IRIS

Integrated and Replicable Solutions for Co-Creation in Sustainable Cities

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Disclaimer

Executive Summary

Objective of this deliverable is to provide a detailed overview of the preliminary results of the Nice demonstration. This deliverable is intended for the following audiences:

- Stakeholders in the Nice ecosystem as it should provide a detailed overview of the solutions that are implemented by each of the partners;
- Stakeholders in the demonstration districts as it should provide them with an overview of the solutions and on how local stakeholders are involved;
- Project partners in the other lighthouse and follower cities;
- Broader public, which is interested in the details of the demonstration.

This deliverable will facilitate the common understanding of the demonstration activities and the preliminary results. It will allow the Steering Committee of the project to assess the current status and compare with what is stated in the DoA and possibly provide feedback on the last period (M49-M66) of the IRIS project.

These first 4 years of the project have been rich and have allowed, through TT1, the construction of the Palazzo and IMREDD buildings, which are fully operational and whose data go back to the CIP.
The demonstrator on the heating curve, now in operation for two winters, has enabled the first conclusions (economic, behavioural and technical) to be drawn from this installation.
The dashboard, which had to be installed at the La Seyne sur Mer station, is in operation. The possibility of relocating this demonstrator to the Arenas is still under discussion and is not certain to happen in the time remaining for the project.

In TT2, the construction of the DHCN network is almost complete and will be fully operational with the activation of the production plant. The first buildings, including the IMREDD, have been connected to the network and to the EMS, allowing data acquisition and the launch of various control strategies.
The development of the interface between the EDF S&F EMS and Agregio is almost complete and the first virtual tests will take place shortly on the IMREDD building before being launched on the two TT1 buildings.
In IS 2.3, the developments have started on both UC. Whilst the V2G EVCI and EV are commissioned and operational, the 2nd life-battery stacks have also been delivered, but sourcing from the market of the needed inverter and BEMS have been proven to be hard.

Despite a change in scope and technical difficulties, the TT3 demonstrators are progressing. All the electric vehicle charging stations involved in the V1G demonstrator will be replaced and connected to the network and management software by the end of 2021.

The bi-directional charging stations will be received by the end of the year and the first tests will be able to start at the beginning of 2022.

The TT4 demonstrators are mostly still being deployed, only the BIM/CIM model is completed. The next period will be dedicated to work on the scenarios based on the TT1 and TT3 demonstrators.

The COVID 19 pandemic impacted all demonstrators but particularly those of TT5. The awareness campaigns in schools could not be implemented and were postponed to other measures during

extracurricular time. Despite this, visits to substations and actions carried out with the social grocery shop were carried out.
Concerning air quality, the demonstrator with the IMREDD students has been completed. The awareness campaign for the general public is much delayed and will be launched by the end of the year or early 2022.

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Abbreviation	Definition
EU	European Union
WP	Work Package
BESS	Battery Energy Storage System
V2G	Vehicle to Grid
RES	Renewable energy sources
SOC	State of Charge
DSO	Distribution system operator
DHCN	District Heating & Cooling Network
PCM	Phase Changing Materials

1. Introduction

The IRIS project in the Métropole Nice Côte d'Azur region is being carried out on an experimental basis in partnership with industrials. The challenge around innovation is met with concrete productions and successful demonstrators. Focusing on the energy transition, the various solutions have updated new uses for the citizen in the fields of energy savings, energy efficiency and environmental awareness.

Located between the sea and the mountains, the Métropole is subject to topographical constraints requiring agility and adaptability of solutions. Indeed, the climatic and health hazards of the last 24 months, have required the mobilization of the population and the community : COVID 19, mobilization of employees to organize the telephone platforms, distribution of masks, reception of the public in vaccination centres, support for vulnerable people, delivery of meals at home. To this was added a natural disaster on the territory, the storm ALEX caused the disappearance of villages, infrastructures and required an immediate crisis management that was added to the health crisis.

1.1. Scope and objectives

We are entering a decisive decade to act in the face of the climate challenge.

The fight for the protection of soil and biodiversity, as well as the decarbonization of lifestyles, production, consumption and displacement patterns, is a historic responsibility of our generation. It is necessary to collectively implement rapid and unprecedented transformations. This vision is reflected in the Métropole Nice Côte d'Azur territory according to the following axes :

TT1 – Smart renewable and near zero energy district

The objective of this action was to optimize the self-consumption of solar energy. For this, the partners developed solutions: On the new PALAZZO and IMREDD buildings with positive energy and low carbon photovoltaic panels coupled to a storage battery on these two buildings have been installed. All this is connected to an EMS (Energy Management System) allowing an optimal steering.

The social housing of the “Les Moulins” district, which are adjacent to this modernity, have benefited from the installation of numerous sensors in order to regulate the individual and collective temperature as well as possible.
Finally, the creation of a dashboard on the Seyne sur Mer site, located in the border department of the Var, made it possible to explore a new tool for real-time data reports, which could be duplicated on the Haliotis place located in the Nice Métropole.

TT2- Smart energy management and storage for flexibility

The objective is to implement energy flexibility to control costs and support the electricity network in case of peak consumption :

Creation of a geothermic network on the alluvial table of the Var which connected to the buildings of Nice Merida (Palazzo and IMREDD), produces the hot and cold of the buildings.
Creation of an EMS (Energy Management System) that allows the real-time energy optimization of the production and consumption of IMREDD and PALAZZO buildings.

TT3- Smart e-mobility

The objective was twofold, on the one hand to provide energy flexibility for the V1G and V2G, and on the other hand to manage a fleet of cars in carsharing according to uses (reservations and use). This innovation at the national level highlights the agility of the solution by its flexibility in the use of the electrical network.

TT4 – CIP on information services

The development of the CIP has enabled the collection of data that will be used to create future uses, such as :
- The AZUR model: it displays hourly air quality data on the territory of the city of Nice. Ideal to launch alerts to the population it participates in the sensitization of it to adopt new behaviours.
- The BIM/CIM (Building Information Model) model takes energy and environmental data back in real time, making it easier to manage energy with an optimal rendering at the building level, and increased monitoring of the level of the Var River to anticipate raw events.
- Scenario to simulate an environmental context based on air quality and energy data

TT5 – Citizen engagement

One of the objectives within the framewok of the project is to conduct citizen awareness campaigns on air quality and the energy component.

1.2. Lighthouse demonstration project

The Ambitions

Over time, digital innovation takes root in the city's territory to help improve public service to its citizens. Sometimes exploited in a logic of pure innovation, the digital on the territory tends today towards more sense and efficiency, led by an administration that knew how to evolve in contact with its environment.

A step forward has now been taken by the Metropolis, which is rethinking its Smart City strategy around local convictions and priorities. The will is to improve the quality of life and health, to achieve the climate and ecological transition, to secure and develop the territory, to ensure equity and solidarity in the territory.

The challenges

The Metropole Nice Côte d'Azur lighthouse demonstration will address the following challenges:

1. To become energy neutral districts, a high penetration of renewable is necessary, in addition to low energy buildings and infrastructures. There is a clear need for integration of decentralized

renewable energy systems in the district, and convergence between electricity production, cooling and heating system.
2. For high penetration of renewable electricity, increasing the flexibility of the electricity grid is essential. Therefore demand response management as well as integrating storage capacity at district scale are necessary solutions
3. To make a success of a massive transfer from thermal mobility towards electric mobility, thanks to a widened offer of EV, while insuring an optimal operating of local electric network thanks to a smart management of EV charging stations. With a view of an urban traffic more effective and pleasant, and a lowering of air pollution level, which will also be obtained by a smart management of road traffic in real time correlation with urban monitoring.
4. To fuel the development of innovative applications and services in the fields of sustainable mobility and energy, a city- owned digital platform will collect and mutualize all mobility, energy, environmental data produced from the various districts to offer a true city data market place to city partners. Thanks to the use of open and standard programming interfaces (APIs), the City Innovation platform shall interoperate with platforms from other cities, universities and private companies supporting the same programming interface standards.
5. To engage citizens as informed user of new urban services by implementing the methods and tools to assist them in a proactive change of their behaviour in terms of sustainable mobility and energy efficiency

Expected impacts

The smart city then becomes a soothed metropolis, which places the human being at the center of its concerns, using current and future digital resources for the common good of the entire metropolitan territory and beyond, demonstrating agility in the transformation of space and utilities.

1.3. Structure of the deliverable

From a holistic point of view the Iris project is ongoing despite the health and climate hazards, and thus thanks to the mobilization of our partners and their exceptional endeavour. While achieving the objectives of the solutions, they had to continuously produce their reports in order to write the milestones of the project.

Year 2020 /2021 were very heavy in terms of tracking of the situation, with the sensation of not being anymore the leader of the situation but the one that reports silence. Nevertheless, despite the lack of exposure of the actions, the partners remain on their positions and all the developments made in remote work remained continuous versus the outdoor activities completely blocked due to the lockdown period we met in France, and particularly in our area :

- From march to May 2020 /
- From October to Dec 2020 /
- Then from January to May 2021 we were free but could not move further than 10km away from our living address, and remote work was still the rule while possible.
- We were back to work in June 2021, with masks as soon as we were indoor, until now and with no limit of distance, but the masks remain mandatory for indoors.

And despite this alarming atmosphere, the different actions of the 5 transition tracks remained focused and committed while possible.

Regarding the Near zero energy retrofit district, the part of the load curve after lots of meetings, and legal discussions regarding the impediment for the nominated partner (EDF) to act in that deliverable because of our procurement rules that nominated a new company (MSE) to do this action, the challenge has been taken. We solved that and soothed the relations between the competitive companies in order to go ahead and work in the interest of the french consortium.

The freefloating encountered various issues, merely because unforeseen internal troubles raised up : obsolescence of the actual electric charging stations, budget to bring the internet to them, definition of the new perimeter of the experience in order to respect the budget, lack of interactions between the services into the Metropolis...We organized meetings in order to make understand each department their actions and needs. A requirement specification has been written by the Building Department in order to use better the manpower and the budget to realize these specific actions that were not taken into account until now. We had to create new links within these services in order to inspire them to work hand in hand to achieve the goals of the experience. When ones said we can not plan anything because there is always an emergency above the emergency we asked them to plan the actions regarding a clear, realistic and ambitious retroplanning. We reduced the scope and the ambitions of the beginning to touch the end of the experimentation and leave the utopian vision of the all electric vehicle. A real discussion on the future of our free floating is raised as costs and investments are very important for the municipalities in charge of building these infrastructures to answer the swap of behaviour in order to achieve the źerocarbon.

The developments of the CIP by Métropole Nice have been achieved and already replicated by another of our partner. With regularity and combining their talents they improved the API algorithm to share and maximize the datas.

To keep going on the environment side of the project, the citizen engagement is the deliverable that suffers more in terms of non-respect of the milestones. Despite motivated teams, the incapacity of meeting each other stopped completely all the activities in this Iris Task. The only one still working during month 33 to month 45 were the sensors installed in the framework of the load curve and still giving datas, incrementing our reports and analysis ...

Not really enough when the whole objective of the deliverable is cooperation, meetings, exchanges, cocreation, workshops ... No more movement, no more noise excepted the nature : birds, boars in the streets of the city of Cannes, the nature shows us it still exists, the traffic is down, we breath so well, air quality has never been as good.

So, the measure regarding air quality is not relevant no more useful, everyday datas are going better and better. The communication services of the municipality regarding the context and the non sens of producing a campaign in that context : peak pollution is at the lowest and we want to spread an awareness campaign to our population to use soften ways of transport where the Covid 19 exposure is at the highest ? The paradox of the situation created a real issue, on one side the will to respect the engagements of the deliverable and on the other hand the global environment going better and messages absolutely unsuitable facing the situation.

2. Preliminary Results of Transition Track 1

2.1. Overview

Nice LH overall ambition is to drive **the Nice Eco Valley district** into a **Near Zero Energy district** that is livable, safe and socially inclusive, by integrating renewable and smart energy, electric mobility solutions, supported by meaningful information services thanks to open ICT**.** Transition Track #1 (TT#1) will contribute to this ambition by developing and integrating:

- A high share of locally produced and self-consumed solar energy in new buildings.
- Cost efficient energy saving measures adapted to the refurbishment of degraded and poorly efficient existing multifamily buildings.
- Smart information and communication technologies enabling to raise environmental awareness within the local community and among end users about the deployed energy solutions at the district level.

The technical measures intended to be demonstrated in the Nice LH have been classified in four different groups:

Measure 1: Collective self-consumption at building scale

Collective self-consumption at building scale is a new concept for commercial and residential customers in France while only a small number of projects have been done in Europe so far. This concept will be implemented and tested in Nice Méridia on two positive energy buildings under construction (PALAZZO MERIDIA and IMREDD buildings).

Measure 2: Optimization of heating load curve

A new smart control system will be implemented and tested in Les Moulins on two degraded high-rise buildings (132 apartments) enabling to adjust the heat supply to the individual demand in each apartment.

Measure 3: Commissioning process from the design to the operation

An innovative commissioning process will be tested to measure the real energy savings induced by this smart control system.

Measure 4: Dashboard providing real-time energy balance

An urban scale Local Energy Management Dashboard will be implemented and tested in Grand Arénas on a waste heat recovery system allowing near real-time measuring, failure tracking and energy management at home, building and district level, facilitating the efficient operation among various energy resources and evaluating any potential optimization actions.

The matching between technical measures and Integrated Solutions as defined in the GA is given Table 1 and illustrated in Figure 1.

Table 1: Technical measures vs Integrated Solutions

Integrated Solutions	Measure number	Measure title
IS 1.1 (Positive Energy Building)	Measure 1	Collective self-consumption at building scale (Palazzo Meridia)
	Measure 1	Collective self-consumption at building scale (IMREDD)
IS 1.2 (Near zero energy retrofit)	Measure 2	Optimization of heating load curve
IS 1.2 (Near zero energy retrofit)	Measure 3	Commissioning process from the design to the operation
IS 1.3 (Symbiotic waste heat network)	Measure 4	Dashboard providing real-time energy balance

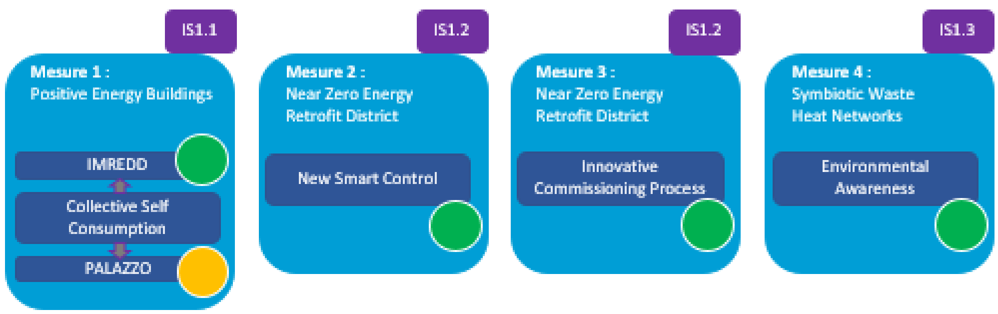
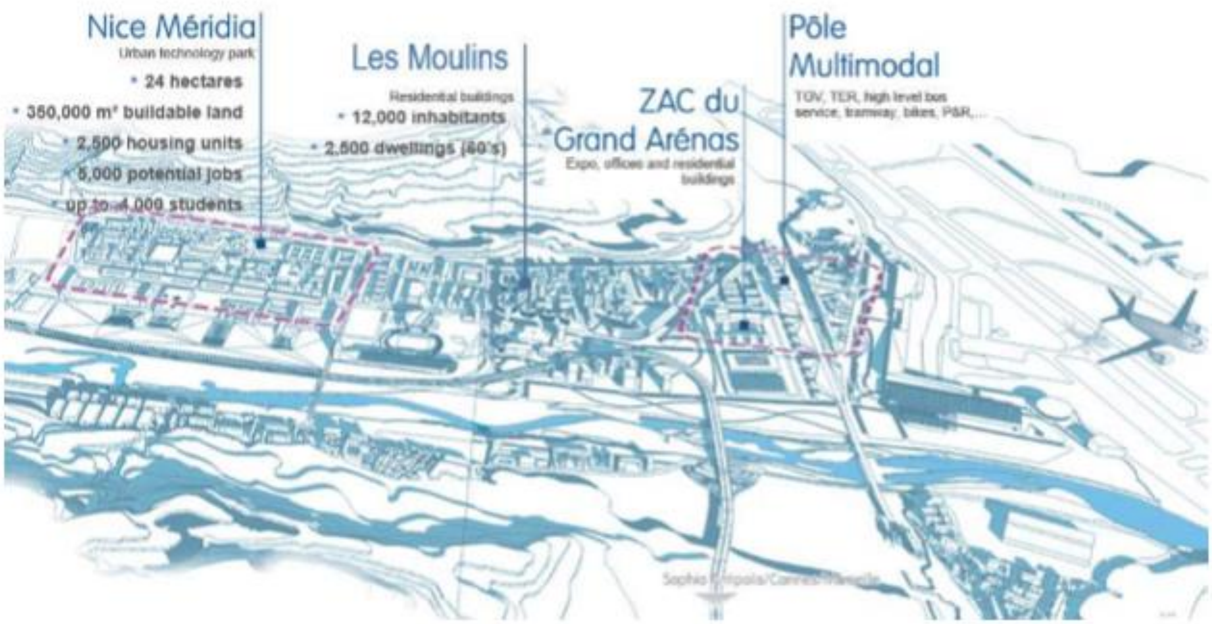


Figure 1 - Schematisation of the relation and hierarchies among the chosen Use Cases and Sub Use Cases as by D6.3

The demonstration area for TT#1 is in the Nice Eco Valley district, a continuum of 3 homogeneous areas: Grand Arénas, Nice Méridia and Les Moulins (see Figure 2).

Figure 2 - Overview of the demonstration districts of Nice (source: MNCA)



Les Moulins

Nice Les Moulins is an income-deprived neighborhood in the west part of Nice (2 969 social dwellings built during the 70's, around 12 000 inhabitants) with degraded mid-rise and high-rise buildings and a shared district heating.

Cote d'Azur Habitat, the social housing company in charge of Les Moulins together with the municipality of Nice and the National Agency for Urban Renewal launched an ambitious renovation program with general objectives to demonstrate the feasibility (technical, financial and social) of innovative low energy renovation processes for buildings.

Started in 2011, the renovation program in Les Moulins is planned over 12 years, as a first step of a larger development in the Nice Eco Valley district, to be completed within 20 years (see Figure 3 and Figure 4).

Figure 3- Overview of Les Moulins area before renovation (source: MNCA)

Figure 4 - Les Moulins area after renovation (source: MNCA)

Grand Arénas

The new international business district of the Nice Côte d'Azur metropole will be that of the “Grand Arénas”. The Grand Arénas represents a highly strategic sector, at the gateway to the city of Nice and in the immediate vicinity of Nice Côte d'Azur international airport. Its articulation with the international airport and the future multimodal exchange hub of Nice-Airport gives it exceptional accessibility and rapid connections with the whole of the Eco-Valley and the metropolitan area. To the existing tertiary site of 10 hectares, a complementary area of 49 hectares will be added, corresponding to potentially 700 000 m² of new floors-pace (see Figure 5).

Within the Eco-Valley, the goal of the Grand Arénas is to create a lively, innovative and eco-friendly neighbourhood, as the two driving principles of the new international business centres are urban diversity and eco-exemplarity. In addition to the offices and other facilities, a diversified housing offer is ensured (social mix), accompanied by services, shops, hotels or public facilities. The first development phase will be realized by 2021, achieving up to 140.000 m² of new mixed developments.

Figure 5 - Plan of the Nice Grand Arenas project (source: EPA plaine du Var)

Nice Méridia

High priority operation of the eco-valley, the technological pole of Nice Méridia will have a first development area of 24 ha or 537 000 m² of new mixed-use floor-area, with the objective to achieve 200 ha in the long term (see Figure 6).

Its location and its mixed used program will make it an outstanding eco-district, aiming at providing high quality living and working conditions. Its vocation is to be a catalyser of innovation, thanks to its dedicated R&D and educational spaces with a vocation to attract businesses and institutions dedicated to technology and services from the sustainability and health care branches. This target should be achieved by first attracting public and private R&D and innovative organizations which should self-reinforce themselves by speeding up the developments of incubators, start-ups, co-working spaces and business centres among other.

Aiming at functioning as an «eco campus», the development program wants to enable short circuits between knowledge and innovation. With such aim, the IMREDD (a branch of UNS, IRIS partner) and the PALAZZO MERIDIA (owned by NEXITY, IRIS partner) buildings have been opened on site, promoting innovation and the creation of businesses related to the sustainable development and “green tech” (see Figure 7).

The leitmotif of the land use and transport organization is “accessibility”: this should enable to provide an integration of offices, shopping and housing areas among the districts, as well as access to services connected to the sport centre situated in the same perimeter.

Figure 6 - Land use plan of the Nice Méridia project - (D&A - Devillers et Associés)

Figure 7 - : Overview of the demonstration districts of Nice Meridia (source: UNS/IMREDD - modifications by EDF)

2.2. Implementations

2.2.1. Measure 1: Collective self-consumption

Collective self-consumption at building scale is a new concept for commercial and residential customers in France while only a small number of projects have been done in Europe so far. This concept is being tested in Nice Meridia on two positive energy buildings recently constructed (in 2019-2020). **Fout! Verwijzingsbron niet gevonden.** lists the main features of the two positive energy buildings that host the use case.

Table 2: Main features of the two buildings supporting the demonstration

Building name	PALAZZO MERIDIA	IMREDD

Picture (project)		
Picture (construction stage)		
Building category	Office building	Educational building
Building owner	NEXITY (private)	Nice university (public)
End of construction	December 2019	January 2020
Total floor area (m^2)	7860	4970
Total height (m)	34.75	15.66
Energy target	Positive energy building	Positive energy building
Energy system	District heating &cooling system	District heating &cooling system
PV surface (m^2)	412 m^2 on roof top	848 m^2 on roof top
Type of storage system	Electric battery	Electric battery (first and second life batteries)

IMREDD

The IMREDD demonstrator for the measure 1 in TT#1, is fully operational. Indeed, the photovoltaic system and the lithium-ion battery pack have been installed during Q3 and Q4 2020. First tests involving the energy management system operated by EDF S&F, occurred during Q1 2021. IMREDD and EDF S&F are currently implementing a scenario based on the maximization of the self consumption.
Instead of being injected on the electrical network, the electricity produced by the photovoltaic pannels is consumed localy.

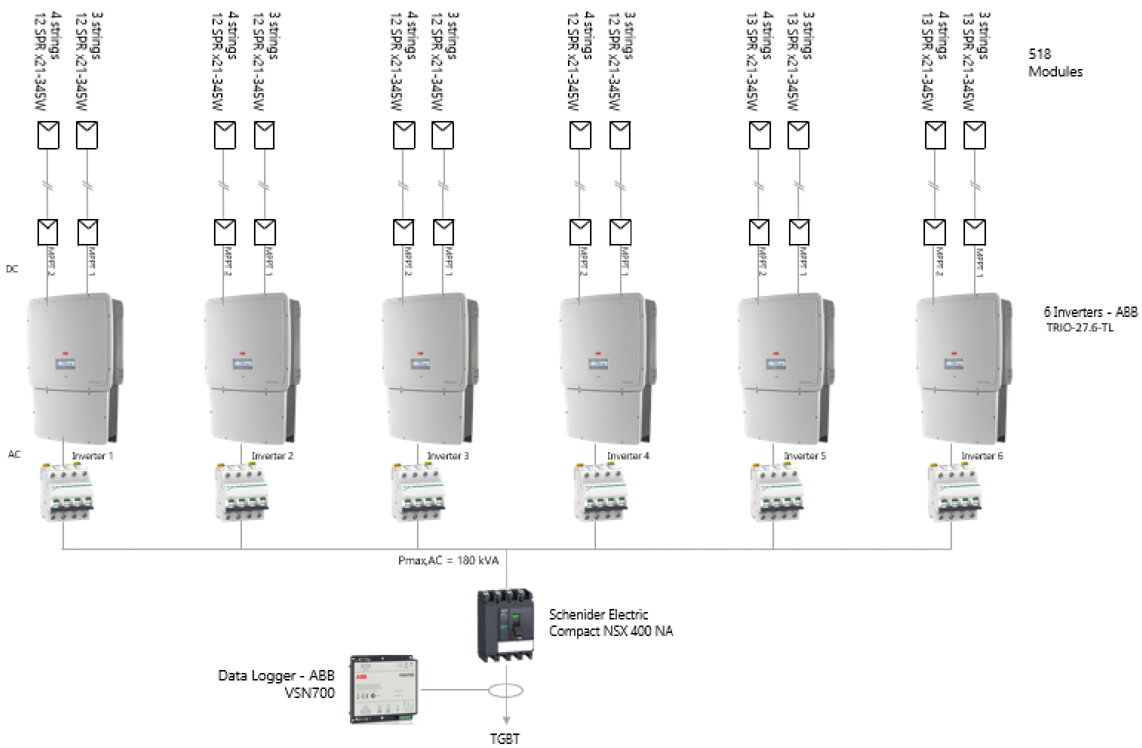
Figure 8 - : Photovoltaic system on IMREDD's rooftop.

Then, the share of self consumed electricity in the building is increased by the use of a lithium-ion battery. The optimisation of the algorithm that control the battery and the inverters are related to **TT#2 Measure 1 - Stationary storage deployment in buildings and local electric flexibility management.**

Figure 9 : Lithium-ion battery system at IMREDD.

