source
SMAC	Smart Charging Tool
SWOT	Strengths, Weaknesses, Opportunities, Threats analysis
USER-CHI	Project Title: innovative solution for USER centric CHarging Infrastructure
WP	Work Package

References

The INSOC challenge has been approached from an analytical point of view through ethnography techniques, scientific literature and specialized sector reports and studies

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