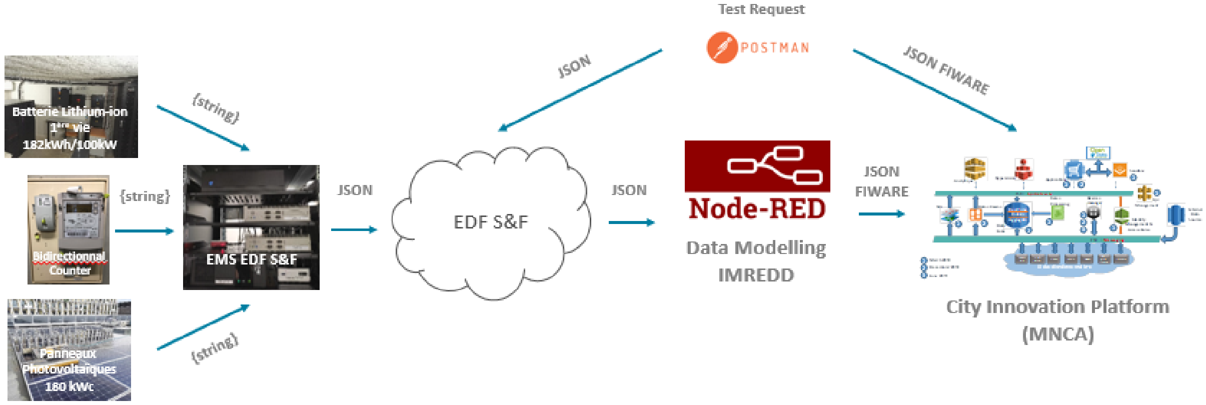
During the implementation of the project, equipments were supplied by different service providers selected during a public call for tender. The commissioning phase included a strong coordination activity between actors that was realized by the IMREDD engineering team in order to handle the integration of heterogeneous devices (from different manufacturers) especially regarding the ICT part.

Figure 10 : Architecture of the Photovoltaic system at IMREDD



The last step of the operation was to recover raw data generated by the PV data logger, the battery and the main counter of the building as described on figure 5. Then, data are standardized according the Fiware data model template. The main goal of that transformation is to push data to the CIP server hosted by MNCA in order to disseminate information of the IMREDD building and allow the calculation of KPIs in all TTs.

Figure 11 : Data Acquisition and Data modelling concept



PALAZZO MERIDIA

All the equipment needed for the experimentation in TT#1 are installed and already commissioned (Figures 12 and 13). Data from the demonstrator are collected and transmitted to the CIP following the process as illustrated in Figure 11.

Figure 12 : Photovoltaic system in the PALAZZO building

Both the building management system and the energy management system are functional.

Figure 13 : Battery storage system and the EMS in the PALAZZO building

Despite a lot of exchanges between partners and stakeholders of the project, the scenario related to the self-consumption use case is still pending. Technical investments with all the partners lead to three different solutions. But a choice must be made in the coming months. Each scenario has advantages and issues as presented in the coming section.

- **Collective Self-consumption between the common area and offices**

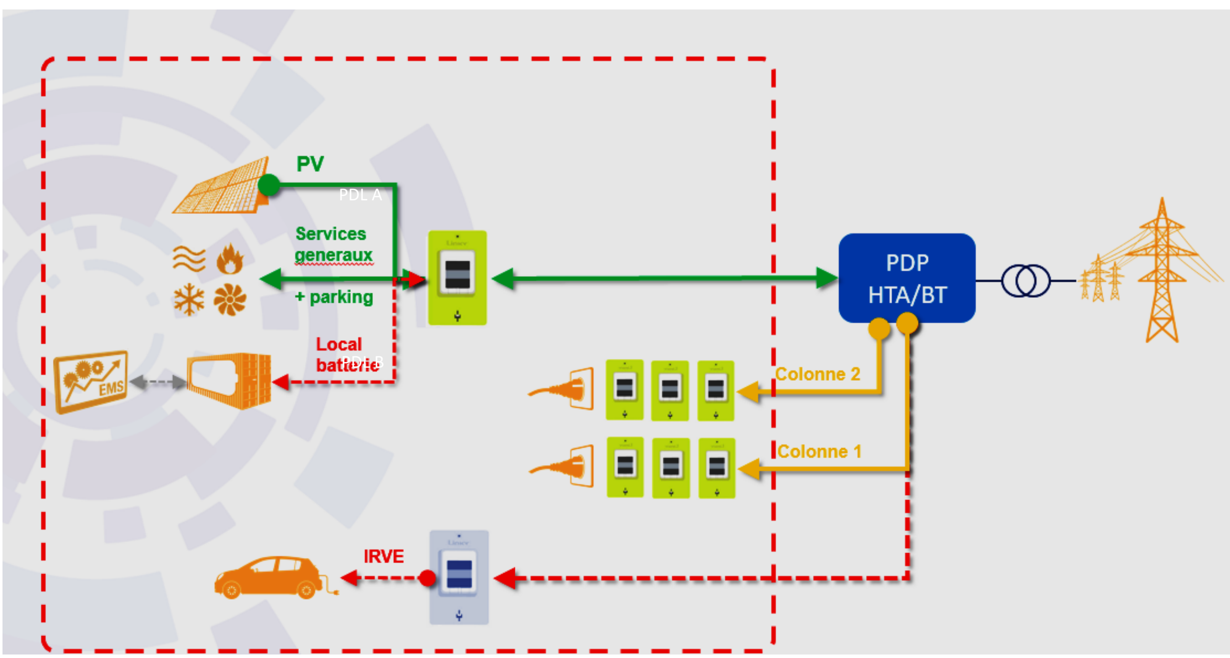


Figure 14 : Collective self-consumption concept between common area and offices

The self-consumption is done between the common area PDL-A and all the owners that signed a contract for the collective self-consumption. EDF would handle the equilibrium regarding the photovoltaic surplus injection into the distribution network.

Observations:

- A company must be created between NEXIMMO 96, DALKIA, EDF
- An information campaign should be done for the owners in order to test the acceptability of the solution at the building scale
- Need a tool to handle the collective aspect of the self-consumption

Strength of the solution:

- Real French demonstrator
- IRIS goal compliant
- EDF can help the project

Issues:

- French regulation is complicated
- Delay on the IRIS schedule for the implementation of the demonstrator

- **Collective Self-consumption between the common area and EVSE**

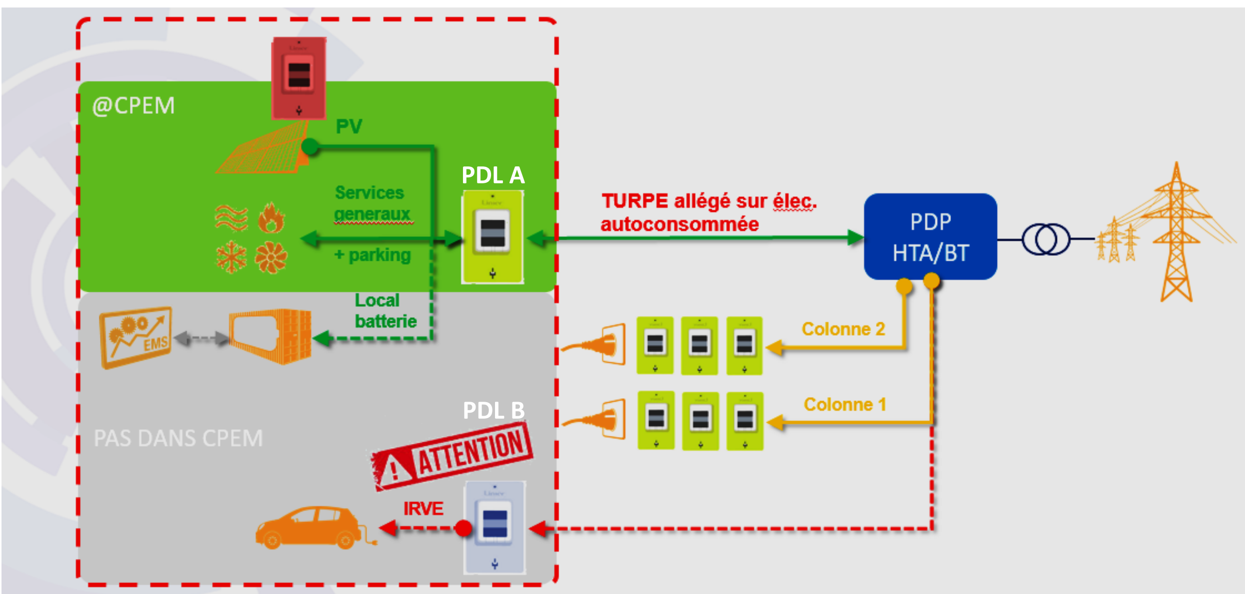


Figure 15 : Collective self-consumption concept between common area and EVSE

In this solution, energy exchanges are done between PDL-A and PDL-B respectively between the common area and electric vehicle charging stations (EVSE).

Observations:

Perimeter

- PDL-A is already functional, PDL-B is planned but not operational yet.
- Uncertainty about the billing mode of the charging station leads to difficulties when it comes to pay the energy provided by PDL-A

PMO

- The maintainer (DALKIA) of the building is not responsible of the technical room where the battery is located. If the situation doesn't change, a company has to be created between NEXIMMO'96 (promotor of the PALAZZO) and DALKIA

Strength of the solution:

- Easier to implement than the collective self-consumption between the common area and offices

- **Self-consumption in common area**

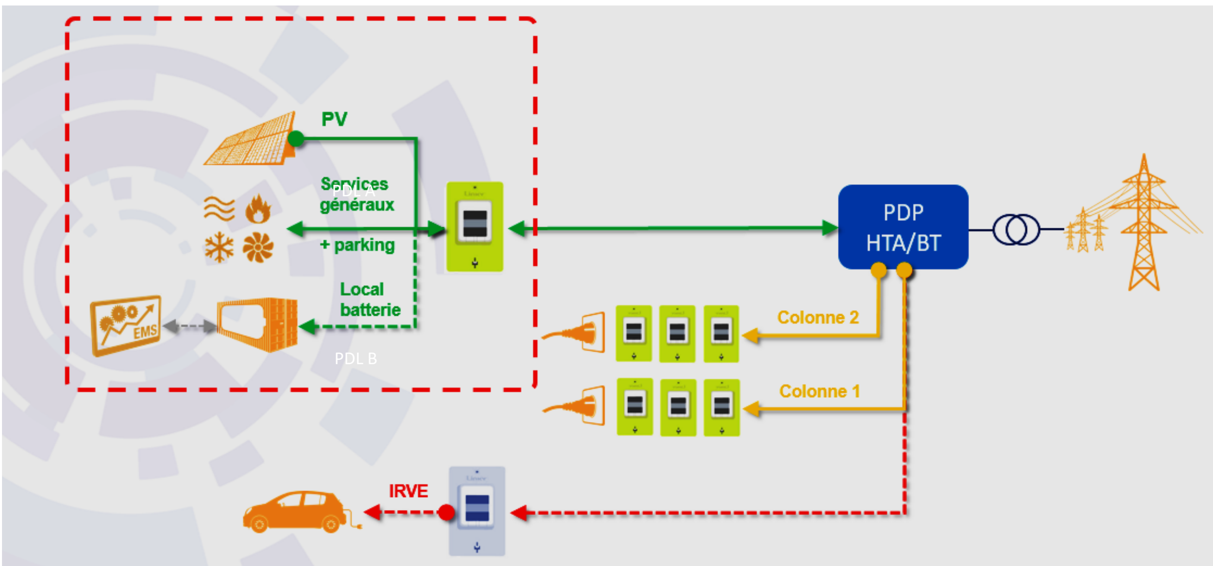


Figure 16 : Self-consumption concept in common area

The energy produced by photovoltaic panels is consumed by the common area or injected on the distribution network.

Observation:

- Not aligned with the IRIS commitment
- Future integration of EVSE is not possible in the self-consumption experiment

Strength:

- Very simple to implement

The final decision for a given scenario is still pending.

2.2.2. Measure 2: Optimization of heating load curve

As part of the renovation of existing buildings, the aim of Measure 2 is to integrate a smart control system within the district heating distribution, giving the possibility to adjust heat supply to the individual demand in each apartment according to their sun/wind exposures but also considering accurate indoor temperature.

The selected experimental area is in the social housing area of Les Moulins in two neighboring towers named 13 & 14 (see Figure 17) recently renovated with high performance external thermal insulation. These buildings equipped with underfloor heating (high inertia system) will permit to test meteorological regulation within an optimal context.

Figure 17 : Overview of the case studies

Tower 13 & 14

- Construction completed: 1968
- Floor area: 10,684 m^2 (5342 each)
- Floor count: 17
- Total of 132 apartments (66 per tower)
- Collective heating connected to the "Moulins" heating network (one substation per tower)

The main workflow of the project consists of three major work themes.

Table 3: Major work themes of the main workflow of IRIS project

Hydraulic works	Sensor network implementation	Monitoring and analysis
1. Identification of the flow of the underfloor heating network 2. Selection of appropriate pipes, valves and pumps	1. Sensor equipment installation 2. BEMS programming and algorithm development 3. test and calibration	1. Dashboard 2. Adjustment and optimization

COFELY designed three strategies to compare the systems. Using predefined KPIs, system performance was evaluated in terms of energy consumption, GHG emission, and profitability.

Table 4: Design of experiments of hydraulic system

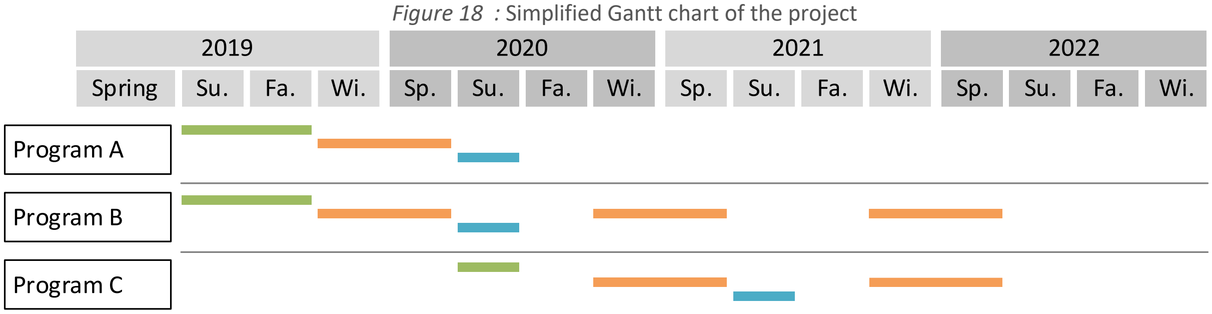
No.	Objective	Main methodology
Origin	Referential system	
S1	Regulate separately the heating system of north and south part of the building to evaluate the performance	Separation of north and south part of underfloor heating network water circulation
S2	Finely control of individual household heating to evaluate the performance comparing S1	Individually regulate the household heating
S3	Find the balance between system complication, investment, and performance	Moderately control of the heating of particular household

Table 5: Strategies for the heating system

No.	Cost	Performance	Strategies
S1	$	Baseline	Separate the distribution of the underfloor heating network into 2 parts: façade north and south
S2	$$$	Top	a) Separate the distribution of the underfloor heating network into 2 parts b) Add individual regulators (valves, pumps, sensors) to all households
S3	$$	Medium-high	a) Separate the distribution of the underfloor heating network into 2 parts b) Reduce the number of individual regulators based on the analyses of S2 and still produce a relatively applicable result.

The entire project will go through 3 cycles. Each cycle is composed of 3 phases: installation and commissioning, test over a heating season, analysis and action plan, which are color-coded in green, orange, and blue, respectively.

Figure 18 : Simplified Gantt chart of the project



No.	Location	Installation & commissioning	Test over heating season	Analysis & Action plan

Prog. A	T14	Implement S1 in T14	Monitoring T14	Benefits analysis and establishment of baseline consumption data.
Prog. B	T13	Implement S2 in T13	Monitoring T13	Adaptation of the distribution to individual needs.
Prog. C	T14	Implement S3 in T14	Monitoring T13 & 14	Technical and economic optimization of S2; Definition of the best control grid.

After more than one year of operation, a lot of data has been collected that enable to develop an optimized solution. The new hydraulic system (pumps, valves, …) and the new BEMS has been implemented and tested in T14 during Q2 2020. COFELY installed the ambient temperature sensors in some selected apartments in T14.

However, some difficulties have been encountered: Individual regulation implies the installation of thermal sensors in each apartment. Some tenants consider these temperature probes as an invasion in privacy and refused their installation in their living room. Moreover, in the case of absence of probe, 2 way-valves are fully opened. Some tenants destroyed them or put them outside so as to be more heated. Finally, around 10 to 15% of probes are not efficient.

These contingencies deteriorate the control performance in the 2020/2021 heating season because we had to act in time, which made it difficult to make an effective decision, or there would be a significant drop in performance in terms of the final KPIs. The track of the actions is presented below.

Time	Location	Action
30/11/2020	T14	Implementation of the 2-way valve regulation per apartment. PID control based on room temperature.
02/12/2020	T14	Modification of the room temperature set point from 19°C to 20°C modification of 2-way valve curve
10/12/2020	T14	Noticed water flow problem on certain floor. Modification of the heating curve (south).
16/12/2020	T13	Operating problem of 2-way valve in substation
17/12/2020	T13	In apartment no.44 modification of setpoint coefficient (change to 0 for solar influence) change primary delta t to 0
04/01/2021	T13	Irrigation problem from 9th floor switch 2-way valves of apartments to manual mode change of pump inlet speed from 800m3/h to 1000m3/h increase of 3°C on heating curve
22/02/2021	T14	decrease of the room set point from 20°C to 19.5°C implementation of a schedule (from midday to 14h) to reduce the setpoint temperature on the north heating network by 5°C
26/02/2021	T14	readjustment of the pump linearization curve for 20°C / 40% of pump water flow speed for 50°C / 100% of pump water flow speed Reduce 10°C setpoint temperature between 12:00 and 14:00

Meanwhile, our information system was not designed for handling this kind of enormous data flow and it rapidly became a burden in in transmission and storage and we had to upgrade and built tools for the system in Q3 2021. It complicated our interpretation for the data acquired and hence became another barrier for our decision making. But an improved situation is foreseeable in the next year.

COFELY gathered all this raw and unprioritized data after the operating period and try to process it to make up an action plan for the next heating season 2021/2022. Some conclusions and decisions have been drawn in Q3 2021 such as:

- Remove the inside variable temperature and keep only the return network temperature probes that are located in the technical closets outside the flats.
- Put only 1 probe per stage and copy it to other flats located at the same exposure
- Limiting the intervention in flats by:
    - Increasing the battery life: reduce the frequency to the minimum required (1hour), put a special low frequency mode in period without heating (24h being the lowest possible)
    - Testing the probes in situ but outside the flats before

An optimized operation will be taken in place in Q4 2021 with the final analysis.

Heating season:

Building 13 heating		**Building 14 heating**	
Starts at	**Stops at**	**Starts at**	**Stops at**
October 2019	April 2020	November 2019	April 2020
Early November 2020	Late April 2021	Early November 2020	Late April 2021
October 2021	April 2022	October 2021	April 2022

2.2.3. Measure 3: Commissioning process from the design to the operation

Measure 3 is based on the REPERE service, a dedicated commissioning process elaborated to check from the design to the operation that energy efficient measures have been correctly implemented in refurbished apartment buildings. This service is based on monitoring and measurement data acquisition. Measurements are performed both before and after refurbishment operation and used to build an energy model of the building. This model is then processed to compare the performance after refurbishment with the performance or bills before refurbishment.

The REPERE service has been used to evaluate the energy savings provided by the optimization of the load curve described in measure 2.

Regarding measure 3, a solution of sensor monitoring has been put in place to verify that sensors measurement is working properly and provide warning reports when they don't. This is the first stage of the REPERE service. The goal of this monitoring is to verify that we have all data necessary for the REPERE service calculation. This monitoring solution is put in place in a dedicated server where are setup routines to update measurement data. In these routines scripts it is checked that sensors are transmitting well and meet their specification in terms of frequency of acquisition. Sensor derivative and value range are also checked to detect any anomaly.

In 2022 the REPERE service calculation will be implemented for the two building towers to calculate the energy savings provided by the optimization of load curve described in measure 2.

Calculation procedures will be coded to process measurement data, train models of energy prediction and use these models to evaluate the energy savings and its uncertainty. This is the main deliverable of REPERE service.

Planning :

2019-2022 : monitoring of the sensors put in place in measure 2.

2023 : application of REPERE service on both building tower 13 and 14 to evaluate the energy savings provided by the optimization of load curve executed in measure 2.

2.2.4. Measure 4: Symbiotic waste heat networks

The implementation of the Dashboard has so far been kept within the ReUseHeat project and no costs have yet been declared for the action under the IRIS.

The action targets at replicating under IRIS, the Dashboard currently running on La Seyne sur Mer DHCN, on the Grand Arenas project. Nevertheless, for the latter, yet 2 major milestones have to be achieved: in first place, negotiations between the private investor (DALKIA) and MNCA are yet ongoing and no final planning can be disclosed and in second place, the replication plan should be developed in agreement with the DALKIA. On both axes, discussions have been launched.

Extensive and periodic reporting have been done under ReUseHeat, and to avoid repetition, a summary is presented in the followings.

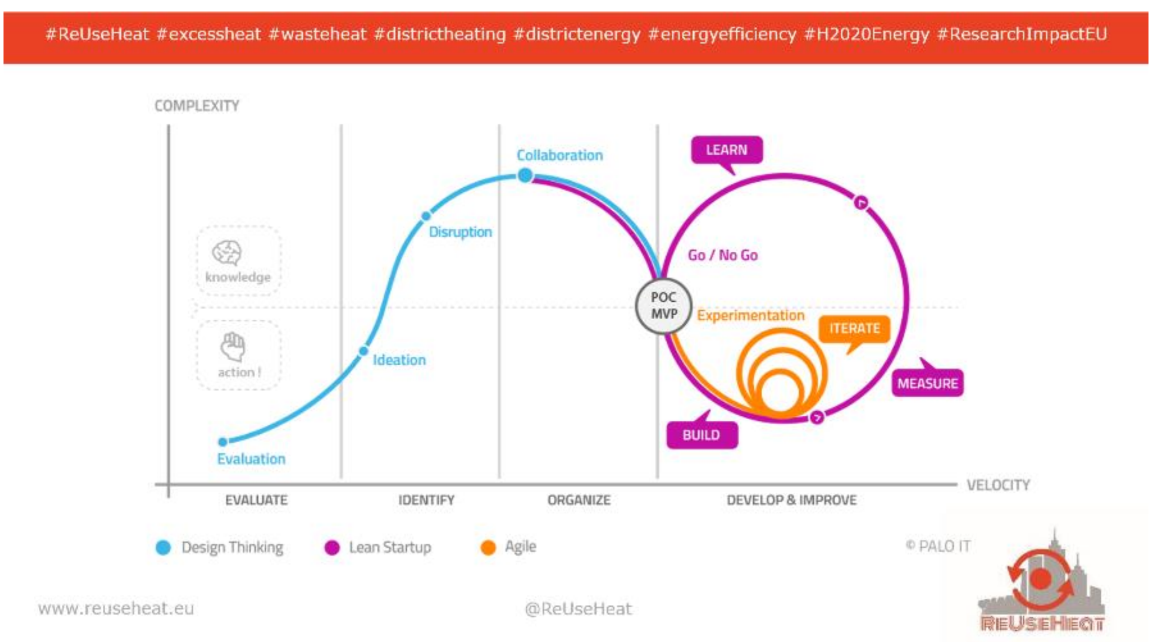


Figure 19 : Schematisation of the followed approach for the Dashboard ideation under ReUseHeat. (Source: EDF)

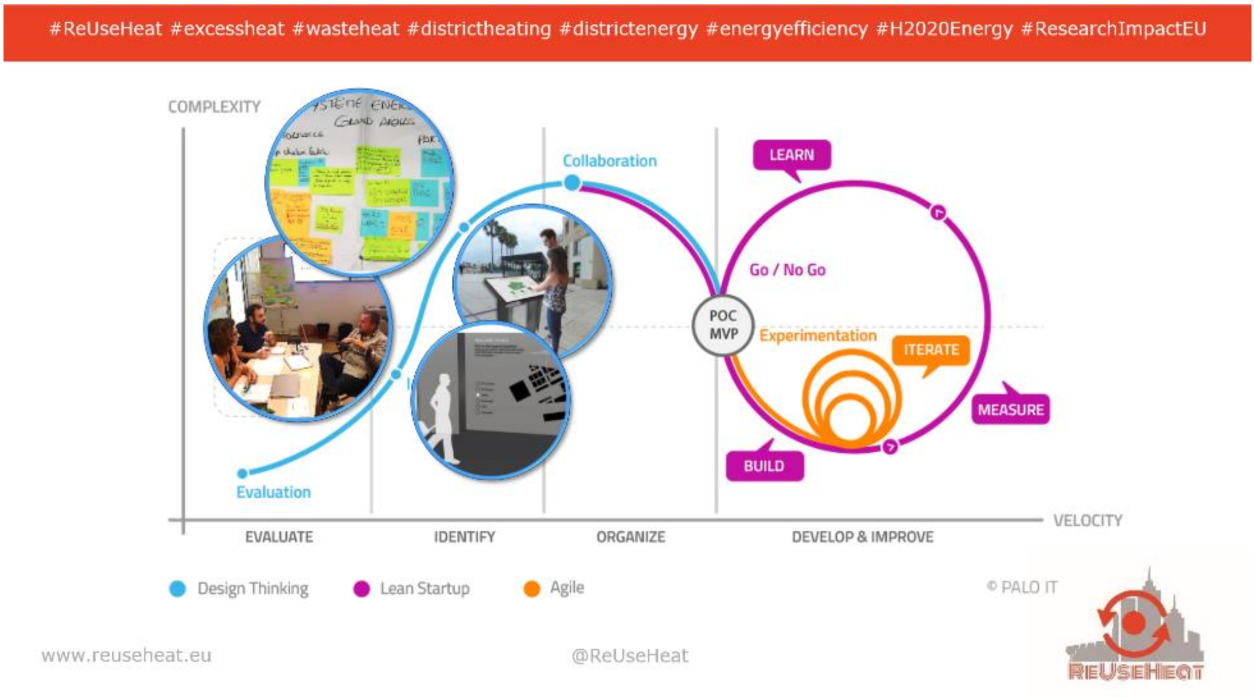


Figure 20 : schematisation of the achievements of the implemented Design Thinking approach. (Source: EDF)

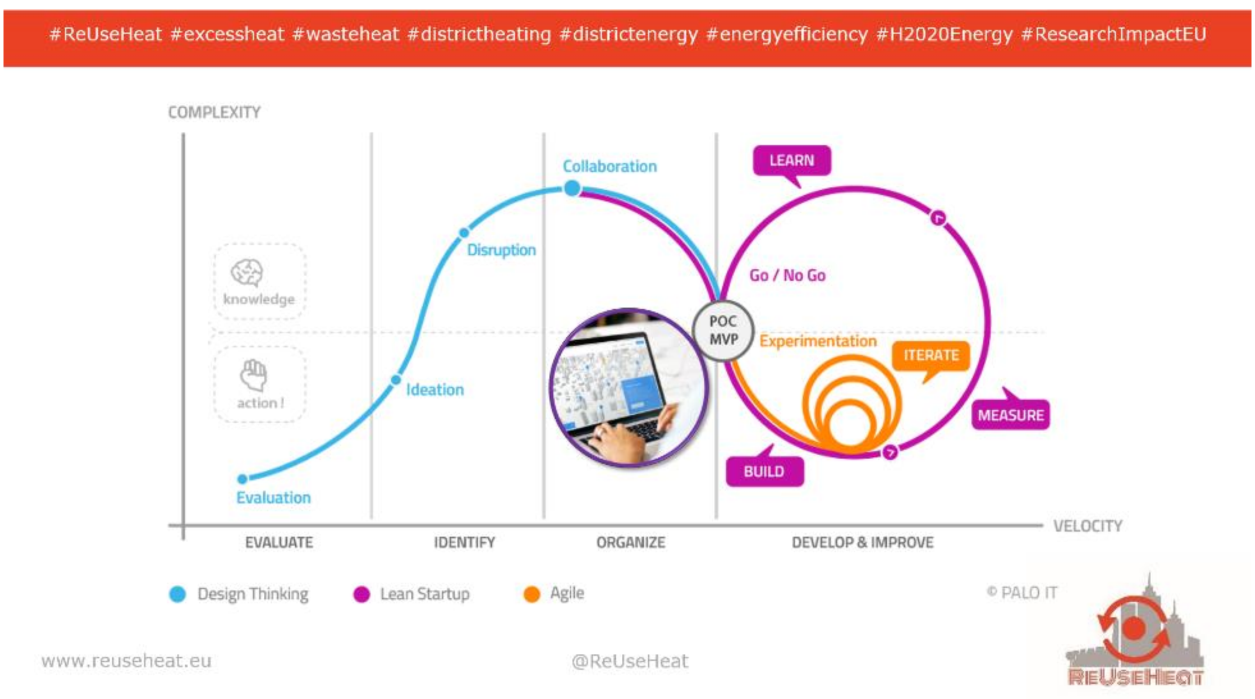


Figure 21 : Milestone of M30: MVP has been implemented and operational. (Source: EDF)

The main milestone for the Dashboard implementation, has been the achievement of a fully functional Dashboard as MVP (Minimal Viable Product) resulting from the Design Thinking approach developed together with the R&D department of EDF, in M30.

Thanks to internal communication, interest has been awaken on the Dashboard and the management of the regional direction of EDF has agreed to dedicate resources from the “MedInLab” structure (dedicated structure in the regional trade direction of EDF, dedicated to the acceleration of innovation), to implement an Agile methodology to push the developments of the Dashboard. Rich user feedback has been achieved thanks to this work, which lead to a complete overhaul of the Dashboard design and content.

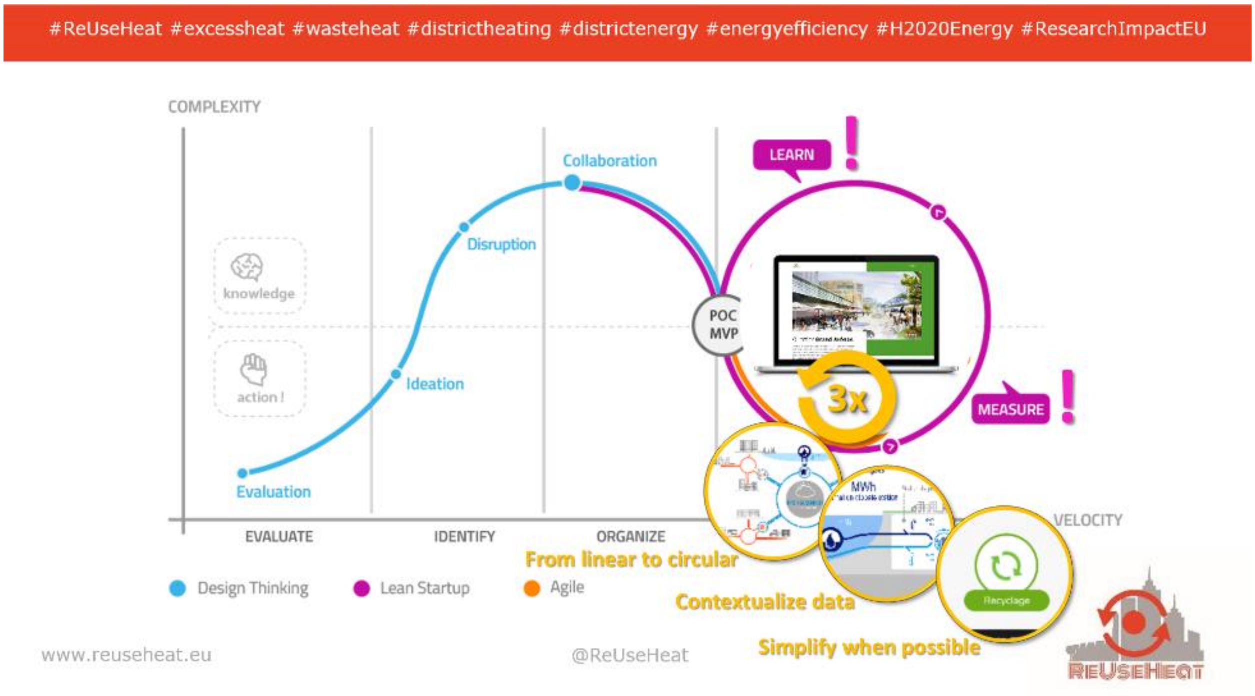


Figure 22 : Schematisation of the Agile methodology implemented thanks to the support of the MedInLab structure of EDF – three user feedback iteration have been possible – main learnings are schematised. Currently, measure and learning phases are engaged. (Source: EDF)

Since April 2021, the Dashboard is completed under the chosen stabilized form.

Yet, during the period, main challenge has been to settle the data quality and consistency matters with the DHCN operator: the DHCN of La Seyne sur Mer, has undergone extension and refurbishment works, which lead to continuous interventions on the local SCADA system, causing continuous changes in the data structure (i.e. naming, indexing and errors), making it challenging to settle algorithms in the Dashboard for the indicator calculation and visualisation. Since, it is expected to have a stable dataflow from M48. Furthermore, the Dashboard has been developed in an additional English version which will be finalized byM49.

For achieving the final measure and validation phases, a dual approach has been chosen and is ready to be launched: first, for retrieving quantitative information to collect the needed KPIs to assess the acceptance of users of the developed product, an on-line questionnaire has been prepared in both English and French (with the collaboration of CARTIFF and IVL); second, for having more qualitative and in-depth answers, an interview guide has been developed together with the sociologist from EDF's R&D department. The two approaches will be crossed, to see if findings from each others are coherent.

2.3. Preliminary results

2.3.1. Measure 1: Collective self-consumption

IMREDD

Since January, the photovoltaic system produces local and decarbonized electricity. Due to different period of test, it is difficult to already compute KPIs. But few interesting facts and information are already available from measurements and on-site observations.

The demonstrator in TT1 is based on the integration of renewable energies in the urban area, it seems relevant to highlight few points observed during the beginning of the monitoring and give feedback to future integrators, users regarding such systems.

Indeed, we noted some unexpected phenomenon during the exploitation of the photovoltaic system due to shadings, dust, hot spots… as explained in the following chapter.

- **PV production analysis:**

According to the preliminary study that was realized before the construction phase, the theorical production was estimated to 201 MWh/year. From the 01/01/2021 to the 30/08/2021, the real energy production from the photovoltaic installation at IMREDD is currently equals to 138,9 MWh representing 69,1% of the theorical annual production.

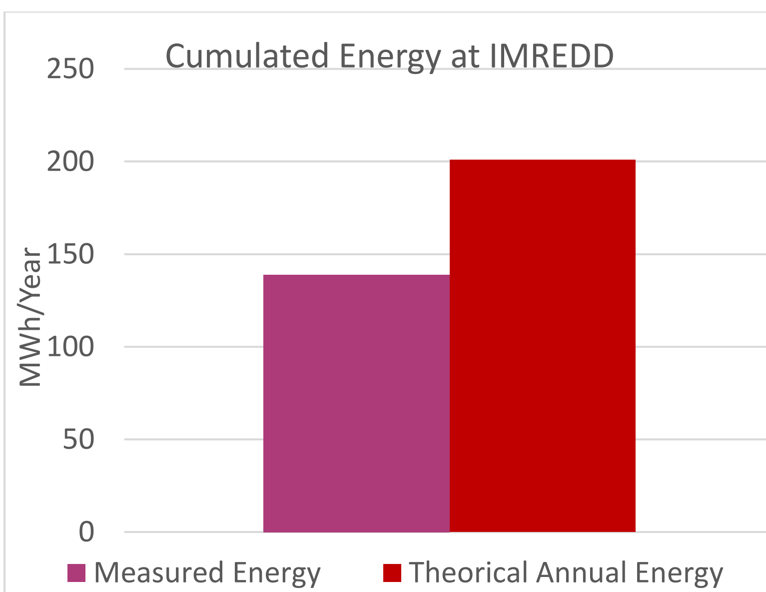


Figure 23 : Cumulated energy produced by the photovoltaic installation from 01/01/2021 to 30/08/2021 at IMREDD

It will be interesting at the end of the year to compare the final real production with the theorical one.

- **Shadings from buildings**

The photovoltaic electricity production is by nature affected by weather conditions. But shadings from the surrounding environment like buildings also impact the generation of renewable energy.

As example on figure 6, the Palazzo building nearby the IMREDD one, has a strong influence on the annual PV production of IMREDD. According to the position of the panels on the roof, inverters begin to produce electricity later in the morning and impact by consequence the theorical production.

Figure 24 : Surrounding buildings (PALAZZO and Car Park) that bring shadings on the IMREDD rooftop

As illustrated in figure 24, the production of inverters 4 and 6 is directly impacted by the surrounding environment especially in the morning.

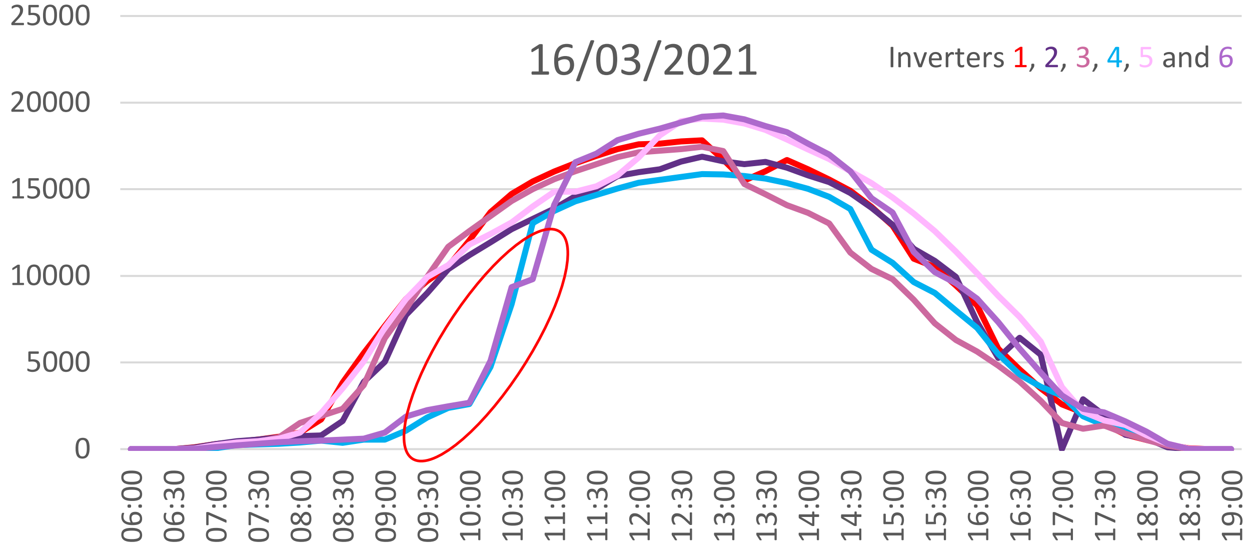


Figure 25 : Photovoltaic production from the different inverters at IMREDD

Figure 25 highlight the effect of shadings generated by the construction nearby IMREDD when located at the observation point situated on the green cross.

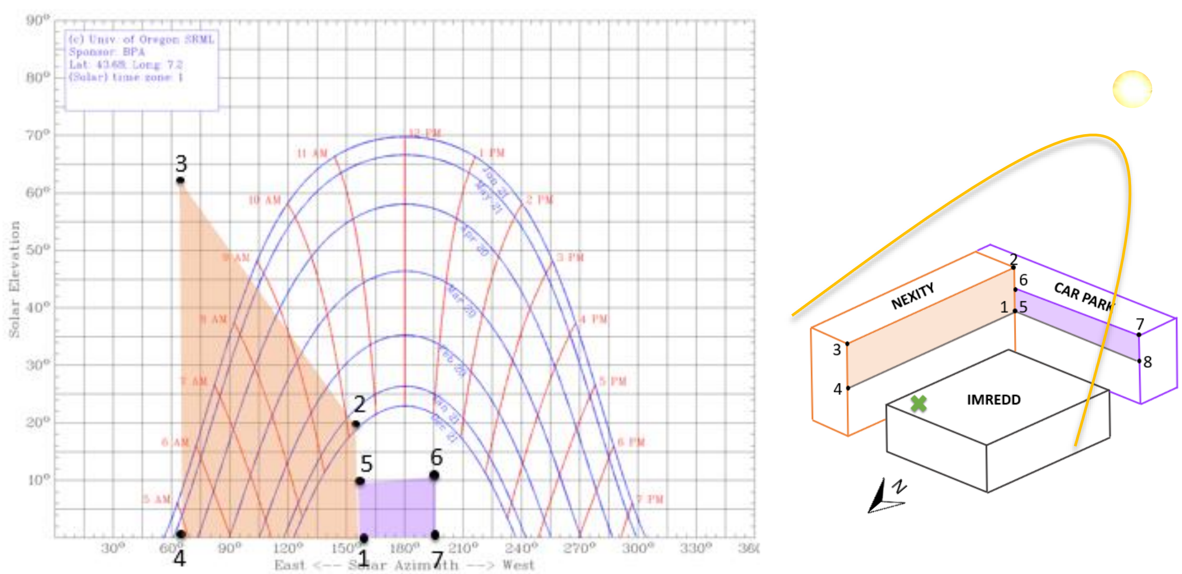


Figure 26 *: Impact of the shading brought by the PALAZZO and the Car Park on the annual irradiation of the IMREDD rooftop*

Such analysis must be done a priori and is justified in smart city projects where obstacles, in a near environment, are potentially everywhere.

- **Shadings from IMREDD's architectural elements**

A fact that wasn't initially considered in the conception of the IMREDD photovoltaic system is the shading brought by the different architectural elements of the IMREDD building itself.

Figure 27 *: Example of shadings on the photovoltaic panels of the IMREDD building*

That type of phenomenon has a direct impact on the production of individual panels or even cluster of panels usually identified as string. According how the panel is shaded, the production is impacted differently. As shown in figure 30, a small shading could have a greater impact than a large one.

Figure 28 : Impact of a shade according to its position on the photovoltaic panel

In fact, it will depend on how the shading hides the panel, activating a given number of bypass diodes. N.B: Cells are connected in string and bypass diodes allow panels to supply power at a reduced voltage rather than no power at all when there is a shading.

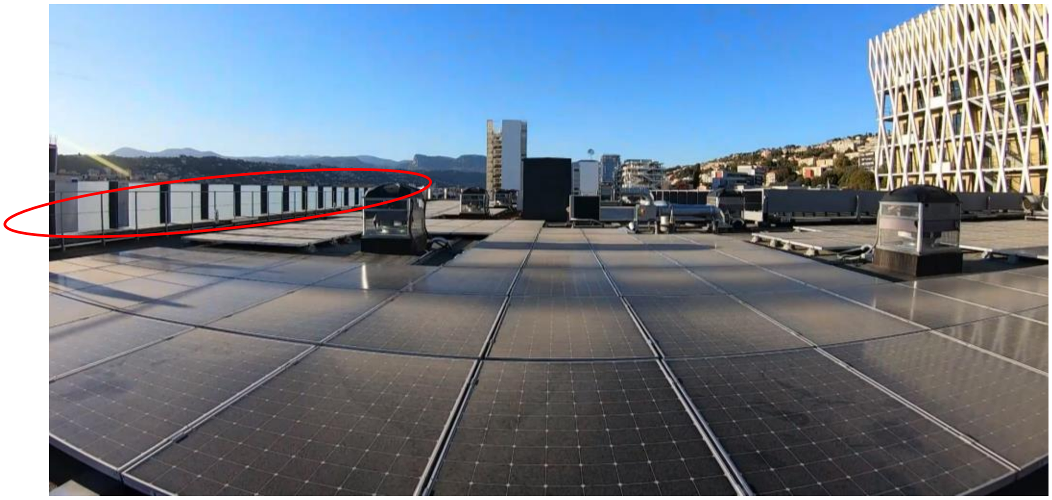


Figure 29 : Another example of shadings induced by architectural elements

Architects must take into consideration such observations in order to optimize the photovoltaic production, increasing by consequence the return on investment of any building projects that incorporates renewable energy sources.

- **Dust**

Panels are layed on the roof, side by side and without any slope. After few months of exploitation, it appeared that rainwater mixed with dust, could let traces on the top of the panel leading to a significative loss of photovoltaic production.

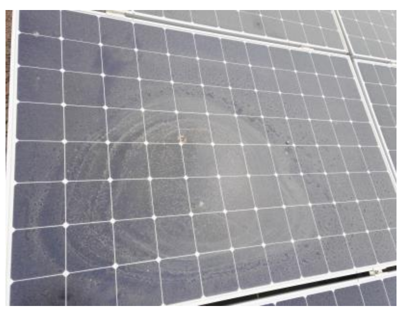


Figure 30 : Dust and evaporated rainwater on a photovoltaic panel

This dirt could increase locally the temperature of a panel as shown in figure 32. The impact will be a loss of efficiency but also could involve an inhomogeneous ageing of the system.

Figure 31 : Impact of dust and evaporated rainwater on a photovoltaic panel

The solution is to optimize the maintenance of the installation through a scheduled cleaning. Moreover, users and maintainers must note that a bad cleaning could be worse than no cleaning at all. Indeed, a bad cleaning could spread the dirt everywhere. Cleaning robots can be used as illustrated in figure 33.

Figure 32 : Cleaning of the photovoltaic panels

- **Hot spots**

Another phenomenon that could appear in a photovoltaic plant is the so called "hot spot".
Thermography in figure 12 can feature this kind of issue resulting most of the time from:

- Animal droppings
- Tree leaves
- Corrosion
- Dirt / dust
- Broken glass
- Internal problems of the cell

The destructive effect of hot-spot heating can be anticipated by a correct maintenance of the system through scheduled thermography and cleaning. IMREDD engineers identified in figure 34, one hot spot during the annual maintenance of the installation.

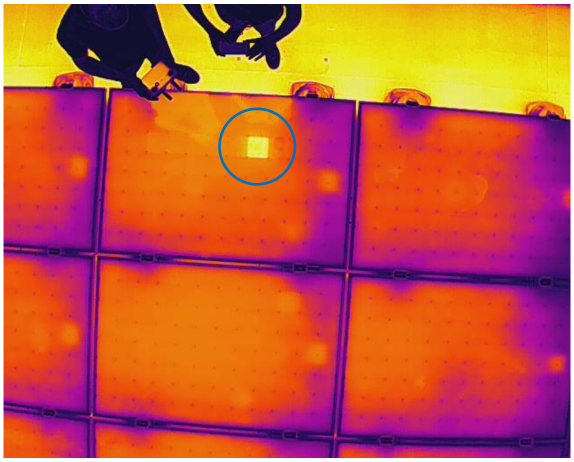


Figure 33 *:* Hot spot identification at IMREDD

As a temporary conclusion regarding the first experience on measures 1 at IMREDD, stakeholders like architects should pay a particular attention when studying the integration of renewable energy systems. On the other side, end-users should not neglect and anticipate the maintenance time and cost. Such recommendations could optimize the use of the energy produced locally and contribute to a better lifespan of the system.

PALAZZO MERIDIA

The photovoltaic system of the PALAZZO building produces local and decarbonized electricity since March 2021 reaching 313 580 kWh at the end of September.

Month	Energy production (kWh)
March	14 993
April	/
May	39 035
June	51 004
July	53 395
August	71 866
September	83 287

Table6: Photovoltaic production in PALAZZO building

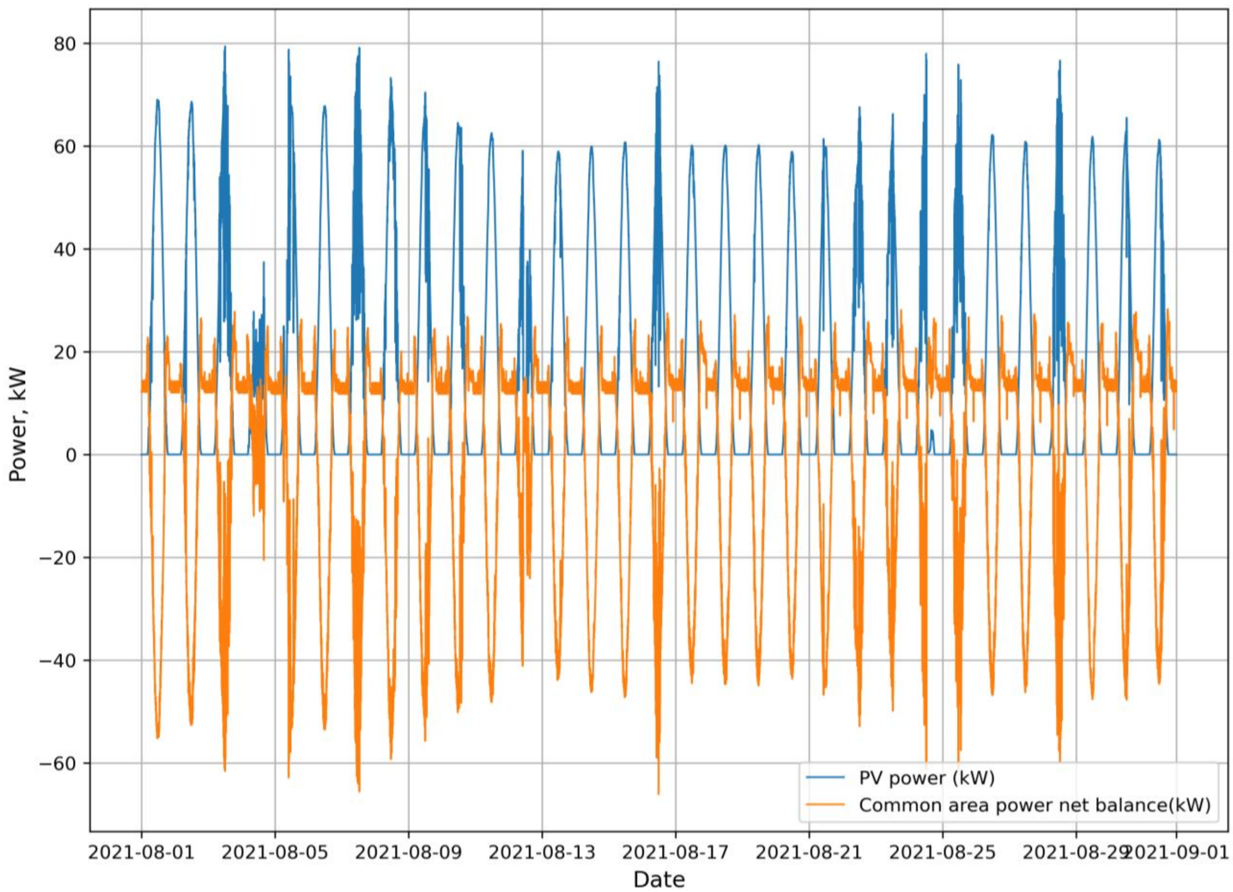
In addition, monitoring system is operational since March but need some improvements: one power metering is yet missing to take every common area in count and power metering for battery must be extended to an algebraic value in order to distinguish the charge from the discharge.

Those setbacks should be interpreted as a lesson:

Professional working on technical management of the building are not at all familiar with high resolution data. They tend to consider *energy* monitoring rather than *power* monitoring : the first attempt was to derive power from energy index rather than take power output of metering. Such approach leads to improper aliased time series. They are not familiar with bidirectional electrical power ("what is a negative power ?") nor they are familiar to identify all power meter consistent with a conventional perimeter for which we want to optimize self-consumption. Many errors had been tracked and corrected.

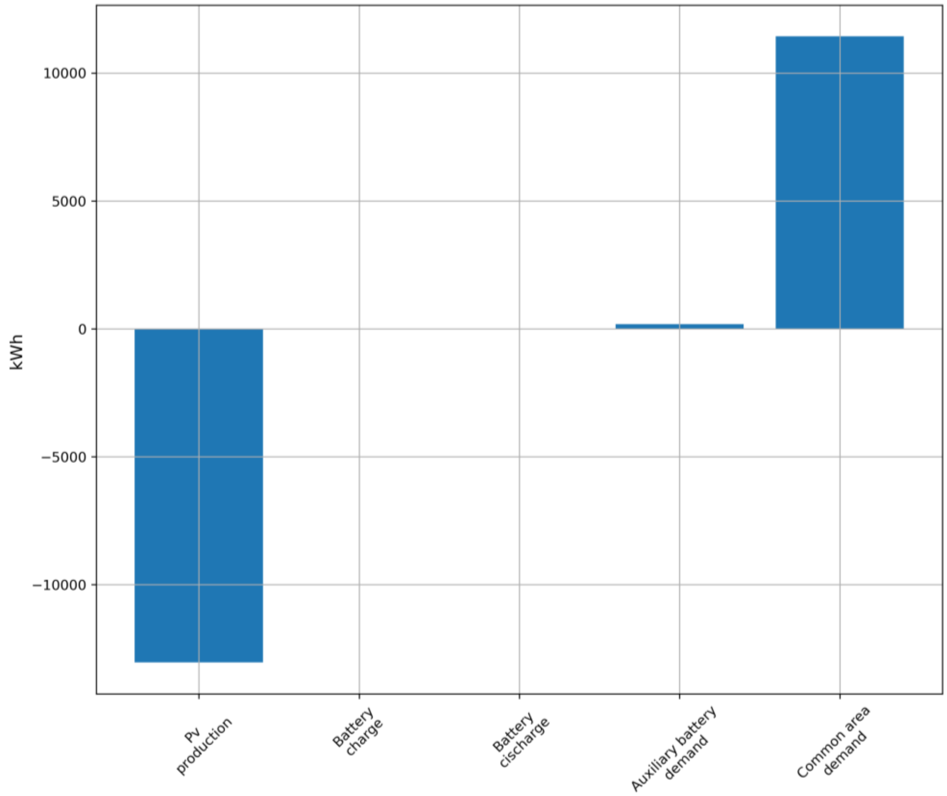
Currently the battery is not yet fully functional due to internet connection trouble. Therefore, first KPI analysis is not yet possible. Nevertheless, it is possible to represent some temporal series of interest and give a first view of self-consumption without battery for the month of August 2021 for example.

Figure 34 : Average power by minute at PALAZZO



Orange curve is the power net balance for common area taking in account le Pv production (isolated in the blue curve) Negative value occurs when PV production is greater than common area demand: in August power exportation from common area occurs each day. In term of cumulative energy total production of PV is the same order of magnitude as common area demand which is about 10 MWh:

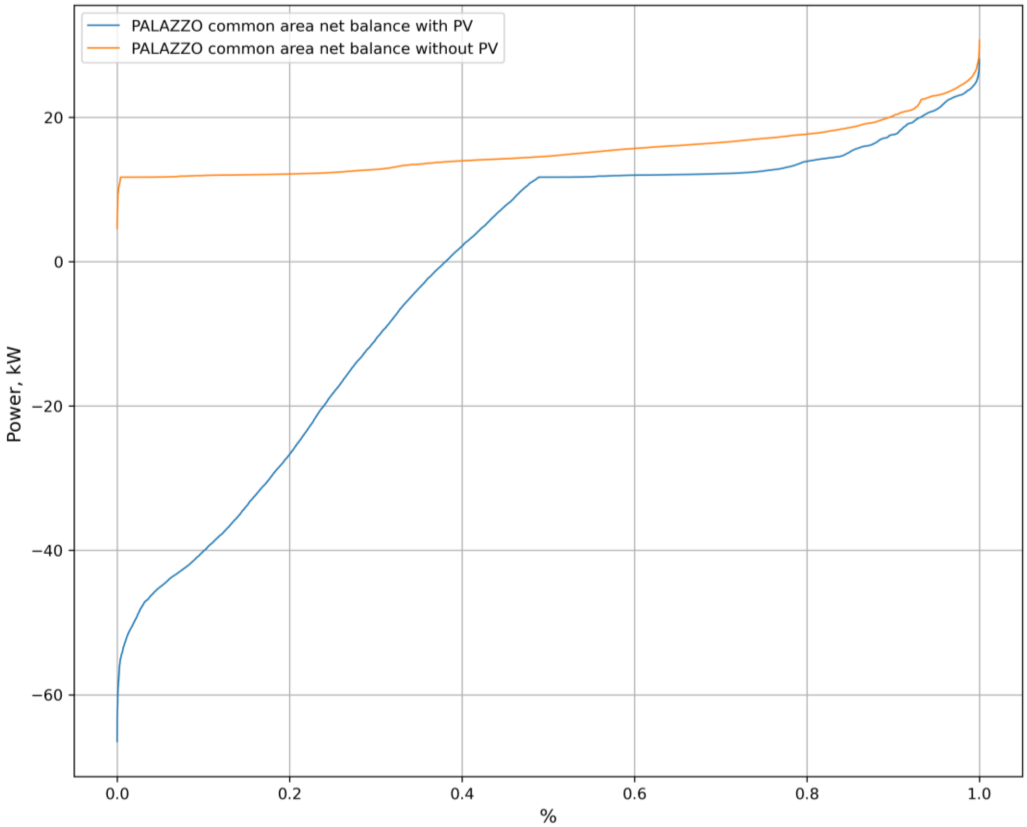
Figure 35 : Energy balance from 2021/08/01 to 2021/08/31 at PALAZZO



It means battery has a clear potential to increase self-consumption. For this month self-consumption was about 40%.

It is also interesting to note that maximum of power demand is weakly affected by self-consumption (-3 kW / 31kW) because maximum power demand is when PV production is low. It can be easily observed with a monotone graph (power data sorted and plotted by increasing value) :

Figure 36 : Monotone by minute from 2021/08/01 to 2021/08/31 at PALAZZO



2.3.2. Measure 2: Optimization of heating load curve

Expected impact:

Choice of remove inside temperature sensors : No impact of the performance expected in the case of only return network temperature if (and only if) the regulation is correctly calibrated in learning mode

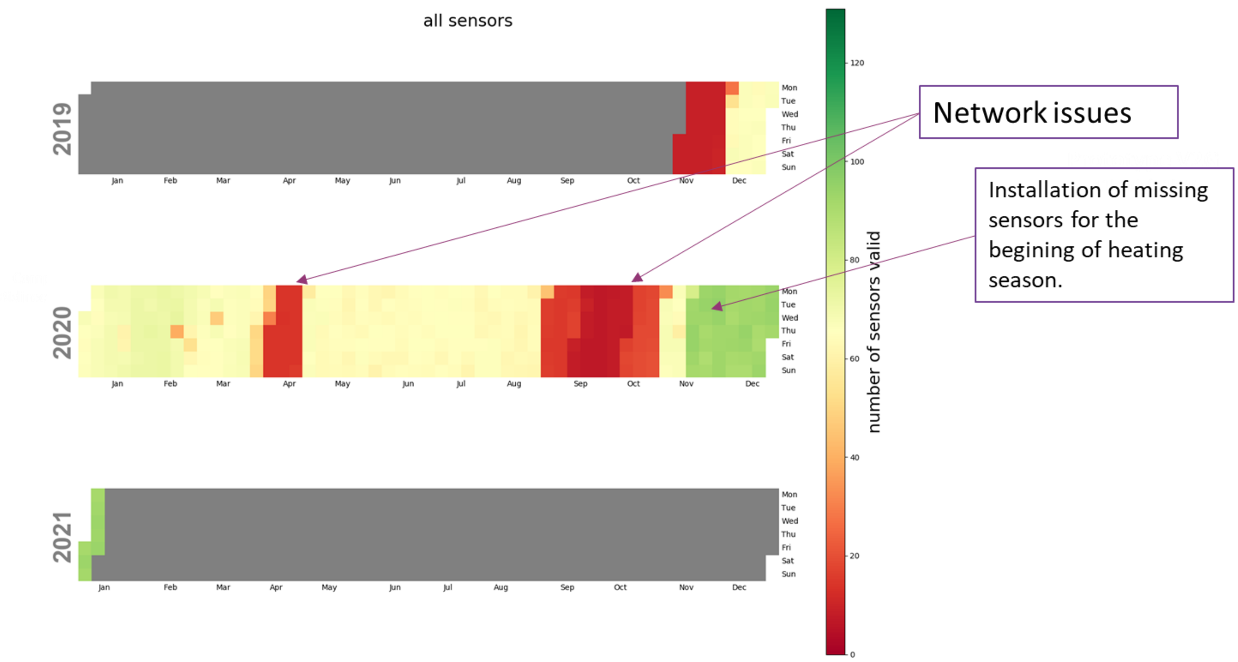
Choice of reducing inside temperature sensors : The impact will be identified in the results of solution 3

2.3.3. Measure 3: Commissioning process from the design to the operation

Setup of sensors on the two sites has been a real challenge due to pandemic restrictions. However, the whole setup has been put in place in November 2020. The Repere service 1st process which is a monitoring script that analyse the instrumentation quality has reported several issues shown in the next figure.

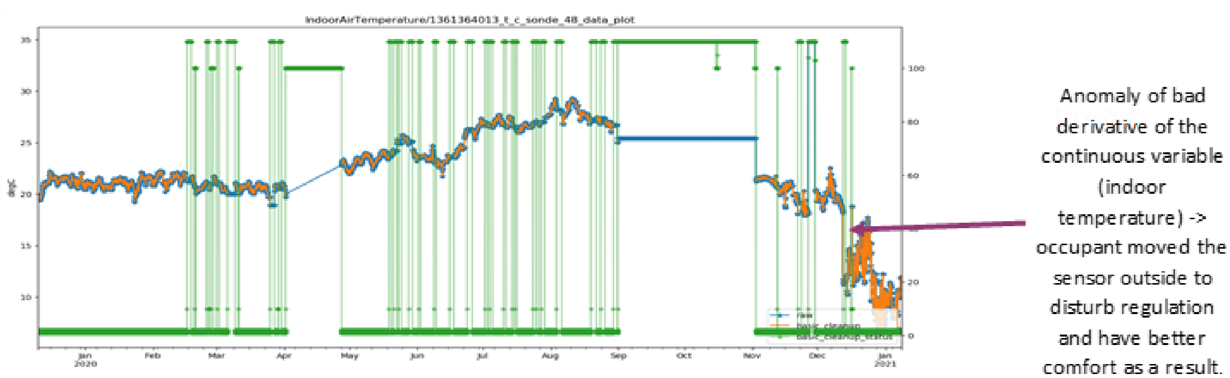
We can see mainly two periods of network issue that has affected almost all sensors in the two building, then the setup of missing sensors at the beginning of November 2020. Some sensors are still at default but after investigation many of these sensors are not necessary for the REPERE service such as water temperatures and onsite weather sensors.

Figure 37 : REPERE : global monitoring graph of sensor quality on the two sites. (number of valid sensors over time).



Algorithms of detection of other anomalies such as bad derivative helped identify suspicious behaviour where occupants were moving sensors outside to force a maximum input of heating in their housing. In the next figure we can see the event detected and the subsequent temperature serie that measure outdoor temperature instead of indoor temperature.

Figure 38 : Indoor temperature serie over a year showing an anomaly



Analysis of all these anomalies contributes to the KPI “Data loss prevention” as it evaluates data loss over time and contribute to the feedback to fix these anomalies.

2.3.4. Measure 4: Symbiotic waste heat networks

Thanks to the work done by the project team and the MedInLab staff dedicated to the project (composed of a professional graphic and web designer and innovation consultants), after having been familiarized with the whole documentation produced under the ReUseHeat project, was to retrieve end-user feedback. Attention has been put on enquiring persons not familiarized with the energy sector (non-technician employees of the company and persons from their own network as students, interns and others). This was important to have a representative sample of a generic Dashboard end-user, which targets the wider population of the inhabitants of La Seyne-sur-Mer, which might have no relation nor basic knowledge on DHCN.

As reported under ReUseHeat: “Such feedback led to the insight that the wording and explanations were yet too technical for such an audience. They expressed the need to have a “simple” explanation of the main working principles of a LT DHCN with more common words and concepts as well as the need of additional schemes and graphical elements serving as examples to support the explanation and ease comprehension.

The Dashboard’s text content, structuring and form has thus, been completely reviewed: the before defined wireframe of the MVP as by D3.5, has been completely changed and enriched in the pedagogic section with 3 additional pages, dedicated to the explication of the functioning principle of the pumping station, the network and the substations (see image below). All texts have ben simplified in terms of used language and terminology.

The addition of this 3 pages, has been done keeping in mind that this can then be enriched with further additional content in case technical innovation is integrated into the network or, in case the Dashboard is replicated on another network (Nice Grand Arenas for instance) needing different explanatory pages. So, these, can be enriched with further ones or simply be replaced.

Moreover, the design of the Dashboard has been further developed, putting attention on design choices for the appearance, structuring and integration of interactive figures, schemes and videos. The aim of such design overhaul was to achieve a higher visual quality of the Dashboard. This has also been verified with the chosen pool of end-users, which validated that the appearance of the Dashboard has been enhanced with the new layout and design.

At the time being, the design has been settled as well as the written content.”

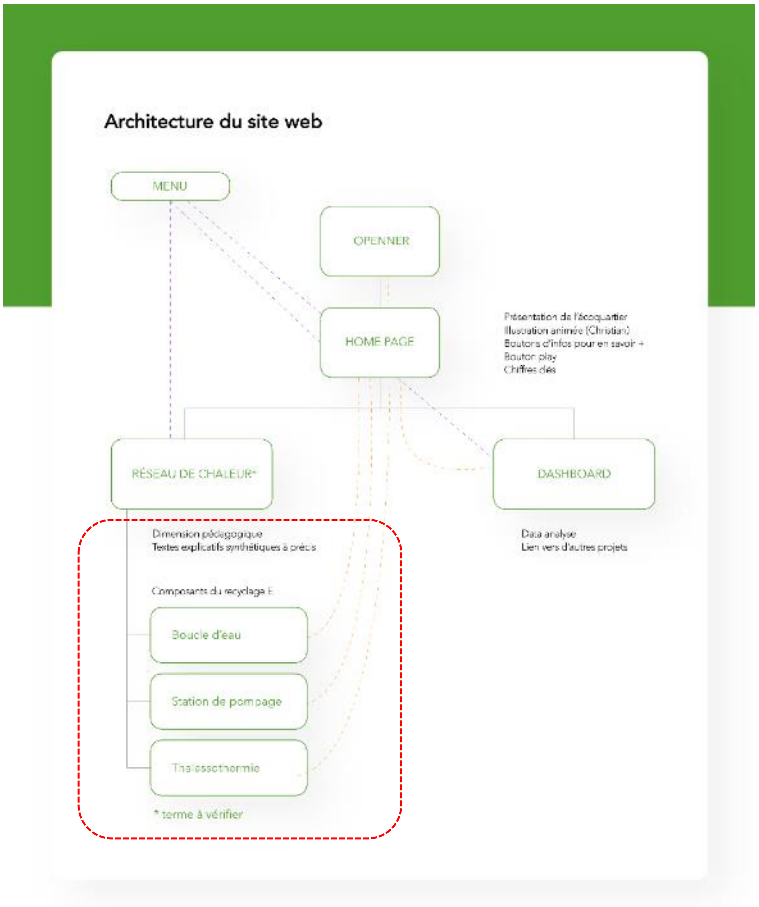
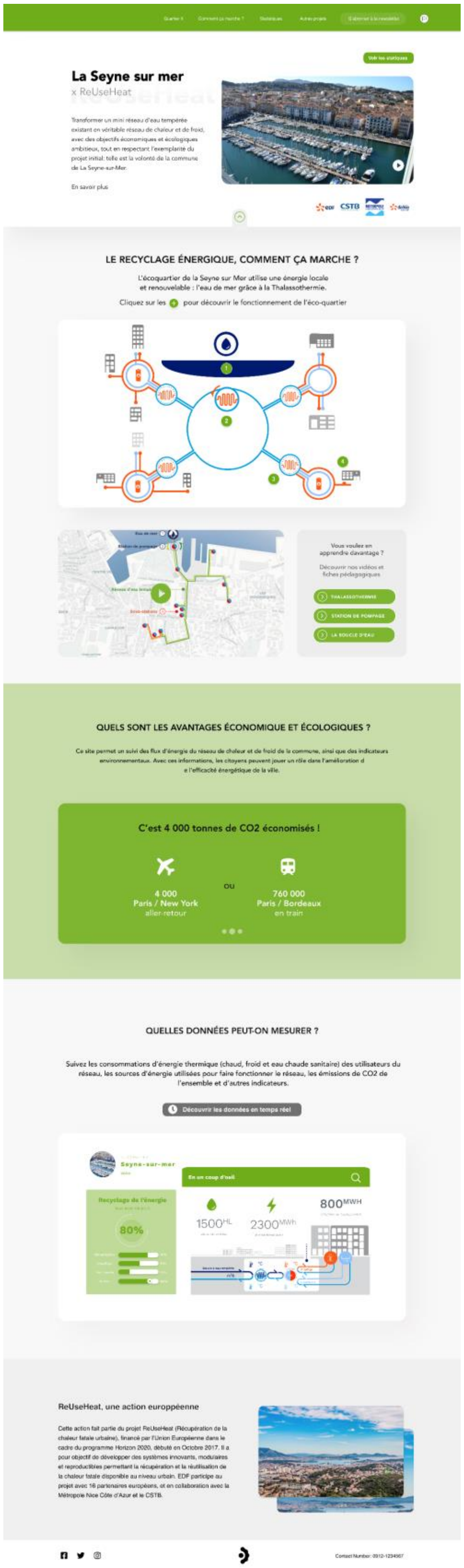


Figure 39 : enhanced wireframe model of the Dashboard. The red dotted rectangle highlight the 3 additional developed explanation pages – Nota: meanwhile a further explanatory page has been added. (Source: EDF)



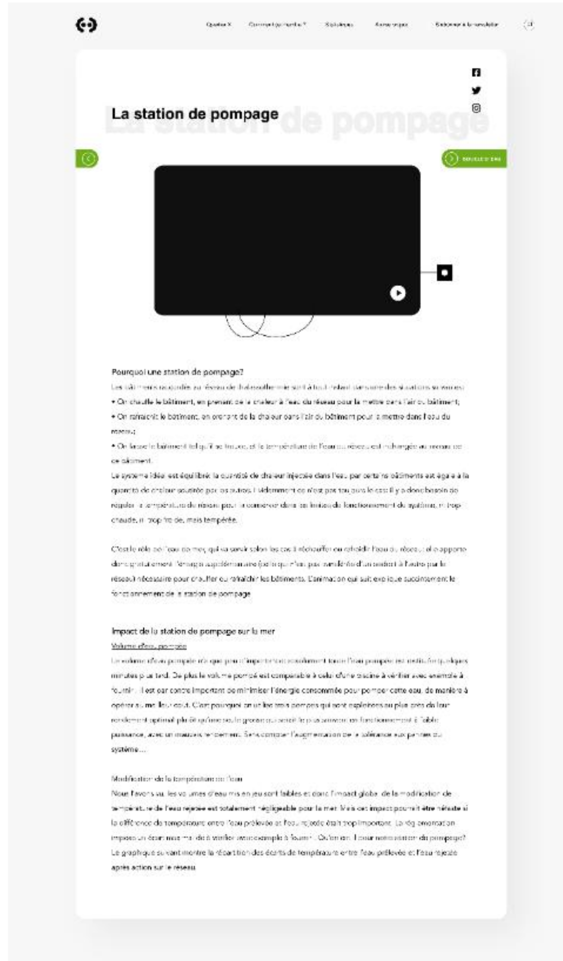


Figure 40 : new retained wireframe of the Dashboard – left: home page; right: one of the 3 newly added descriptive pages - here only the pumping station is visualized as the other pages are based on the exact same design. (Source: EDF)

2.4. Business models and exploitation

2.4.1. Measure 1: Collective self-consumption

The business model associated to self-consumption at building scale has been extensively explained in the KER (Key Exploitable Result) report. This is not repeated here.

2.4.2. Measure 3: Commissioning process from the design to the operation

Regarding measure 3, business model will be evaluated at the end of the project where we can evaluate from actors what are the end benefits of the solution for them and if the cost is viable regarding of the service provided. REPERE service is positioned as a "bankable" business model. There are several issues to be tackled regarding the viability of the business model for this service.

- Instrumentation cost is expensive for only Measure and Verification application such as REPERE service alone. In this TT, however, measurement main goal is to provide input for housing temperature regulation and is part of the technical solution evaluated. Therefore, cost of measurement is imputed to the solution and not to the Measure & Verification application which make it much more viable economically. This example advocates on finding solutions where the instrumentation has another goal than being an input of REPERE service alone to mutualize instrumentation cost. REPERE service could be deployed as an additional service to a solution that has more direct control through sensors on the energy efficiency of the building.

- A potential issue regarding the cost of REPERE is the need of engineering time to configure the service, even if a lot of the process is automated there is still engineering time to adapt REPERE service to an existing instrumentation solution with its own API and workflow. This advocates for a more integrated approach on a standardize measurement solution to fully automate the process.

- Economic value of the service provided. The evaluation of energy savings and the recommendation that are provided alongside this energy savings evaluation is hard to quantify properly now. How much a building owner is willing to pay for that information and how he will use it to reduce its energy consumption is hard to evaluate. For example, if the REPERE service conclude that energy savings can be gained by lowering temperature because they are too high in the building, maybe the owner will not be willing to trade off its occupants' comfort for energy savings and in this case the REPERE service value in terms of energy savings and economic gain will be null.

2.4.3. Measure 4: Symbiotic waste heat networks

The business model associated to the Dashboard has been extensively explained in the related deliverables of ReUseHeat and its associated KER (Key Exploitable Result). This is not repeated here.

2.5. Lessons learned and next steps

2.5.1. Measure 1: Collective self-consumption

The implementation of the two demonstrators (IMREDD/PALAZZO) was extremely interesting due to the different issues encountered during both the conception and the commissioning phases of the project.

<u>**Conception of the system:**</u>

Sizing of the BESS :
In a new building like the IMREDD one, the battery sizing is based on the theorical production and consumption of the building which does not necessarily reflect the reality of the system. (Dust on the panels due to their positioning and shadows are not considered in the theorical production, added consumption due to new equipments). These points can lead to an over-sizing or under-sizing of the storage system.

Lack of regulations regarding the safety of the technical room hosting the BESS :
Regulation for securing stationary storage systems do not currently exist in Europe. Very few people in the construction industry have a good understanding about this type of technology including firefighters. Lithium-ion could scare people when it comes to safety. But concretely, it is no more dangerous to have electric cars in your parking lot than a stationary storage battery.

Costs related to the technical room hosting the BESS :
Durring the initial techno-economical study, the cost associated to the construction and the security of the technical room dedicated to the BESS, were not taken into account. To be more exhaustive, the masonry, the fire door, the firestop ventilation valves, two redundant air conditionings, a fire detection sensor, an emergency stop outside the room to stop the battery power supply, a normal and emergency lighting, the creation of a specific electrical cabinet with dedicated breakers, a specific fire extinguisher for lithium-ion battery… Future stakeholders should pay attention to many things before starting the project.

System implementation in the technical room :
Generally, the ceiling height in the basement is limited and may not correspond to the height of on the shelf storage systems (height less than 2 meters). This was the case for IMREDD, SOCOMEC offered a tailor-made solution in order to adapt the height of its equipment to that constraints. Justifying the presence of a multitude of cabinets between the bidirectional inverter and the battery racks. It waw also necessary to raise the battery racks in order to avoid contact with water in case of flooding since the technical room is located underground.

Storage of BESS modules before the commissioning : the storage of the battery modules between the delivery and the commissioning is a very important step. Indeed, the temperature in the area must be controlled, no humidity, and a mechanical envelope to protect lithium-ion elements is needed. The installation of the modules in the racks can only be carried out by a qualified person. In the IMREDD case, modules remained on the ground for several months due to some delays in the planning.

Commissioning of the system:
Battery cycling. This step is mandatory before the final commissioning and must be done according a specific protocol given by the manufacturer.

IMREDD case :
The SOC of the battery is initially around 25% (storage and delivery initial condition).
1st stage → full discharge up to 5% (from 25% to 5%)
2nd stage → full charge of the system (from 5% to 95%)
3rd stage → full discharge (from 95% to 5%)
4th stage → charge up to 50% (from 5% to 50%)
Since the building is not fully operational, its regular consumption is relatively low around 30 kW, the battery has a charge/discharge rated power of 100kW. It will be necessary to inject a part of the energy into the distribution network to test the battery with its nominal rated power, which requires an authorization from the DSO. Another alternative is to use a resistive load bank to dissipate the excess of energy during the commissioning.

Delta of temperature between BESS modules:
If the air conditioning blows on the battery rack as illustrated in figure 42, modules on the top are going to be colder than the bottom ones. A warning appears when there is a difference of temperature between modules and when this difference goes beyond 10 ° C, the battery falls into a safety mode. Indeed, an important difference of temperature between modules implies an inhomogeneous aging of the BESS. It is imperative to pay attention to this type of constraint since, most of the time, technical rooms are small.

Figure 41 : Left /Air conditioning blowing directly on the battery – Right/Correct position

Supervision of the SOC after commissioning:
If the EMS is not functional after the commissioning of the storage system, it is necessary to upgrade the state of charge of the system manually at least once a month in order to compensate the self-discharge phenomenon.

Temperature and humidity:
The temperature and humidity in the BESS technical room must be maintained within an acceptable range, otherwise the battery will shut down. A probe is directly connected to the system in order to monitor these measurements.

As a temporary conclusion regarding the first experience on measures 1, we could say first that stakeholders like architects must pay a particular attention when studying the integration of renewable energy systems in future cities.

On the other side, end-users should not neglect and anticipate the maintenance time and cost of the implemented solutions.
Such simple recommendations could optimize the use of the energy produced locally and contribute to a better lifespan of the system.
Further results will probably lead to more precise conclusions about this kind of demonstrator.

Next step would be both in IMREDD and PALAZZO buildings to continue the experimentation and, in fine, compute KPIs with a meaningful data set.

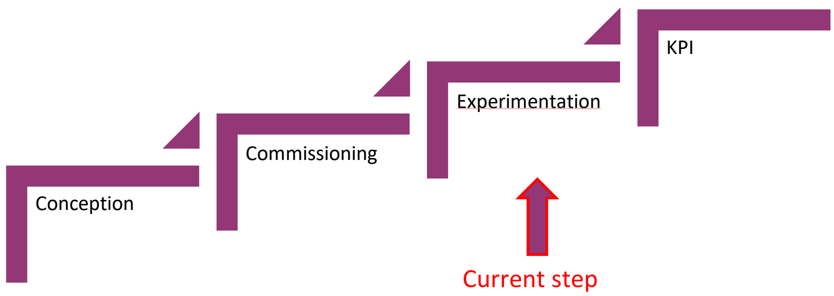


Figure 42 : Project steps and current situation

2.5.2. Measure 2: Optimization of heating load curve

The optimization of this project has been targeted as a demonstrator for the future low-income home energy assistance program. The objective is to explore a powerful yet operational methodology that could help provide a potentially viable business model and advance IoT technology from a practice perspective

2.5.3. Measure 3: Commissioning process from the design to the operation

Regarding measure 3, there are a few lessons learned from this stage of monitoring. First, there is still a certain challenge in instrumenting housing buildings with sensors especially inside housings where the occupant can be sometimes reluctant to accept this intrusion in his privacy. The difficulty of this exercise has been increased much by the ongoing pandemic, making these operations much more difficult in times of lockdown.
Second, the algorithms designed to identify technical default on sensors has found an unexpected use of detecting occupants "cheating" intentionally with sensors.
Third, even if most of the process is automated regarding the computation of sensor data, there is still some time-consuming manual engineering process to be done especially on plugging the REPERE process to the existing instrumentation solution API.

2.5.4. Measure 4: Symbiotic waste heat networks

As reported under ReUSeHeat, the main lessons learned during the described implementation phases are the followings:

- It is difficult to predict the progression of private-invested large scale projects like the Grands Arenas, where public and private actors are involved and the overall set-up is “complex” in terms of commercialisation and implementation. The project has so far cumulated 3 years of delays, and since, the negotiation between the private and public actors has caused several complete review of the project from a technical, financial or contractual point of view. Yet, a final planning is not available, whilst objective should be to have a commissioning of the system by Q3 2022.
- Human intervention in monitoring platforms is yet unavoidable and can be source of misunderstandings in terms of data management as structuring and naming. A completely automated and reliable data management system is yet far from being part of current operation practices. To open such systems towards external users, is yet bounded to the development of specific APIs, which need clear technical and functional specifications and are rather thought for being associated to “static” IT infrastructures. Changes in data naming, structuring or source, need human intervention for adaptation of algorithms and closed feedback loops among involved teams and parties, is not only unavoidable but crucial.
- Metadata and detailed mapping and descriptions are usually not much developed due to the time and resource consuming process related to such extensive documentation realization and updating, which still have to proof their interest in cost-benefit terms for a private DHCN operator.

The end-user feedback gave important feed-back on the expectation of a non-technical audience from such a tool as the Dashboard is, bringing into light the general knowledge gap of the local general public concerning DHN limiting, if not forcing to avoid, the use of technical jargon for explanations or media content which instead, has to be kept simple as imaginably possible

3. Preliminary Results of Transition Track 2

The aim of this report is to provide an easy to read report on the preliminary results of this transition track 1,5 year before the end of the project. The report is less technical compared to the previous reports. We should avoid duplicating technical content that is already found in D5.3-D5.7, D63.-D6.7 and D7.3-D7.7.

In this chapter the overview of demonstration measure implementations, preliminary results on end-user and stakeholder feedback, expected impacts and KPIs, business models and exploitable results is provided.

KEY MESSAGE
Include in the start of each Transition Track chapter a brief paragraph providing the key messages for the audience, e.g. on the key results, the key recommendations or key learnings that you would like to pass on. The key messages of each Transition Track could be used as well for the Executive Summary.

3.1. Overview

As to avoid any further misunderstandings between the nomenclature and articulation among "Measures" and "Integrated Solutions (IS)", as has happened among different Deliverables in the Project (i.e. D11.4 and D6.4), a common agreement has been achieved among involved parties (EDF, EDF S&F, AGREGIO, MNCA, IMREDD, MSE). The matter has been discussed at Project Coordination level (Utrecht, CERTH) and the following articulation applies as by Grant Agreement (section "1.4 Ambition") to TT#2:

1. **Measure 1 - Stationary storage deployment in buildings and local electric flexibility management :** corresponds to IS 2.1 and IS 2.3 respectively
2. **Measure 2 - Smart multi LEMs :** corresponds to IS 2.2

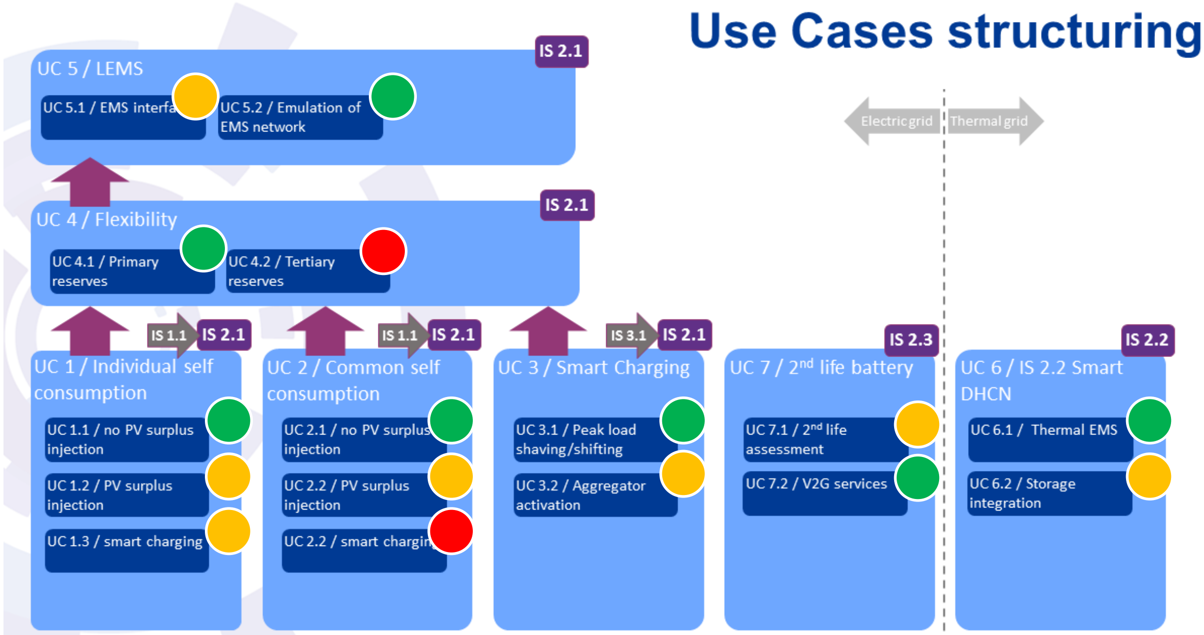


Figure 43 : schematisation of the relation and hierarchies among the chosen Use Cases and sub Use Cases as by D6.4. The scheme specifies also the relation of UC with other TTs or ISs // Green: UC is started or under operation; Orange: not yet implemented; Red: UC not pursued anymore (source: EDF)

In brief, all IS have been launched. Most are on the planned development stage whilst, a general delay up to 12 month has to be accounted for due to the delayed delivery of the related buildings and assets. In the figure below, the overview of the district is given, with the identification of Nice Meridia by the dotted line.

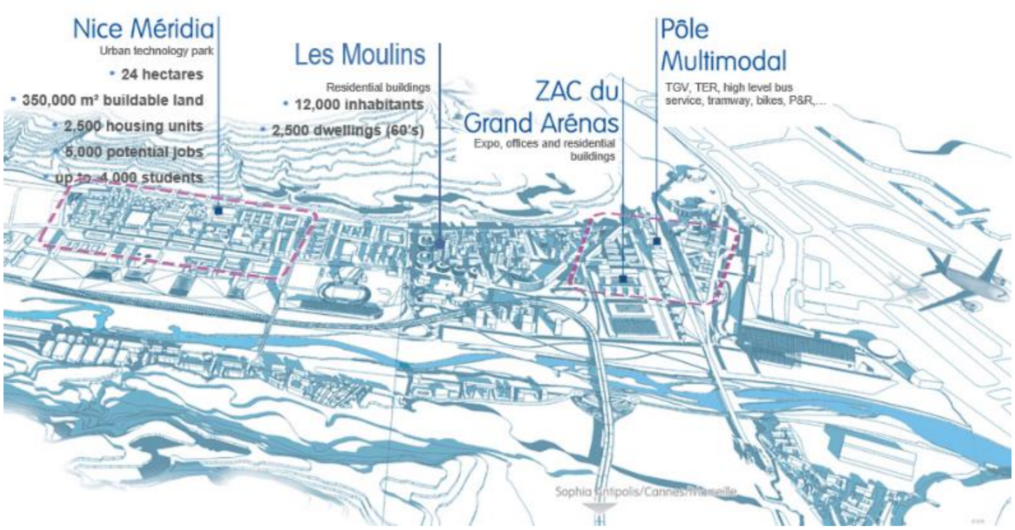


Figure 44 : Overview of the demonstration districts of Nice. Measures 1 and 2 will concentrate on Nice Meridia District – left dotted polygon (source: MNCA - modifications by EDF)

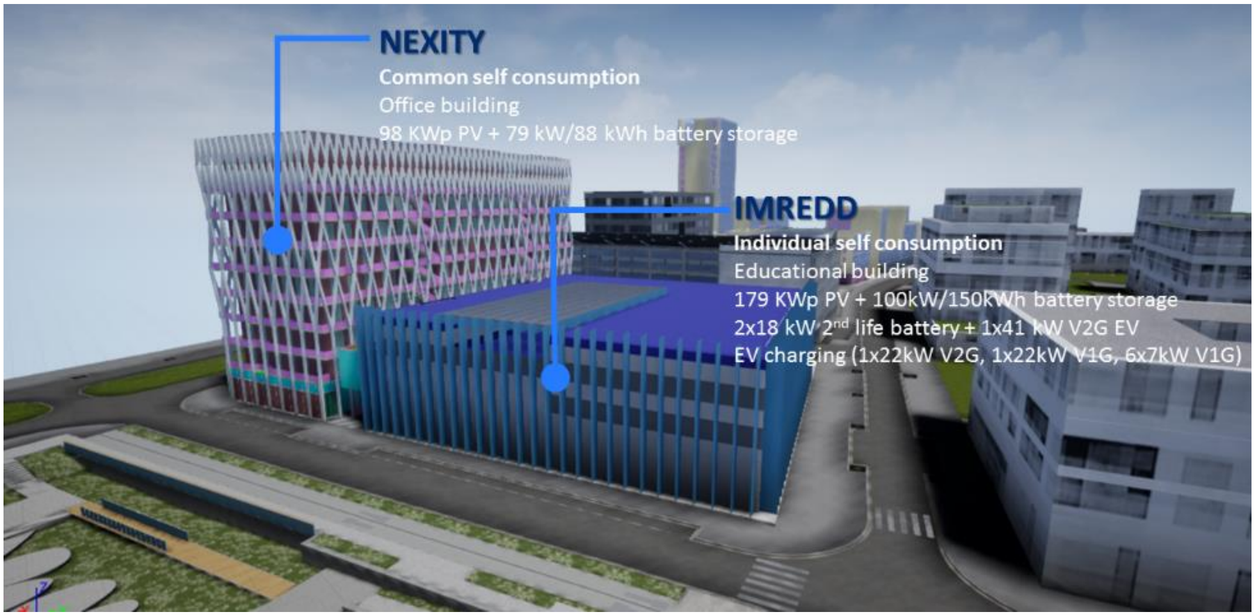


Figure 45 : rendering of the IMREDD and NEXITY case-study buildings for Measure 1 - S 2.1 and 2.3 with relevant technical details (source: UNS/IMREDD - modifications by EDF)

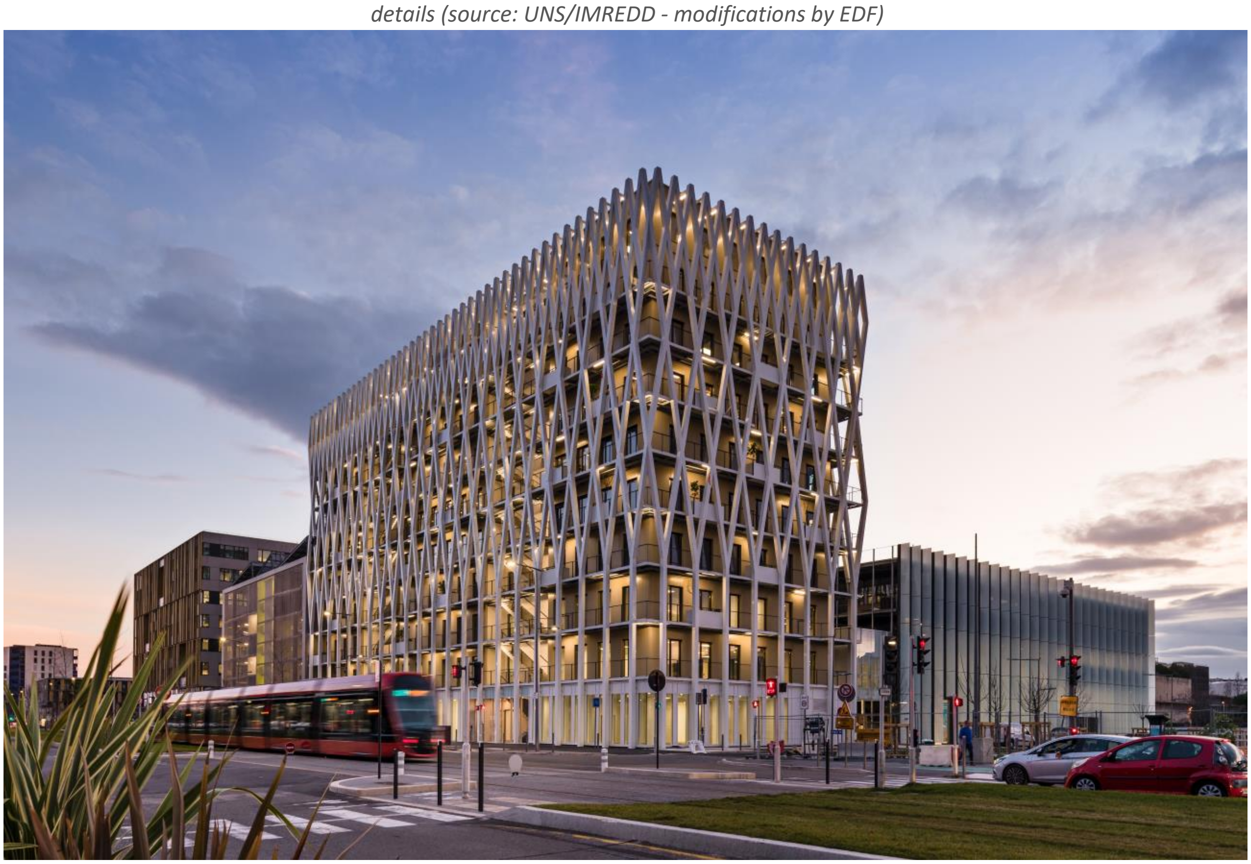


Figure 46 : photo of the NEXITY and IMREDD buildings as by 02/2020 (Photo credits : © Y. Bouvier for Nexity)

As for Measure 1, IS 2.1 is progressing as foreseen and achieved UC 1.1 and 2.1 as by Figure 43 : *schematisation of the relation and hierarchies among the chosen Use Cases and sub Use Cases as by D6.4. The scheme specifies also the relation of UC with other TTs or ISs // Green: UC is started or under operation; Orange: not yet implemented; Red: UC not pursued anymore (source: EDF)*

, so the operation of the EMSs for PV self-consumption maximisation. Both IMREDD and NEXITY buildings have yet to formalize their self-consumption scheme in order to allow surplus PV to be sold to the grid whilst all installations are operational and commissioned. EVCI is available in the IMREDD building (while its interfacing is yet encountering API issues) but not to date in the NEXITY building. Therefore, only IMREDD will integrate both BESS and EVCI monitoring and management. IS 2.3, has been started concerning the interfacing with the V2G EVCI as well as the usage of the RENAULT ZOE V2G AC. The 2nd life BESS has been delivered partially, currently two battery stacks are available on site. The corresponding BEMS and the inverters are under sourcing however, the specificity of the material and the unavailability of industrial products still delays the commissioning of the whole system.

As for Measure 2, IS 2.2 is progressing as planned and achieved UC 6.1. The current DHCN development status is as follows:

- The first buildings (including IMREDD) have been connected to the provisional heating and cooling production system and monitoring solutions.
- The DHCN will then be fully operational with the activation of the geothermal production plant. The objective of the Nice Meridia demosite is then to demonstrate that District Heating and Cooling networks can be an attractive solution, efficient, cost effective and relevant while combining heat and cool production, integrating a high share of renewable energies as geothermal coupled with heat pumps and thermal storages therefore, also supporting local renewable energy penetration into the electric grid.

Figure 47 *: left - in violet, the perimeter of the DHCN operation under the PDS contract – IMREDD and NEXITY buildings are highlighted under the red rectangle in the centre upper area (Source: EPA Plain du Var, addition by EDF); Right - planned DHCN layout and overlay of existing buildings (source: https://www.google.com/maps/d/viewer?mid=1TkVPt5Z4ZqCFmPZZu81-RcsMxyv98VwH&ll=43.680735227580634%2C7.2003187737274175&z=16)*

2018	2019-2020	2021-2022	2023-2024	2025-2026	2027-2028	> 2029
69 444 m²	106 097 m²	246 236 m²	304 131 m²	356 656 m²	447 284 m²	516 208 m²
	0,8	0,8	1,6	1,6	1,6	1,6
	2	3,2	3,4	4,3	5	5,7

Figure 48 : visualization and listing of Nice Meridia's mid-term planned connection phases. The extension of the constructed surface is highlighted in the coloured boxes (in square m² per period) and below the corresponding network length listed, divided in geothermal (line 2 in km per period) and hot/cold water (line 3 in km per period) pipelines. (Source: MNCA)

The related EMS called "hypervision" has been implemented over the connected buildings and yet to be to the production plant. It aims at providing a smart controller of the DHC production plant. This controller will define energy management strategies in order to minimise operational costs and to maximise the use of available renewable energy sources (thermal and electric). To do so, it aggregates all relevant information in real-time (measurements, predictions, etc.), computes energy management plans over a relevant prediction horizon (typically 24h), applies set points to the underlying systems, and monitors the realisation of planned operation to detect failures and deviations.

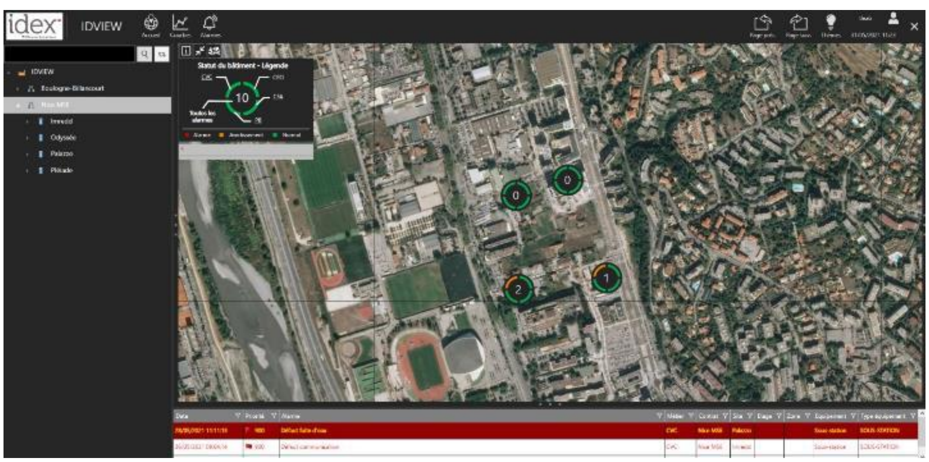


Figure 49 : Overview of the DHCN EMS ("Hypervision") (Source: MSE)

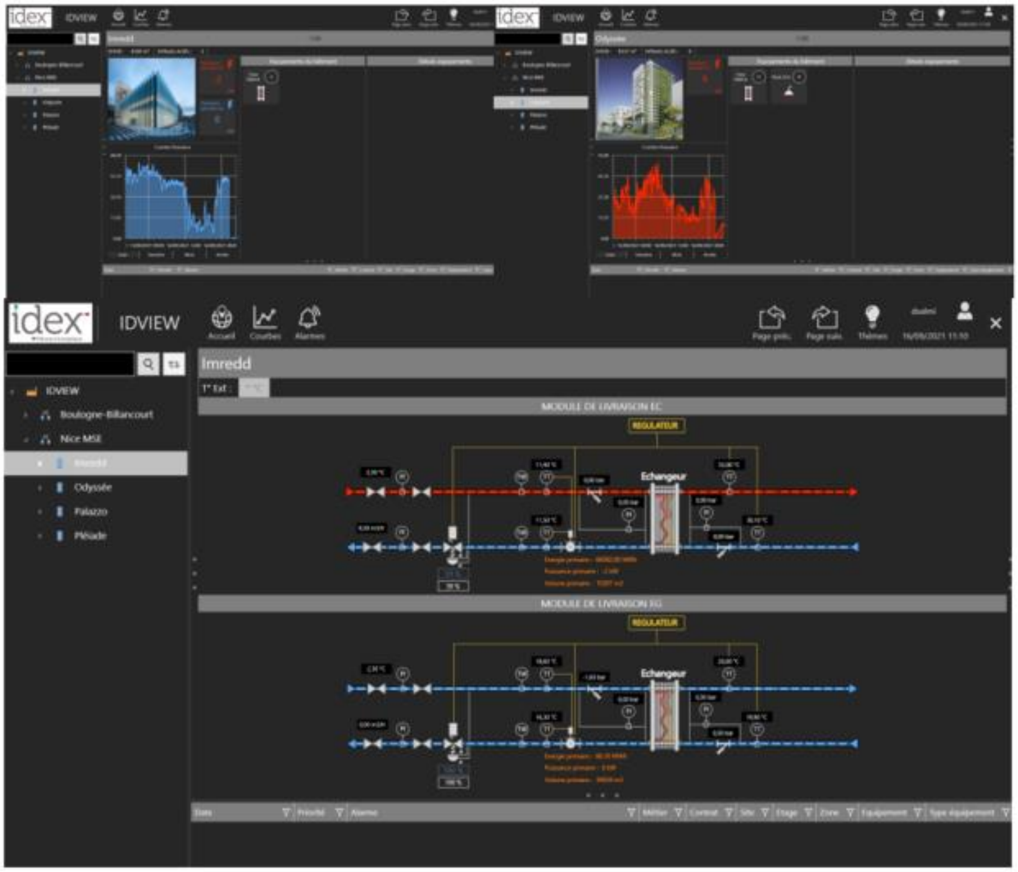


Figure 50 : Overview of the DHCN EMS ("Hypervision") supervising connected building. (Source: MSE)

3.2. Implementations

Measure 1

The summary of the status of the planned implementations as for Measure 1 – IS 2.1 (as by D6.4), are summarized in the figures below. The EMS's PC-stack has been in place since Q4 2020 and after first tests in Q1 2021, the EMS and SCADA have been commissioned in April 2021. The operation mode put in place, at the time being, concerns the maximization of PV self-consumption while waiting for the PV system to be regularized and allowed to sell PV to the grid and start so the next sub-UC (UC 1.2 and 2.2 respectively as by D6.4). PV forecast is not active yet and should happen in Q3 2021, while tests for the controlling of the PV inverters' power output on the IMREDD building are pending. Current BESS' cycling focuses on optimizing daily charging and discharging cycles, to ameliorate the SOH and life-expectancy of a BESS. The EMS updates are done remotely.

Figure 51 : EMS hardware at IMREDD (Source: IMREDD)

The interface development between EDF S&F's EMS and AGREGIO's platform is almost complete, needing yet to update the API in order to synchronize communication among the platforms and first virtual test should be performed in Q3 2021 on the IMREDD building (sub-UC 4.1 as by D6.4). If those are successful, real test could start in Q4 2021, to ensure the communication chain from aggregation platform, via the EMS down to the BESS works properly and expand the work on the NEXITY building.

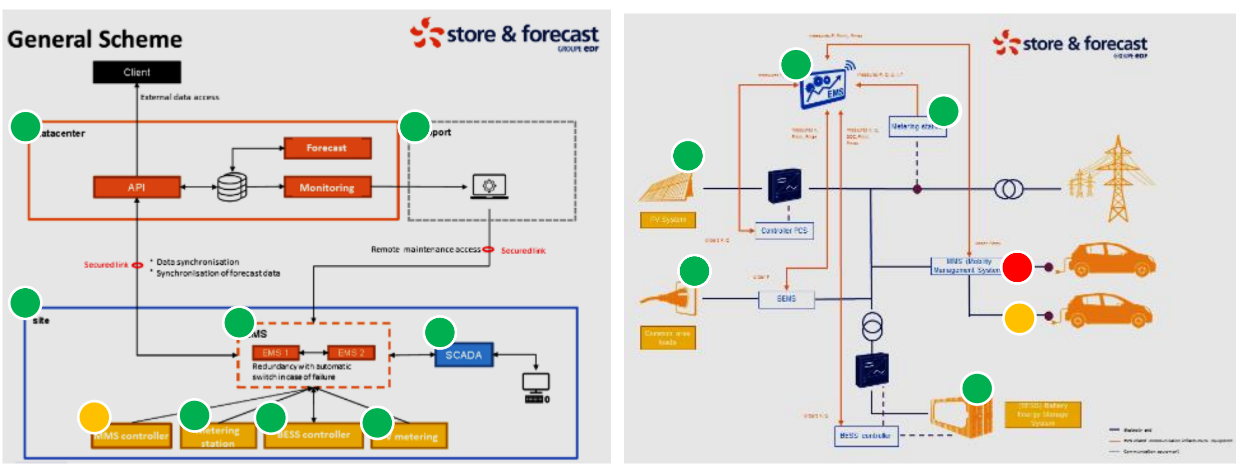


Figure 52 : IMREDD building // Left : overall EMS system conception as by D6.4 and as delivered today – "orange" flagged MMS controller: interfacing with V2G EVCI is yet not possible due to API problems // Right: overall communication and control infrastructure conception as D6.4 and as implemented today – "Red" flagged EVCI – the currently installed Mobility Management System does not allow any information exchange with any third party system, so neither the EMS (Source: EDF – EDF S&F)

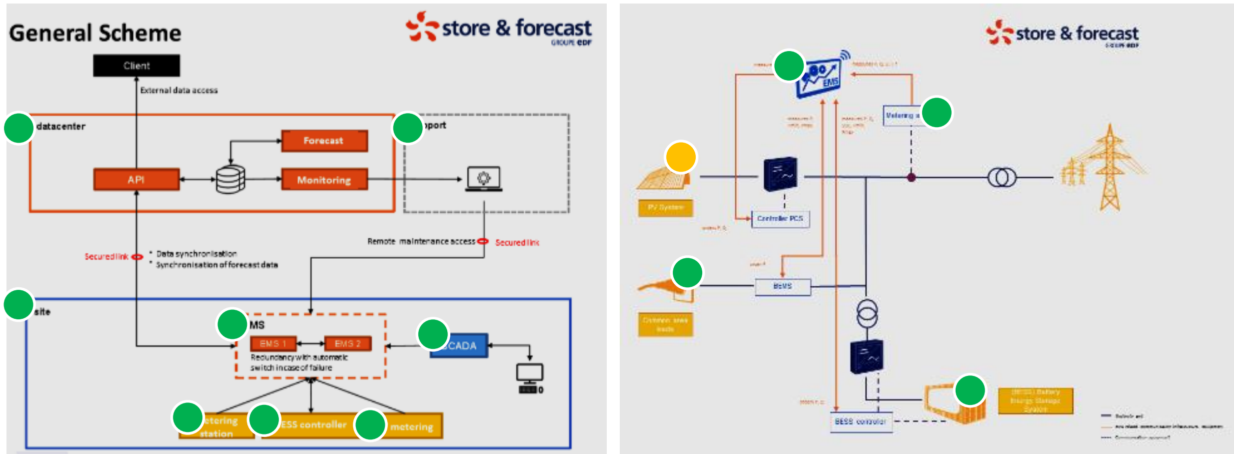


Figure 53 : NEXITY building // Left : overall EMS system conception as by D6.4 and as delivered today // Right: overall communication and control infrastructure conception as D6.4 and as implemented today – "Orange" flagged PV system – the installed converters can be metered and are connected to the EMS, but do not allow external orders making the PV system not controllable (Source: EDF – EDF S&F)

Implementation: the example of a tailor-made SCADA for the IMREDD energy management system

The optimization of energy systems relies mostly on the energy management system that is going to host algorithms used for the implementation of the different scenarios. Such systems require a monitoring interface or SCADA, allowing a supervision of the building.

For the sake of the IRIS project, IMREDD, EDF and EDF S&F worked together in order to create a human machine interface that could fit all scenarios that have to be implemented during the lifetime of the experimentation and beyond. A strong interaction between both IMREDD and EDF S&F engineering team, lead to a first prototype described in the coming paragraph.

The main page of the SCADA, as in the figure below, allows the user to have a global vision of the system in real time, especially regarding the power flow between load, BESS and RES. By clicking on different tags, users can visualise a lot of information like the weather condition or the scenario currently used. The setup of all the system is available and alarms are also monitored.

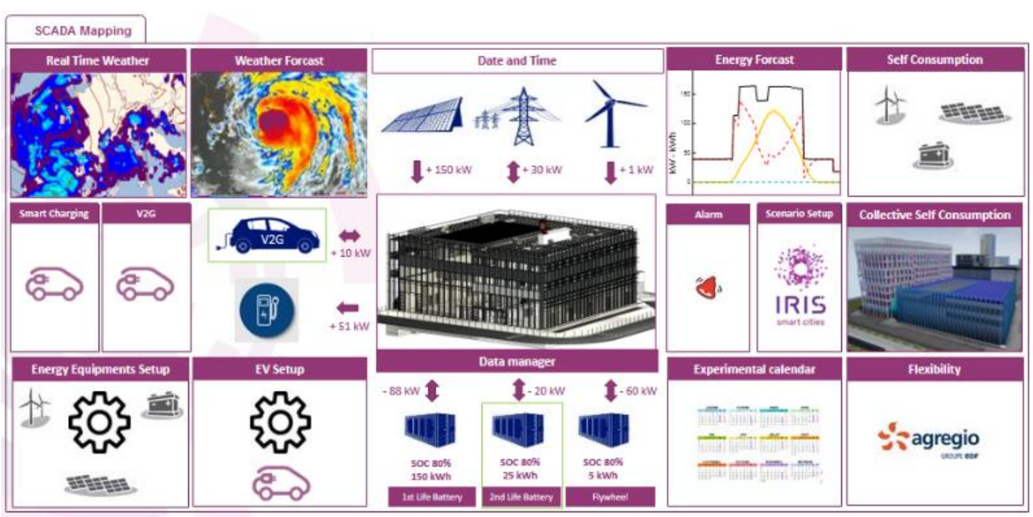


Figure 54 : Main page of the SCADA system project developed by EDF S&F and IMREDD (Source: IMREDD)

Since meteorological conditions are a crucial input when it comes to forecast and optimize the energy in a building, it seems reasonable to have a monitoring both on the real time weather and on the forecasted one.

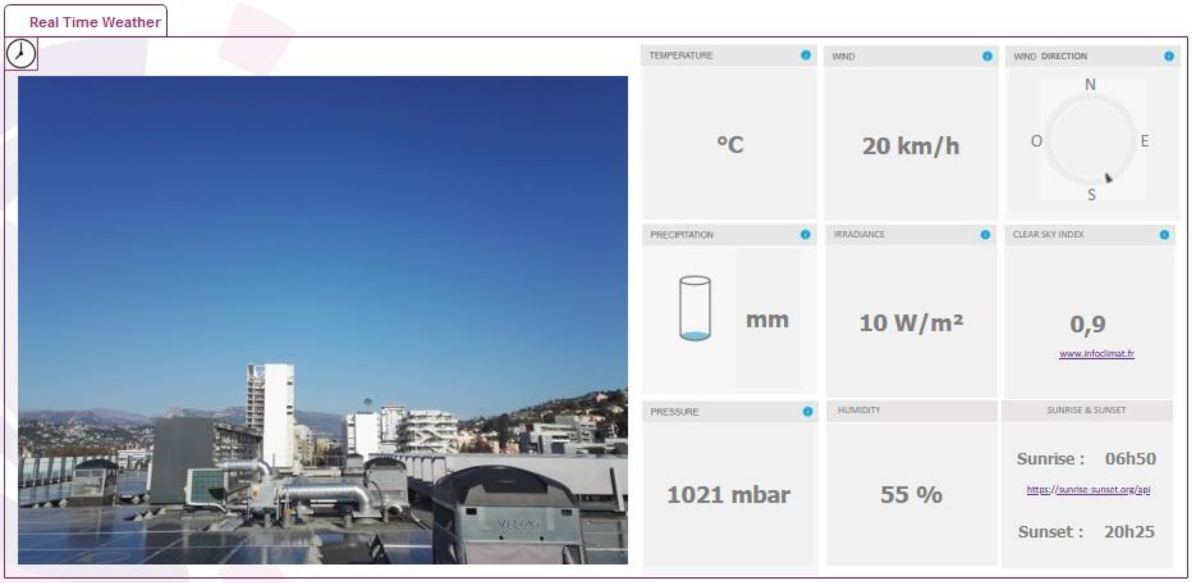


Figure 55 : Real time weather page of the SCADA system project developed by EDF S&F and IMREDD (Source: IMREDD)

The first scenario that is currently implemented at IMREDD, tries to maximize the self-consumption of the photovoltaic energy produced locally. Figure 56 : Self-consumption page of the SCADA system project developed by EDF S&F and IMREDD (Source: IMREDD)

presents a visualization of the cumulated energy generated, through indicators but also shows the real time power flow through curves. The screen can be refreshed according to the time scale chosen by the user. Self-consumption rate and Self-production rate are, in this use case, the main indicators reflecting the performance of the system. The information related to the BESS used during the experimentation like its real time SOC, is available.

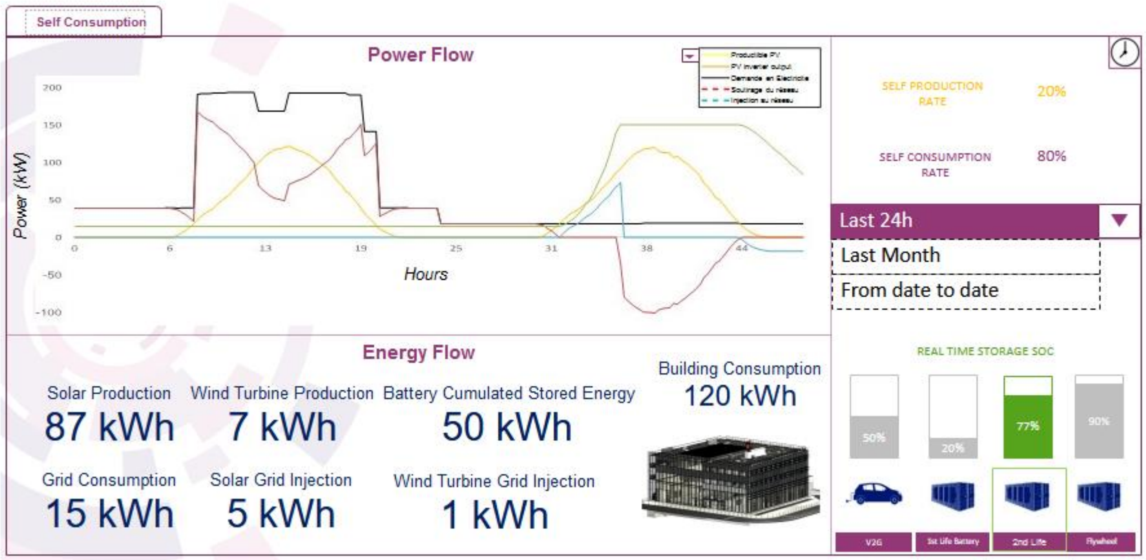


Figure 56 : Self-consumption page of the SCADA system project developed by EDF S&F and IMREDD (Source: IMREDD)

Different energy storages or energy sources are available at IMREDD. Users can select in the setup (Figure 57 : Setup page of the SCADA system project developed by EDF S&F and IMREDD (Source: IMREDD)

), the storage that will be used for the experimentation. Since all the electricity produced on site can't be stored or directly used by the building, it is possible to inject or not the PV surplus on the network just as indicated by the option selected on the screen. Further developments about Electric vehicles are planned but are not within the IRIS scope. A real example of the SCADA is presented in the coming preliminary results.

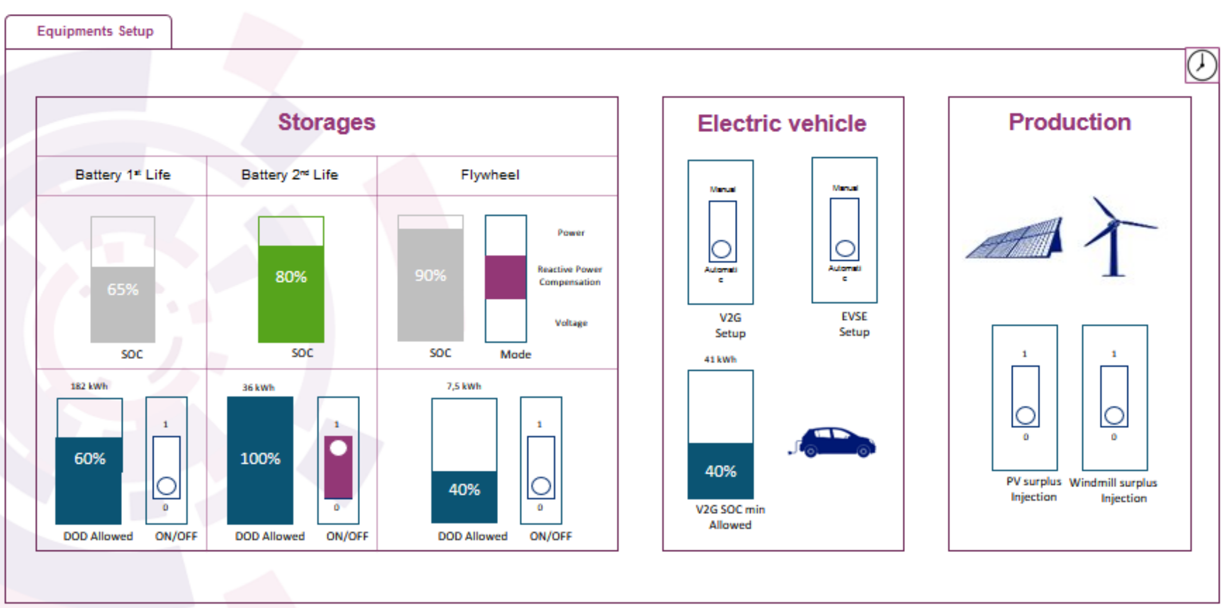


Figure 57 : Setup page of the SCADA system project developed by EDF S&F and IMREDD (Source: IMREDD)

Measure 2

Implementation : development of the DHCN working as a multi-energy Smartgrid providing the Nice Meridia demosite with a high share of renewable energies

The DHCN development have seen some major breakthroughs these past months:

- The 12 geothermal wells have been achieved
- All the DHCN distribution pipes have been laid considering the buildings yet to be built and connected over the 15 coming years
- 4 buildings (including IMREDD) have been connected to the provisional heating and cooling production system and 3 more will come by the end of 2021 (the DHCN will by then be in its final configuration connected to the geothermal energy production station)
- The energy station (including the 5 thermo-frigorific pumps of 6.5 MW and heat 5.7 MW cool, a positive chiller of 2 MW, an ice storage system, and a negative “bi –regime” chiller of 850 kW dedicated to ice storage) is operational and will be activated by the end of September 2021 (M49). The DHCN will then be fully operational.

Figure 58 : Heating and cooling production systems implementation (Source: MSE)

Figure 59 : He Geothermal well chamber (Source: MSE)

Figure 60 : Time-lapse following the construction of DHCN energy production plant (Source: MSE)

Implementation: development of energy storage opportunities

The complexity of the operation of Nice Merida DHCN supervision will increase by the integration of energy storage yet to come by March 2022. The site could provide 3 types of storage opportunities designed, implemented and operated by MSE at a district level:

- Centralised ice-storage: by storing cooling energy under the form of ice, the storage could be operated in a peak-shaving mode, so charging at low demand period as at nigh time and discharge the stored energy during peak hours. The systems implemented and which will be activated with the production plant by the end of September 2021 resumes 140 m^3 to deliver 7 MWh.
- Innovative heat storage: the design of the PCM large scale heat storage located in the heat and cold production plant has been completed in August 2021. The system that has been designed resumes a 600 kW peak power on discharge with a 1.2 MWh energy. It uses use high performance bio-sourced PCM with low melting temperature (considering the DHCN temperature range

35/65°C). Its implementation (including a smart well energy level measurement with reporting and control from the district multi energy supervision) will be completed by March 2022.

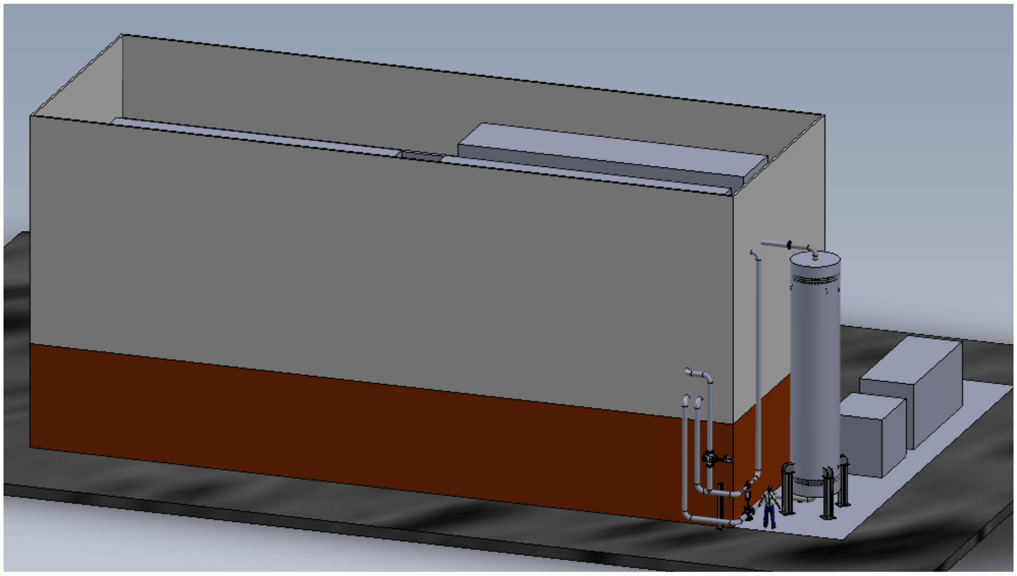


Figure 61 : PCM heat storage integration foreseen within the production plant (Source : MSE)

- Centralized 2nd life electric battery : the DHCN operation team currently considers the opportunity of implementing a 1.2 MW (616 kWh energy) 2nd life electric battery used in a previous nearby location (Iles Sainte Marguerite by Cannes). This battery is planned to be installed at the production site by March 2022 to provide electrical energy services to the production plant and nearby buildings within Nice Meridia.

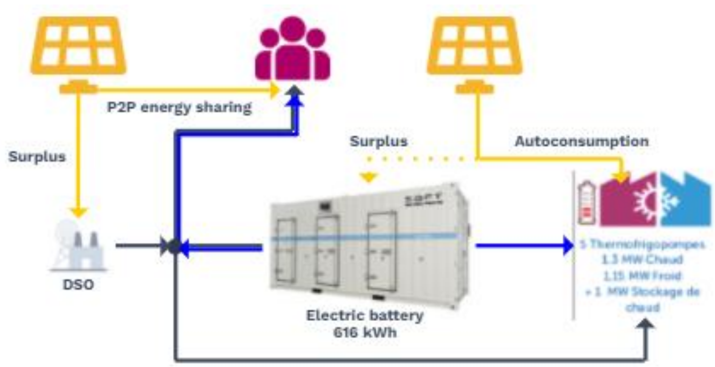


Figure 62 : Possible integration & use cas of the 2nd life centralized electric battery (Source: MSE)

All these storage assets should eventually allow the DHCN to get a 3-hour global autonomy (that could be valorised upon a local flexibility markets) allowing an estimated heat and cold peak shedding of 20% to 25%.

Implementation: Multi energy networks modelling, simulation and operational optimization tools

The multi energy supervision algorithms are currently trained on a first pool of customers, towards optimizing the thermal production and the network's hydraulic balance. Pumps and operating system (Heat Pumps – HP) are electrical grid clients and consumers. Consequently, they could provide by themselves flexibility to be integrated into the MSE supervision system.

The current demonstration aims at assessing the potential convergence of operational strategies for integrating the management of heating, cooling and power at district scale, thanks to the supervision system to be deployed over the DHCN:

- *Data platform & Optimisation algorithms:* a data platform collecting, aggregating, storing and communicating (while respecting data protection regulation) all local district data (consumptions, uses, productions, etc.) has been implemented. This data platform connection to the Nice City Data Platform is ongoing. From the monitored data collected by MSE from its assets and from all the local actors (buildings properties, landlords, Nice City, local energy services companies…), we will support the post-treatment and analysis of the data to turn it into KPIs indicators. An evaluation of the smart controller performances will so be realised all along the monitoring period. Evaluation of the numerical model accuracy will be done in parallel. The first results obtained will provide advises for the optimisation of the management algorithms, and measures for the improvement of the whole system performances. In particular, with the support of the numerical simulator, an evaluation of a model-predictive control based on MILP (Multi Integer Linear Programming) approach will be compared to the smart controller implemented to evaluate its interest.
- *Simulation & modelling (numerical twin):* a dynamic model of the local Nice Meridia DHCN has been designed. In parallel, the control platform ("hypervision") which will support the local smart controller over the DHCN has been implemented. In a second step, we will test and evaluate the smart controller proposed in the first place on the annual simulation platform thanks to the dynamic model developed. Different kind of scenario and possibly control strategies will be investigated and sensibility studies will support the evaluation of the smart controller. In a third step, from the results obtains, pre optimisation on the control algorithms can be performed with iterative processes.
- *Smart controller ("hypervision") implementation:* after validation and pre-optimization of the smart controller, its implementation has been performed on the local DH at block scale. A one year monitoring of the smart controller (starting from the activation of the production plant in September 2021) will be realized to evaluate its performance regarding the KPIs defined in WP2.

3.3. Preliminary results

Main result for Measure 1 is the launching of real-life demonstration activities on IS 2.1 and 2.3. In IS 2.1, both EMS are operational, data have been started to be streamed since April 2021 and monitoring is ongoing. The EMS's SCADA system streams monitored data accordingly.

Nevertheless, the road to the systems' commissioning what not easy at all: being a transversal task, the PV+BESS and the related ICT endowment, have seen misunderstandings in roles and responsibilities among addressed construction-task. Additional work coordination was necessary among different engineering and construction companies and high reactivity of involved partners were key to the successful implementation.

Still missing, are the registration of the PV systems as self-consumption endeavours in order to enable PV surplus injection to be sold. Here the chosen UC approach for IS 2.1 has proven appropriated and effective towards the needed steps to be undertaken for the EMS operation and development.

Regarding IS 2.3, the yet missing availability on the market of "standard" components for 2nd life BESS, demonstrates the early development stage of such technology. The sourcing and commissioning phase have been delayed due to the encountered difficulties to find adequate material, and experienced companies, for the needed BEMS (and power electronics) and inverter.

Figure 63 : IS 2.3, 2nd life batteries from Renault Kangoo and V2G prototype (Source: IMREDD)

Experience feedback: the example of the daily charging and discharging optimization cycles

When it comes to maximize the self-consumption of a building, a common and intuitive strategy for the EMS is to charge/discharge the BESS with the maximum power available. This strategy doesn't consider the ageing of the BESS. Indeed, the lifespan of the storage is strongly correlated to the number of charge/discharges cycles but also to the C-rate. The C-rate indicates literally how fast the battery is filled or discharged. One could consider that the lowest is the C-rate, the longer will be the lifespan of the storage.

EDF S&F algorithm focuses on both maximizing the self-consumption rate and optimizing the daily charging/discharging cycles, to ameliorate the SOH and life-expectancy of a BESS.

An illustration of this approach is shown in Figure 64 : Screenshots of the implemented SCADA system developed by EDF S&F for the IMREDD case (Source: IMREDD)

. The 104.1 kW from the PV installation is shared between the consumption of the building, the charge of the battery and the injection into the electrical network. The battery inverter has a 100 kW nominal power capacity. The charging power is, in this case, equal to 19.6 kW and the injection to the grid is equal to 50.39 kW. Instead of giving this amount of electricity to the DSO, it could be possible to charge the battery with an equivalent power of 69.99 kW (19.6 + 50.39) but it would not be necessarily SOH friendly and optimal over a day. In fact, it will depend on the daily PV production and building consumption forecast. Such strategy could enhance the use of lithium-ion batteries in future smart grids.

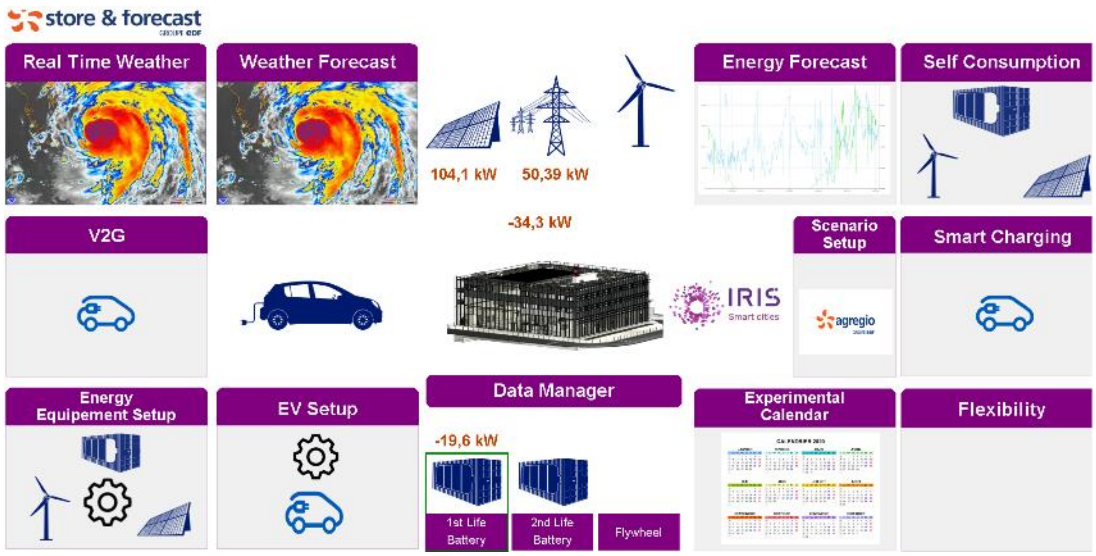


Figure 64 : Screenshots of the implemented SCADA system developed by EDF S&F for the IMREDD case (Source: IMREDD)

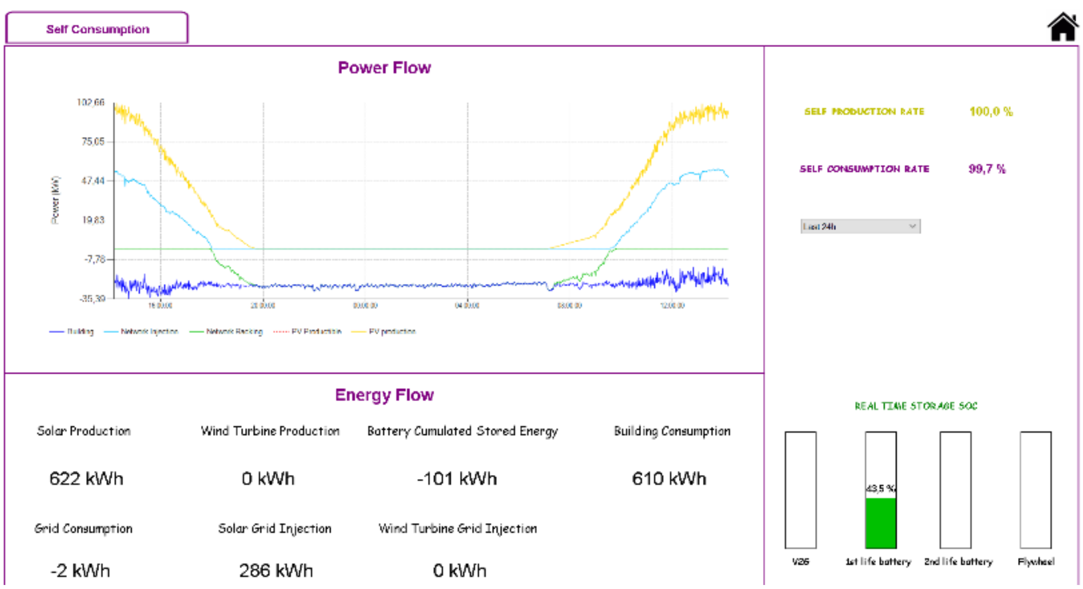


Figure 65 : Screenshots of the implemented SCADA system developed by EDF S&F for the IMREDD case (Source: IMREDD)

Concerning Measure 2, preliminary results are yet to come following the implementation of the production plant in September 2021 and the integration of the “Hypervision” including the local DHCN smart controller. Results significant analysis could be provided after a 6 month to one year monitoring and smart controller optimization.

3.4. Business models and exploitation

3.4.1. Business model canvas – Measure 1

Key Partners

- organizations within the EDF Group (LTP to EDF)
- real-estate and construction companies
- building owners or association
- engineering companies
- operation companies
- public entities

Key Activities

- The activity is directly linked to the willingness of customers to integrate renewable energy sources in the actual context of energy transition
- Distribution channels are developed within EDF group and its subsidiaries
- The revenue stream will be generated in a near future by the activation of flexibility services via a BESS in the tertiary sector under operation conditions, in addition to the EMS and BESS O&M services.

Value Proposition

- Expertise and dedicated companies on the whole value chain > ability to accompany the client on all phases
- Reduction of overall system sizing thanks to operational performances
- Security of service supply and quality – data and evidence driven
- Make PV+BESS systems viable under current market conditions, thanks to a valorisation service offered, coupling PV+BESS+EMS O&M with flexibility services via an Aggregator. Respective platforms will be able to communicate and exchange information and orders, providing a seamless service to the customer.

Customer Relationships

- The service commercialization will lean on the existing network and channels of the EDF Group.
- The service will have most probably be developed on both public or private tendering market and direct B2B commercialization.
- Due to the diversity and complexity of building projects, contractual forms will have to be addressed on a case-by-case manner, depending on the Group’s perimeter of implication and project stage/maturity.
- The service will come in addition to the existing service portfolio addressed to clients, with the (hopefully validated) promise to make PV+BESS integration economically viable.

Customer Segments

- Client is an owner, constructor/developer or operator of any tertiary sector building: offices, education, and commerce.
- He has strong environmental ambitions and is not against investing in a PV+BESS system.
- He has or will launch a tendering procedure related to his real-estate project (independently if green- or brown-field project).

Key Resources

- All key resources are entailed in the EDF Group, from commercial staff, advanced data analytics engineering to exploitation personnel.
- ICT infrastructure is adapted accordingly (EMS + Aggregation platforms)
- Integration of the service in the offer-list of commercial staff and the related “training” for correctly setting up and negotiating commercial propositions
- Billing via existing means.

Channels

- The Group can leverage from its existing commercialization and communication channels, addressing real-estate related clients as principal customer.
- Evidence and data based communication.
- Public and private tendering will have to be screened and used to develop and push the offer to the market.

Cost structure

- The biggest costs are on the CAPEX side, for investing in the PV and BESS.
- The overall exploitation service, mostly linked to the O&M of the system and licensing of the EMS and Aggregation, will have to be in accordance with the revenue streams that can be created by their operation, so to have at least, a win-win solution for the involved parties - reach an acceptable IRR for the contract’s or assets’ life-time.

Revenue streams

- The revenue streams for the company are mostly related to engineering and O&M fees (also for licensing of the EMS+aggregation system)
- Additional revenues generated by the aggregator, will have to be split among involved parties.
- Particular attention has to be paid in case EPC (Energy performance Contracting) model is adopted in the exploitation phase, as revenues will be more or less directly related to the exploitation performances of the system or parts of it. This service has thus to be accounted for and integrated in the contract accordingly.

Bankable business model

- The business model is believed to be bankable nevertheless, the demonstration has to be attended to better evaluate the order of magnitude of the savings/revenues that can be achieved for the customer.

Recommendations to cities that want to replicate this result

List the most important factors to enhance replicability

- Develop a low-carbon energy system strategy for their territory, with a focus on three main aspects:
    - availability and accessibility of local RES for energy production at building level (PV mostly) and assess the interest of constraining building projects to adopt minimal requirements in terms of RES share > BESS are only of interest if PV or other variable RES are integrated in the system in a considerable manner.
    - Integrate the notion of RES based low to neutral temperature district heating and cooling networks, so with heating/cooling assets (Heat Pumps) located at building level > expand

the possibility of a DHCN operator to offer building O&M services in link with the network and thus, leverage from bi-later energy storage/production means.
  - Integrate in the strategy that the existing market for energy flexibility is yet constrained in the TSO level > avoid to address a local level, which will most probably not enable a viable BM to any involved party. Instead, ensure tendering integrate as requirement that consortia have to entail aggregators (registered ones) in case BESS are through to be deployed.
- Develop the dedicated tendering on their own building stock, identifying "forerunner building" which can become a reference for the industry and thus, favour the adoption of the technology/solutions.

How can your company support cities wanting to replicate this solution?

- Dedicated WS and communication and dissemination campaign
- Participation to call for tenders
- Integrate service in commercial offers of the EDF Group and integration in its common network and channels.

3.5. Lessons learned and next steps

TT#2 is started successfully whilst delayed, mostly due to the imposed work-restrictions concerning COVID-19. Demonstration has started since April 2021 for Measure 1 and will fully start in September 2021 (with the activation of the DHCN energy production station) for Measure 2.

Measure 1

The articulation of the IS 2.1 and 2.3 in UC and sub-UC has proven to be effective at this project stage. More in particular the articulation of IS 2.1 in UC 1 and 2 enables to develop the demonstration whilst the commissioning of the self-consumption endeavours progress. In IS 2.1, the systems have been implemented as planned and only minor deviations apply, impacting the operation via the EMS. Data consistency and quality is yet under analysis, as communication among the different metering/monitoring platforms is punctually experiencing problems, as usual in the first exploitation months. The SCADA are operational and in the IMREDD building, thanks to the project specific developments, it has been integrated in the overall exposition area opening the data to users and visitors alike. Once the commissioning of the buildings complete, new operation modes of the EMS will be implemented, according to the planned UC. By end of the year, first test will be started for testing the EMS and aggregator platform interfacing.

In IS 2.3, the developments have started on both UC. Whilst the V2G EVCI and EV are commissioned and operational, the 2nd life-battery stacks have also been delivered, but sourcing from the market of the needed inverter and BEMS have been proven to be hard: no "off the shelf" solutions are available for these type of systems and providers are limited, indicating the still early market development stage. Concerning the V2G experimentation, IMREDD is still working on the interfacing of the EVCI and enable to access the charging point remotely via the extended OCPP protocol. As next step, both 2nd life BESS and V2G system, should be integrated in the SCADA system of the EMS and also develop dedicated operation modes to be tested accordingly. Flexibility availability and battery degradation will be the main results expected.

What the so far work has shown, as also highlighted in the Key Barriers as in D2.1, are the following factors:

- *BESS solutions – knowledge and regulatory gap*
  - The overall level of knowledge on system design, delivery and operation of BESS, in the tertiary and residential sector, is limited and solution didn't reached significant enough market penetration. Knowledge about technical, permitting and regulatory constraints is limited to a very few "insider" companies, having implemented first R&D/industrial demonstrators and official guidance for residential and tertiary buildings is missing, more particularly for fire-safety requirements.
  - The support of EDF and EDF S&F in this regards, have here been key for not delaying further works and commissioning.
- *Limited common self-consumption/P2P market/No DSO level market*
  - Given the current absence of a DSO level market and the current public and private electric system design and operation practices (concerning provision security and service quality), little incentive is left to pro-sumers to organise for trading and exchanges of RES electricity (PV) at the local urban/district scale or to adopt complementary assets as BESS or other storage solutions. The flexibility market is yet restrained to the TSO (transmission system operator) and aggregators are yet the most effective (if not only) manner to provide bankable services to the grid.
  - This enforces the chosen approach which with IS 2.1 (UC 4), targets Primary Reserves as main mean to provide flexibility to the grid and hopefully, provide enough revenue streams to balance the overall BM.
- *Smart buildings system integration APIs vs. BOS*
  - Too often, proprietary systems and platforms multiply supervision and reporting interfaces for building owners and operators alike. Built to serve "silos" among building exploitation tasks/businesses, share of data and information among them is limited and often, not even possible without (costly) interventions of the system provider or software developers (ad-hoc API and IT architectures development). The situation can be defined as "spaghetti ware": as many APIs have to be created as there are services and underlying metering/IoT/management systems and platforms. Project implementation costs and more importantly, that of delivery and exploitation phase, are driven by the development of such "ad-hoc" APIs. The situation on the demonstration site in unfortunately not much different.
  - This converges with the implementation mode proposed by the SBA (Smart Building Alliance) as for their R2S (Ready-to-Service) Label, which the demonstration partners endorse after the achieved experience: the constriction process has to integrate an "IT/Smart Task" (as an electricity, fluids or civil-works task) in the work assignment. Responsibility of the task has to be clearly assigned and objective should be the harmonisation and avoidance of inconsistencies and overlaps among information and exploitation systems/infrastructures. This is however nowadays not the case and seldom implemented.
  - The proactivity of IMREDD and NEXITY and the other involved partners, has enabled to handle the issue: key were regular common exchanges and share of information to monitor progress.

Measure 2

The first significant results regarding Measure 2 should be analysed after the 6 first month of nominal use of the DHCN. Indeed, by March 2022, the DHCN will have been operated with an advanced controller of the DHC production plant to minimize operational costs and to maximize the use of available renewable energy sources (thermal and electric).

During this period to come, some final implementation will occur:

- Implementation and connection of the PCM heat storage to the DHCN energy production station by March 2022
- Implementation and connection of the 2nd life electric battery to the DHCN energy production station by March 2022
- The connection to the DHCN of 3 more buildings by the end of 2021 and allegedly 6 more in 2022
- Integration of the optimization algorithms within the DHCN EMS overtaking the control use case of the production systems

The one year monitoring and improving of the control systems ("hypervision" and algorithms) will provide indicative results of the DHCN performance and flexibility.

4. Preliminary Results of Transition Track 3

The aim of this report is to provide an easy to read report on the preliminary results of this transition track 1,5 year before the end of the project. The report is less technical compared to the previous reports. We should avoid duplicating technical content that is already found in D5.3-D5.7, D63.-D6.7 and D7.3-D7.7.

In this chapter the overview of demonstration measure implementations, preliminary results on end-user and stakeholder feedback, expected impacts and KPIs, business models and exploitable results is provided.

KEY MESSAGE

Include in the start of each Transition Track chapter a brief paragraph providing the key messages for the audience, e.g. on the key results, the key recommendations or key learnings that you would like to pass on. The key messages of each Transition Track could be used as well for the Executive Summary.

4.1. Overview

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 D6.5.

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 reserves by reverse power transfer from the battery to the grid (V2G). The smart integration of such strategies should lead to the optimization of the overall energy expenses, and possibly generate a new savings/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. Key in the work will be also the interfacing of the platforms among IS3.1 and 3.2 and leverage from the developed API and information exchange to ameliorate the customer journey on one side, and service provision on the other.

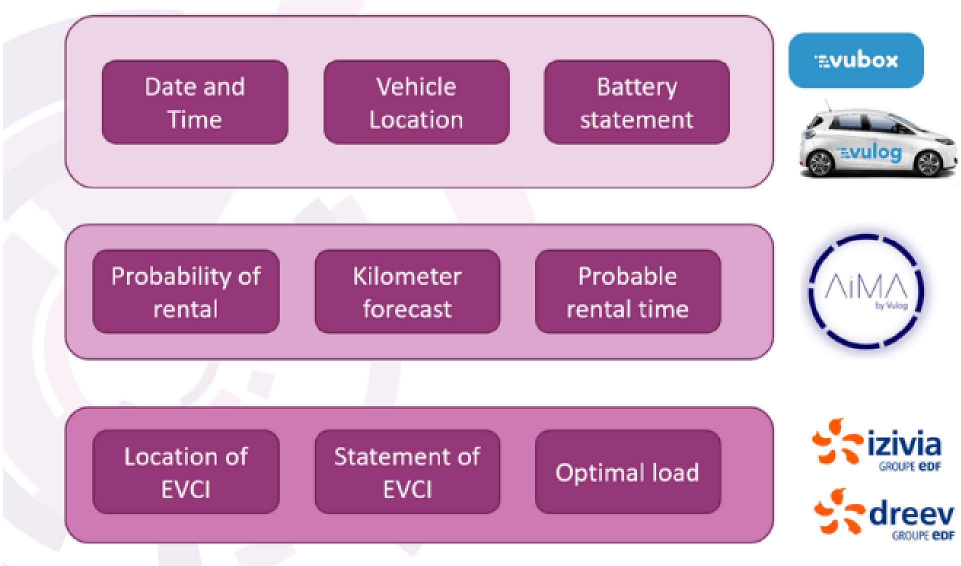


Figure 66 : Source of data useful for prediction. (Source: VULOG)

IS 3.2 measure, focuses on fleet management of public shared EVs, 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. 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.

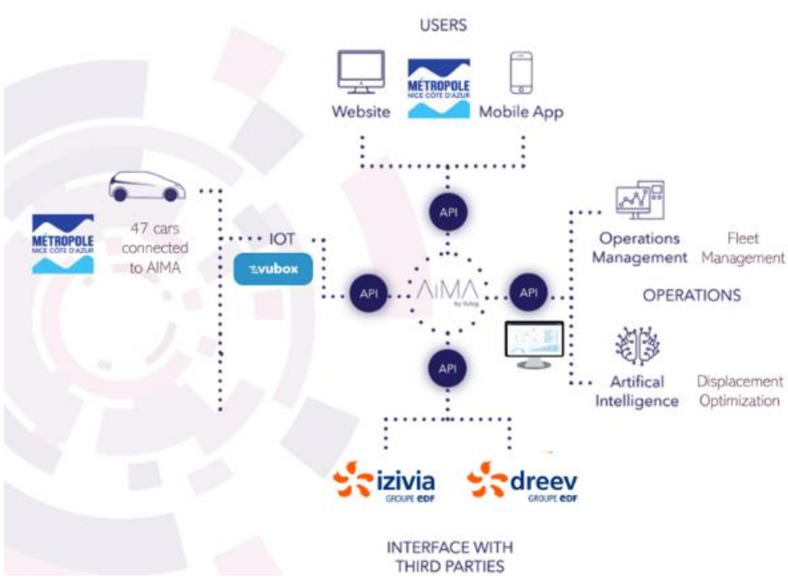


Figure 67 : AIMA platform interaction. (Source: VULOG)

The main work has been focused on completing the feasibility assessment on the sites proposed by MNCA and the scope has been set to following perimeter:

- ***IS 3.1 - Test V1G offer on the private fleet of MNCA:*** 17 EVs to be used by MNCA employees equipped and monitored by VULOG. Technical prerequisites have been validated. IZIVIA will install his energy management equipment on 2 sites: *Immeuble Connexio* and *Parking Corvésy*. IZIVIA's existing real time smart charging algorithms will be adapted to take into account the data provided by VULOG's EV fleet management platform in order to establish charging schedules: estimated energy amount, departure time, vehicle model, current state of charge. A dedicated API is set up for this purpose. The last technical assessment has led to retaining two out of three sites:
    - *Immeuble Connexio : 12 EV charging points - 22 kW* (Schneider EVLINK SMART WALLBOX) in the parking > works have been terminated to solve the current power limitation (3 kVA maximum power) and charging points are connected in parallel, and installation of needed ICT equipment is also almost complete.
    - *Parking Corvésy : 5 EV charging points - 7 kW* (Schneider EVLINK PARKING) > 4 charging points are currently being replaced and needed ICT equipment installed.
    - *Face immeuble le Plaza: site has not been retained* - 14 EV charging points (Legrand GREEN'UP T2P3) on public street > EVCI not compatible with smart charging and work would impact public space: the needed budget for works exceeds largely the upper value for the demonstration.
    - *Provisional planning:*
        - Start of works – 01/09/2020 (signature of amendment to public O&M contract)
        - Approval amendment to GA – Q4 2021
        - Solution development and equipment delivery – Q4 2021
        - Metering/control test – Q4 2021/Q1 2022
        - Test of Smart Charging offer – from Q1 2022 onwards

- ***IS 3.1 - Test V2G offer on 3 V2G vehicles of the private fleet of MNCA:*** 3 V2G chargers based on DREEV's V2G solution will be installed for serving 3 cars used for public/official events of the Metropolitan's authority. Technical prerequisites have been validated (i.e. historic usage data to ensure compatible usage profile). The contract will be developed outside of the project between commercial agreement among MNCA and IZIVIA. However, what will be part of the project as in the V1G use case, is the interfacing of the service with the system provided by VULOG. A dedicated API will be set-up to enable reservations to happen via the VULOG platform, whilst maintaining VG services and overall battery SOC management via the existing smart charging management system. The retained site is as follows:
    - *45 rue Gioffredo: 3 11 kW* charging points for 3 Nissan Leaf within the parking > on site audit has to be done to define work requirements for the electric and ICT installation > the visit is under planning and once achieved, works are ready to be launched.
    - *Provisional planning:*
        - Works and commissioning of equipment – Q4 2021
        - Start of V2G service – Q1 2022
        - Interfacing with VULOG platform – after mid 2022

- ***IS 3.2 - Smart charging combined with free floating test :*** As of today, VULOG car sharing platform is enabling the booking of vehicle as soon as the battery load is above a specific threshold (enough for achieving 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 focusing 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.

4.2. Implementations

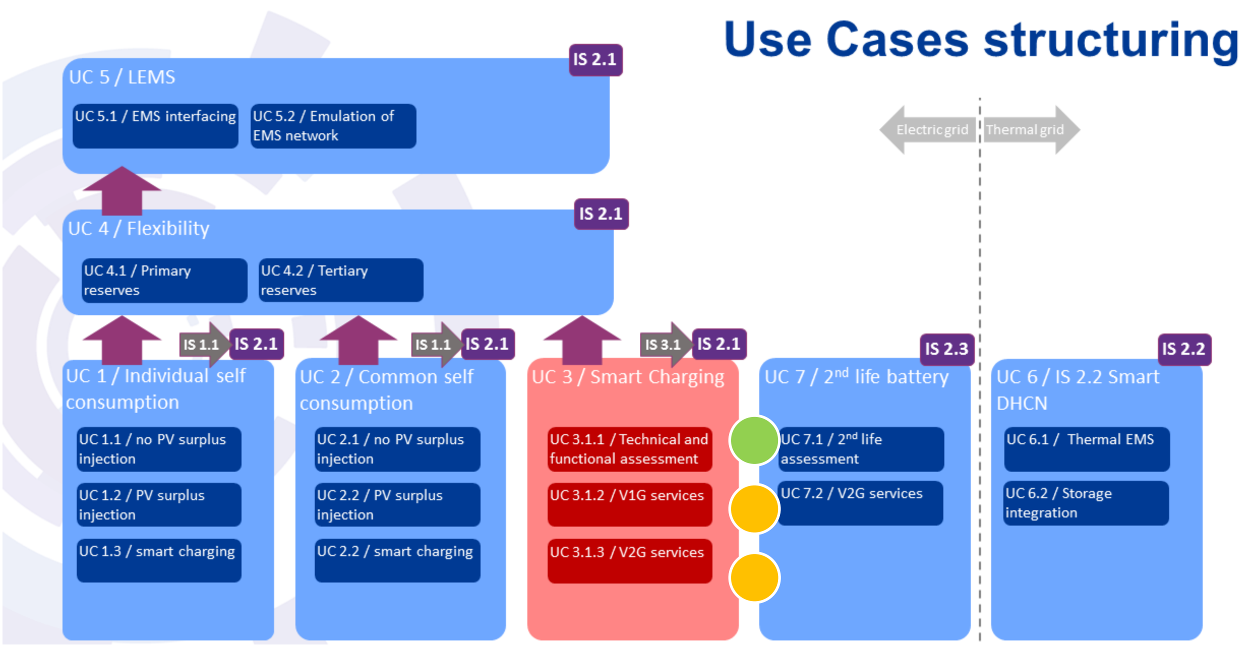


Figure 68 : UC structuring of IS. 2.1. In red, the UC related to TT#3 is highlighted – Green circle: UC has been started; Orange: UC on halt or not started yet (source: EDF)

As by D6.5, IS 3.1 or UC 3, has been initiated as planned. The technical assessment for the 3 sites is almost complete, whilst functional assessment is partially launched, mostly focusing on the definition of the API specifications to interface the V1G and V2G services with the platform provided by VULOG. To this end, since Q4 2020, MNCA, EDF, IZIVIA and VULOG have held at a monthly basis, information exchange, progress sharing and decision making meetings. This, accompanied by on-site visits and audits and sharing of MNCA of historic data, has enabled to achieve a detailed knowledge of the retained sites and define associated interventions and budgets, while ensuring the right pre-requisites are given for both for both V1G and V2G related actions.

EDF and IZIVIA will start engineering and equipment installation works on the sites, once MNCA will share the works-planning for the retained 3 sites.

For IS 3.1, the work will consist of following actions:

- provide and operate the needed on-site equipment (automation system – local energy management system for 2 sites and 17 charging points and additional ICT equipment/services);
- monitoring of the charging behaviours and define, develop and implement control strategies for activating flexibility for the EVCI;
- develop the needed algorithm to calculate charging schedules based on mobility needs expressed by VULOG. A heuristic approach has already been specified by IZIVIA and is currently under tests;
- develop the needed API(s) for the interfacing of IZIVIA's and VULOG's platforms and
- if a V2G EVCI can be implemented with MNCA, ensure the interfacing/API for interfacing the respective platforms of DREEV (IZIVIA's V2G service supplier) and VULOG; assess the replication potential from the achieved return of experience and feed through expertise and information the TT#2 activities (LEMS).

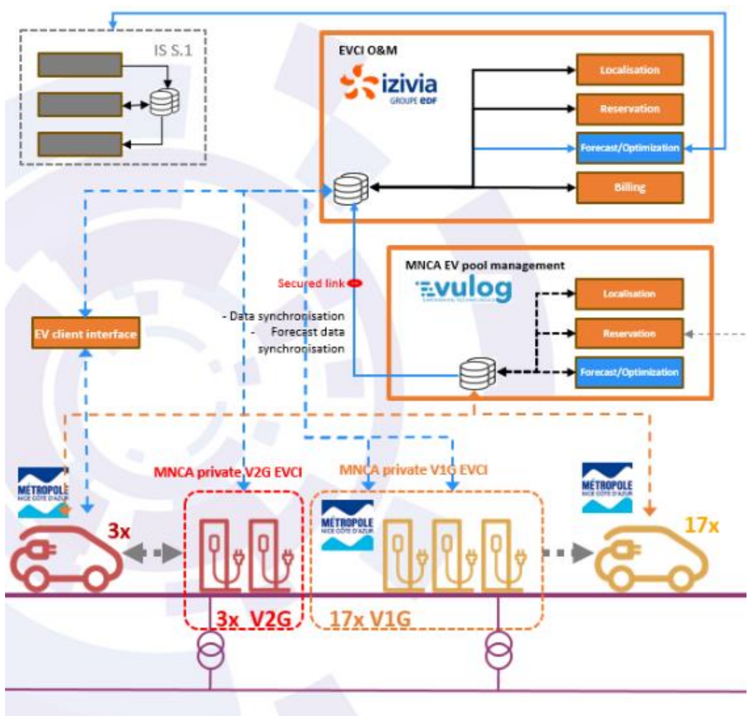


Figure 69 : General system interconnection between the different platforms directly impacted by the smart charging to be implemented in IS 3.1 – the highlighted blue rectangles, corresponding to forecast and optimization layers, are those focused on by IS 3.1; dotted lines correspond to additional interconnections to be done (Source: EDF)

For IS 3.2, the work will consist of following actions:

IZIVIA and DREEV put forward their booking data needs:

- Time;

- Which vehicle will leave and when;
- It would really take trips / km;
- Need to have the car's initial state of charge;
- hypothesis on the battery level.

The purpose of these data is to obtain a forecast of the departure time and the charging point in order to make a planning schedule from battery capacity. For this, several hypotheses have been put forward by VULOG and IZIVIA:

- Either the car has been reserved or it is on site;
- Delay sanctioned, arrival time known;
- As for the reservation, the vehicle must return to its point of departure.

IZIVIA and VULOG have started implementing the connection between the respective platforms of the two companies. Badges have been considered to identify vehicles. However, the Nice metropolis (NCA) has confirmed that each vehicle is associated with a terminal, thereby simplifying the correspondence at this level.

VULOG expressed the need for certain types of data, namely:

- Departure times;
- Energy requirement;
- Vehicle model;
- Vehicle site;
- State of initial charges.

as matter stands, some issues still remain concerning the needs in terms of vehicle load. It is possible to be aware of the booking as well asits, but not the actual load of the vehicle. IZIVIA can only get an estimate of this load.

The load estimate will have to depend on the vehicle, the model. VULOG and IZIVIA must, as a first step, succeed in exchanging information. The idea is to make occasional requests on the charge level but if the vehicle is not in use, to preserve the battery of the box, the VULOG box, the VUBOX, must be put on standby. We can then only know the load value punctually. The wake-up frequency is configurable.

4.3. Preliminary results

The work so far done, has put in light:

- how existing EVCI upgrade is costly, as much as a complete replacement especially if it involves civil works. Within such projects, the costs for upgrading the overall electric and ICT system is considerable, if not predominant.
- The latter, is a too often underestimated factor, as clients are largely unaware on the impact that EV and its EVCI have on their electric system.
- Accordingly, public and private tendering are missing a clear analysis of the overall projects' impacts and thus, underestimating such costs. EVCI sizing is bounded to the related electric system capacity and the EV fleet it should serve. Besides, EV charging is a fast evolving domain and decision made a few years ago in terms of installed power or communication capabilities of

chargers do not ever meet the new expectations of the users. EVCI have to be future proof and future needs have to be anticipated.

- Moreover, clients have seldom a clear vision on the deployment of E-mobility among their own or operated vehicle fleet. This is however the main determinant for defining the perimeter of possible V1G or V2G services, yet bounded to the deployed EV-fleet and associated charging and communication technology.
- EVCI projects are done at a case by case basis whilst a more comprehensive and long-term approach would be needed to properly address the matter.
- In terms of public administration, such projects are complicated to implement, as different parts of the smart charging system, affects different departments of the administration. Buildings' electric endowment and EVCI are part of the building department, energy contracts are managed by the energy department, the private EV fleet is part of the logistics department, while the public fleet falls under the transport department, and last but not least, any IT platform affects the IT department. These interfaces have to coordinated as well as the associated decision making process accompanied, as these departments have seldom the chance to work in such a transversal manner. Long information exchange and negotiation processes are unavoidable, incurring serious delays in the project realization of any optimistic planning.
- The overall proposed services under TT#3 are seemingly encountering user interest and the proposed user-experience adapted to their needs: VULOG's platform will be in front-end to end-users for the vehicle management whilst, the V1G and V2G Smart Charging services will stay in back-end, prioritizing EVs' availability and their batteries' SOC. By any mean, the proposed services go beyond current software and processes in place within public authorities and it is believed that the information exchange among platforms can raise the overall exploitation performance and end-user acceptance, and provide new flexibility levers to the electricity grid. The encountered discussions with the different involved parties, have so far confirmed the interest in the proposed solution.
- Finally, in November 2020, VULOG and IZIVIA discussed APIs, namely:
    - API level? Who will look where?
    - Average battery level depending on the rental period?
    - Rental hour
    - Location duration

  The goal is to understand how we could communicate information systems.
- VULOG, Dreev and IZIVIA have expressed their information needs and have thus set up specifications for "data exchange" between the different databases.
- VULOG and IZIVIA have succeeded in connecting their databases, more specifically, IZIVIA manages to retrieve information on the VULOG database.

4.4. Business models and exploitation

4.4.1. Smart Charging services (V1G/V2G) for local authorities' private EV-fleets

The business model - is it a public business case?

The business model is bankable nevertheless, it is less clear, how much savings can be achieved for the customer and so, clarify the customer promise associated with the service. This will partially influence the commercial offer and its associated costs.

Key Partners

- Technology providers – EVCI, ICT
- Engineering companies – works and cabling
- Consultants – design and engineering

Key Activities

- Active commercial offerings – address public authorities across FR
- Tendering screening – identify key call for tenders enabling to valorise/integrate the service

Value Proposition

- First, and only, smart charging service in France addressing both V1G and V2G technologies for local authorities
- Expertise and dedicated companies on the whole value chain > ability to accompany the client on all phases
- Reduction of overall system sizing thanks to operational performances
- Interfacing with existing/planned EV fleet platform
- Security of service supply and quality

Customer Relationships

- Commercial force to publicize the capacity of the EDF group's to provide Smart Charging services among its customer portfolio
- Integrate Smart Charging as differentiation from competitors in the tendering process.

Customer Segments

- Existing customer segments:
    - B2G - Local authorities – mid to big size cities and metropolitan areas;
    - B2B - private companies with large real-estate park/EV-fleet.

Key Resources

- Key resources are available in the related companies.
- ICT infrastructure is adapted accordingly
- Integration of the Smart Charging service in the offer-list of commercial staff and the related "training" for correctly setting up and negotiating commercial propositions
- Billing via existing means.

Channels

- Use of existing commercial channels of the Group.

- Integration of Smart Charging will be an additive but, distinctive element from the competition as well as the capacity to interface EV-fleet management platforms

Cost structure

- Strategy is the automation of the service, no needing additional resources
- The needed automation equipment is becoming mainstream and has low impact in terms of budget, and can thus be considered as not representing an "additional cost".
- The costs structure of the service will be defined, once results will be retrieved – if saving are considerable, benefit share could be thought of however, it is more probable that the saving achieved form the service will equilibrate the overall additional cost for the customer – win-win approach
- In the case of V2G technology, the revenues are shared with the customer, comparable to the annual charging costs.
- Customers will be able to choose as already given today, different service levels and billing schemes for end-users.

Revenue streams

- Integration in traditional contracts
- The service will be an additional item that will be integrated in existing revenue model.

Bankable business model

The business model is believed to be bankable nevertheless, the demonstration has to be attended to better evaluate the order of magnitude of the saving that can be achieved via Smart Charging for the customer.

Recommendations to cities that want to replicate this result

- Elaborate a comprehensive low carbon transport and mobility strategy, addressing E-mobility
- Assess in a detailed manner the status-quo of the building park and associated EVCI in order to have an accurate vision on additional works and equipment to achieve the set development strategy – equilibrate ambition with investment (and operation) capacity
- Articulate the tendering against the main costs: building renovation works compared to EVCI sourcing and O&M.
- Keep simple cost structures for end-users, hiding the service complexity.

How can your company support cities wanting to replicate this solution?

- Dedicated WS and communication and dissemination campaign
- Participation to call for tenders
- Integrate service in commercial offers of the EDF Group and integration in its common network and channels.

4.5. Lessons learned and next steps

In general terms, the "technological obsolesce/lock-in" is a common situation for early adopters of an EV-fleet and which has to be dealt with some urgency, as what described in the followings, is partly true for a wide range of local authorities.

The speed of development between the EV and EVCI industries, and that of the urban space, are advancing at different speeds: whilst the EV and EVCI industries are evolving fast, tending towards ever higher battery capacities for longer trip durations and higher charging power for shorter charging duration, the overall urban space hosting this emerging transport mode, advances at a far slower pace. Indeed, in the life-span duration of an EVCI (about 10 years), the previous technological approach has become undersized: charging stations become more common and bigger, charging capacities are multiplied by a factor from 2 to 10 and besides, communication standards and protocols are evolving rapidly.

Innovators and early adopters, public or private entities alike are thus, facing an obsoleting EVCI and technological endowment. Existing EVCI upgrade is as costly as a complete replacement. Whilst slow charging was the standard, fast charging is becoming more and more popular and accessible in terms of investment and operation costs. By any mean, within such projects, the costs for upgrading the overall electric and ICT system is considerable, if not predominant. The latter, is a too often underestimated factor, as clients are largely unaware on the impact that EV and its EVCI have on their electric system. Accordingly, public and private tendering are missing a clear analysis of the overall projects' impacts and thus, underestimating such costs. Moreover, clients have seldom a clear vision on the deployment of E-mobility among their own or operated vehicle fleet. EVCI projects are done at a case by case basis whilst a more comprehensive and long-term approach would be needed to properly address the matter.

Innovators and early adopters of EV solutions, have aging EVCI that has to be replaced, whilst charging and overall EV-battery capacities have at least doubled. This leads to a discrepancy between expectations and real techno-economic feasibility, where the upgrade of a building integrated charging stations, can demand to double or triple its supply capacity. The impact of up-grading works' costs seems obvious.

Similarly, early adopters of public EVCI are confronted with the same need as installed charging capacities are undersized compared to current practices. Revamping projects come with important investments impacting their electric endowment on both private and public space.

In terms of governance, current practice need the integration of different departments of a local authorities or companies to realize such endeavours, needing competencies coming from the sectors as building, electricity/energy, IT/ICT, fleet operation and mobility/transport. These are usually driven by different strategic plans or objectives and rarely are enabled to work in a transversal manner as needed to handle this type of matter and can be described as working "in-silo". The governance and coordination of interfaces and the associated decision making processes, is a difficult task and should not be underestimated in terms of duration for a project's planning.

As mentioned, VULOG and IZIVIA have succeeded in connecting their databases, more specifically, IZIVIA have retrieved information on the VULOG database. The end of the year should allow VULOG to connect its database to IZIVIA's so that the company can also retrieve data from the IZIVIA database.

At the end of this exchange, the approach is expected to be replicated with DREEV.

Finally, data exchange is the first step towards the analysis and collection of transport data as well as loading data to be able to correlate these two pieces of information in order to optimize the two processes.

5. Preliminary Results of Transition Track 4

Measure#1 enable to improve air quality data and support citizen engagement. Air data will be retrieved thanks to sensors and stations measurements; traffic data collected on the CIP and on other sources.

Measure#2 provide a dashboard including the digital modelling of the IMREDD building and the building data collection available on the CIP.

Measure#3 provide a Smart Charging management platform that directly communicate with the energy aggregator platform which will trade flexibility services on the energy market.

Measure#4 provide a new tool, the SMART CITY INNOVATION CENT (SCIC) that allow to see in real time the impact of the different energy scenarios on the building.

5.1. Overview

As reminder, demonstration activities within the **T**ransition **T**rack **4** (**TT1**) are organized around 4 measures that initially referred to IS-4.

Measures are now divided as following:

- **Measure 1** Sensors data collection in air quality
- **Measure 2** BIM/CIM data display
- **Measure 3** Data control and monitoring for Smart e-mobility
- **Measure 4** Services for grid flexibility

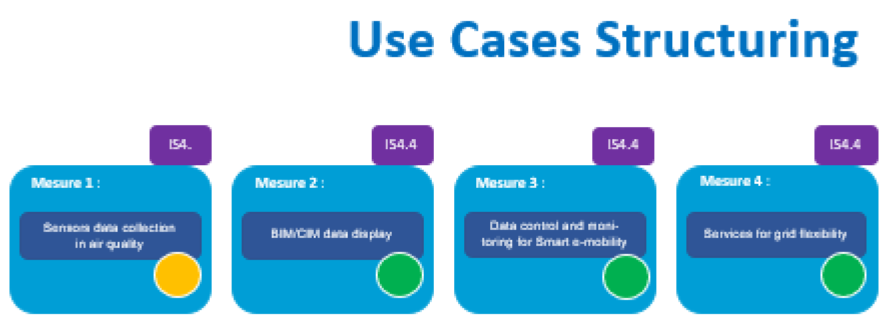


Figure 70 : schematisation of the relation and hierarchies among the chosen Use Cases and sub–Use Cases as by D6.6. Green: UC is started or under operation; Orange: not yet implemented; Red: UC not pursued anymore

All measures have been started but some of them are still pending.

5.2. Implementations

5.2.1. Measure 1: Sensors data collection in air quality

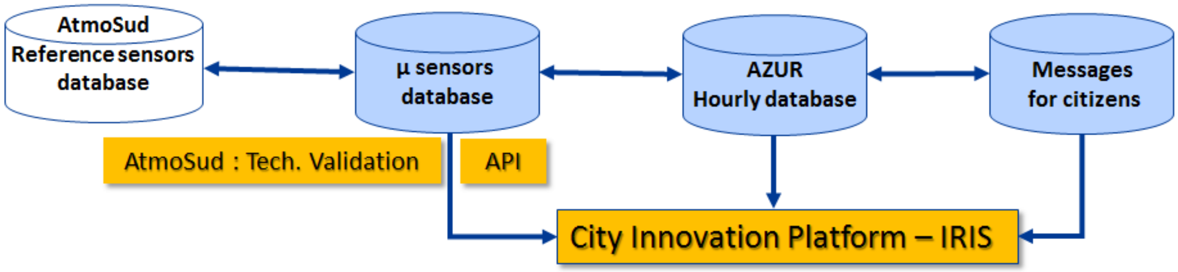


Figure 71 : Data service schema

AtmoSud's contribution to Task #4 consists of sharing data with the City innovation Platform (feed with air quality data and exploit existing traffic data). The data will afterward be used to create citizen engagement demonstrators.

This achievement relies on two actions:

- Improve the air quality measurements with micro sensors
- Upgrade the AZUR air quality mapping model with hourly forecast and real time information. This service will be fed by micro sensors' measurements and traffic data.

<u>**Current Status**</u>

AZUR is the forecast air quality platform developed by AtmoSud to provide information at very high resolution. This platform already provides daily forecasts for several pollutants: PM_{10}, $PM_{2.5}$, NO_2 and O_3. AtmoSud, with the contribution of its modelling and innovation team, has designed this platform with a great agility. IRIS project will allow to develop the hourly module and to provide a near "real-time" air quality information using AZUR methodology.

Currently, the only real-time input is observations from AtmoSud monitoring network. Over Nice city, this network regroups 4 stations: Nice Airport, Nice Arson, Nice Magnan and Nice NCA port. To provide high spatial and temporal resolution information, AZUR platform needs an update of the monitoring network with micro sensors over the demonstration area and to use real-time traffic data.

AtmoSud is currently working with the CIP administrators in order to push daily AZUR on the CIP before the end of March. This joint work helps to collect the CIP's traffic data as well.

Two requirements specifications are ready and about to be sent to providers: a first one for micro sensors and a second one for the server.

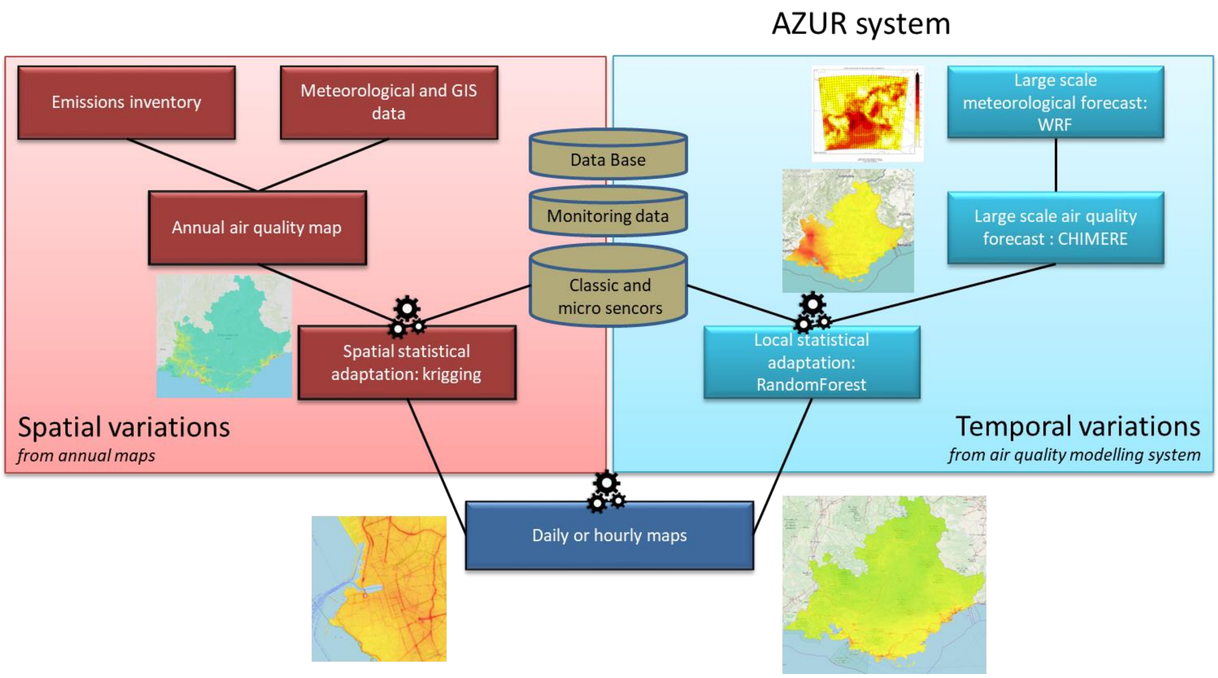


Figure 72 : Data service schema

Procurement of equipment and/or services

Air quality data

Air quality data will be collected from several sources:

- ***Micro sensors***

5 to 7 micro sensors will be installed in Nice Meridia and purchased shortly by AtmoSud after a call for tender. Data provided will improve AZUR compliance at high resolution.

- ***Air quality measurement network***

AtmoSud already owns a measurement network composed of numerous non-stop operating air quality stations. These continuous measurements will enable to check the proper functioning of micro sensors. They may be requested to contribute to citizen engagement as well.

- ***AZUR***

This hourly data model will be developed internally. Developments will be done with open source software. For its operation a server will be purchased.

Traffic data

- ***City Innovation Platform***

After several audit , the CIP does not contain any traffic data.

- ***IMREDD** has no traffic data.*

Faced with these difficulties ATMOSUD has developed a new method adapted

A new adapted method : Notion of neighbourhood: background pollution situation

For all pollutants, the maps are calculated from measuring stations. This calculation is then transposed into their zone of influence called "neighborhood"[1]. The latter are defined so that all the measuring stations cover the whole regional area. The background sites cover up to 100 km. The maps are obtained by aggregating the estimates of each neighborhood by inverse distance. The area of influence of each station is thus limited by the neighboring stations (Figure 73).

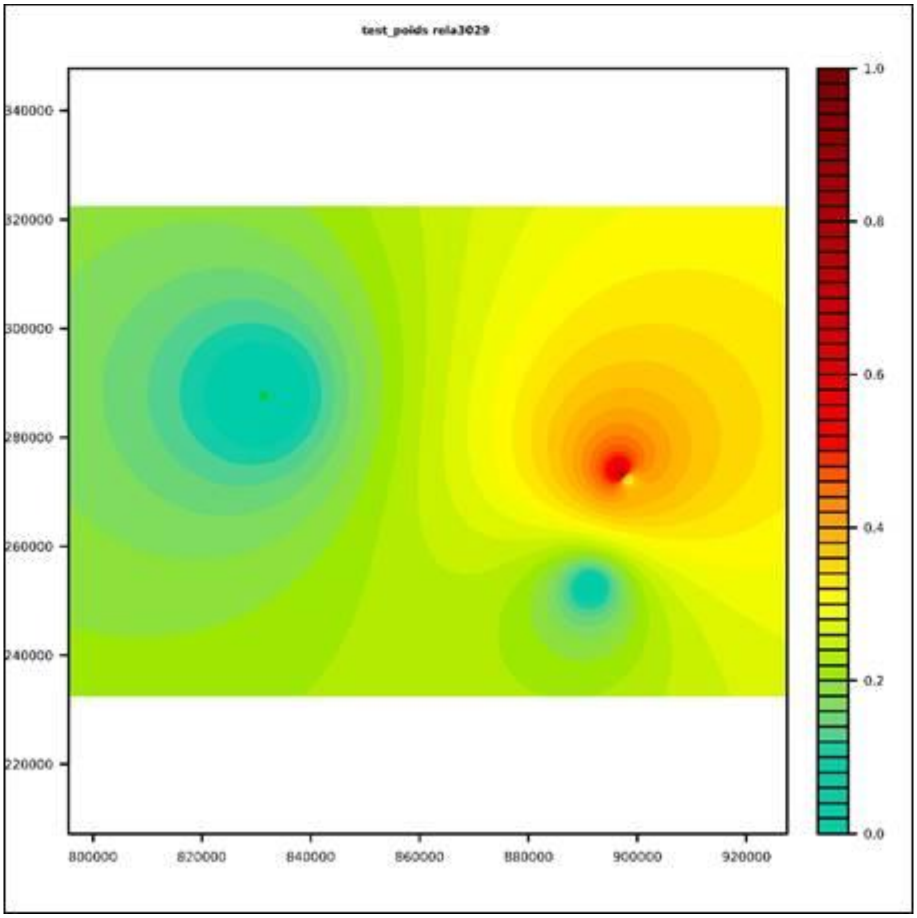


Figure 73 : Relative weight of a measurement site (Aix Art point in blue) in relation with the proximity of three others (points in black) whose traffic

Concept of neighborhood: influence of road traffic

The sites under the influence of road traffic are taken into account by means of a neighborhood based on the linearity of the nearby roads. The weights are calculated as a function of the distance between the station and the mesh points in the following way:

- Linear decay on the axis between 0 and 1
- Transverse: exponential decay between 0 and 1 (degree 2)

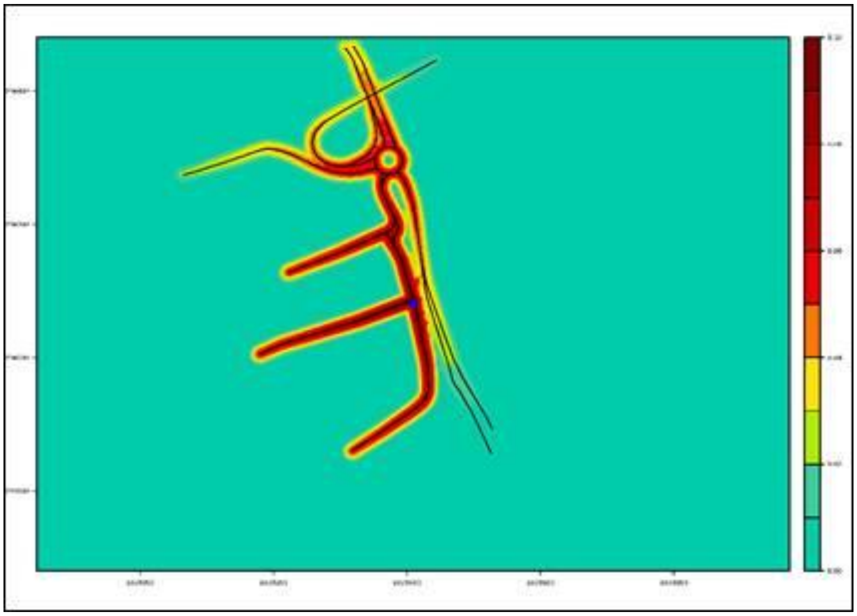


Figure 74 : example of weight in the vicinity of a traffic site

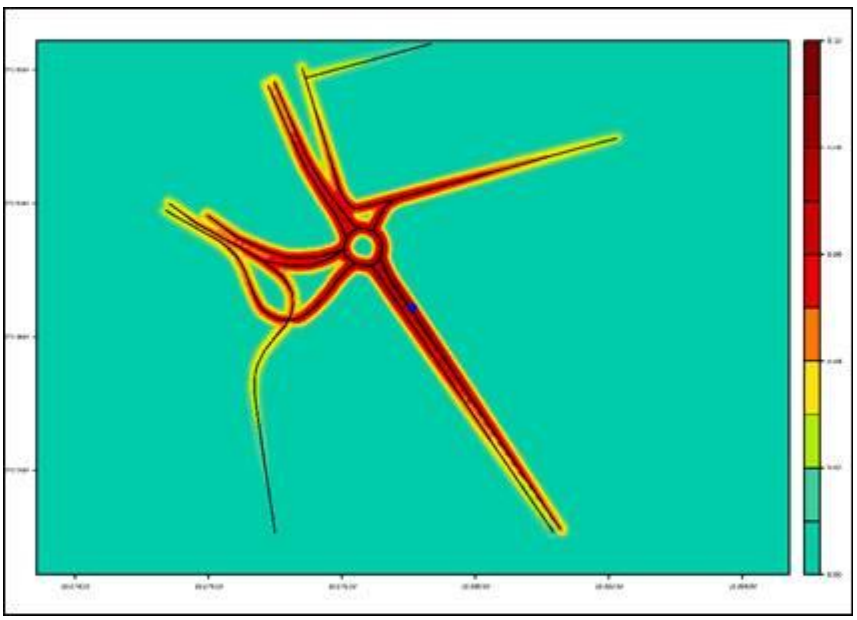


Figure 75 : example of weight in the vicinity of a traffic site

Consideration of micro-sensors

The micro-sensors are taken into account in the post-processing of the Azur maps. Each sensor is associated with a neighborhood as defined above. This one defines the limits of the zone to be modified on the Azure map as well as the weight of this modification. The concentration to be added or subtracted is given by the difference between the value measured at the sensor and the value estimated by the Azure map. This difference is then weighted in inverse distance in the vicinity of the sensor.

In order to consider the uncertainty of the measurements on this type of device, a confidence index is taken into account using a coefficient that lowers the weights in the vicinity of the sensor.

About the calculation grid :
- Work on 5 m grid
- Re interpolation of weights on the departmental grid at 25 m

The calculation of the maps:
- Calculation of the mes-mod deviation
- Multiplication of the weights/sensor by the deviation.
- Addition to the Azur map

Note: the sensor correction grid is not saved. The modifications of the raw map are made sensor by sensor.

Final result

After taking into account the background pollution, the proximity to the traffic axes and the pollution of the micro sensors, it is possible to obtain a mapping of the concentrations (NO2, particles) for each hour of the day. The figure below illustrates the NO2 hourly concentrations obtained for 10 am 22/11/2021 on the Nice Côte d'Azur metropolis.

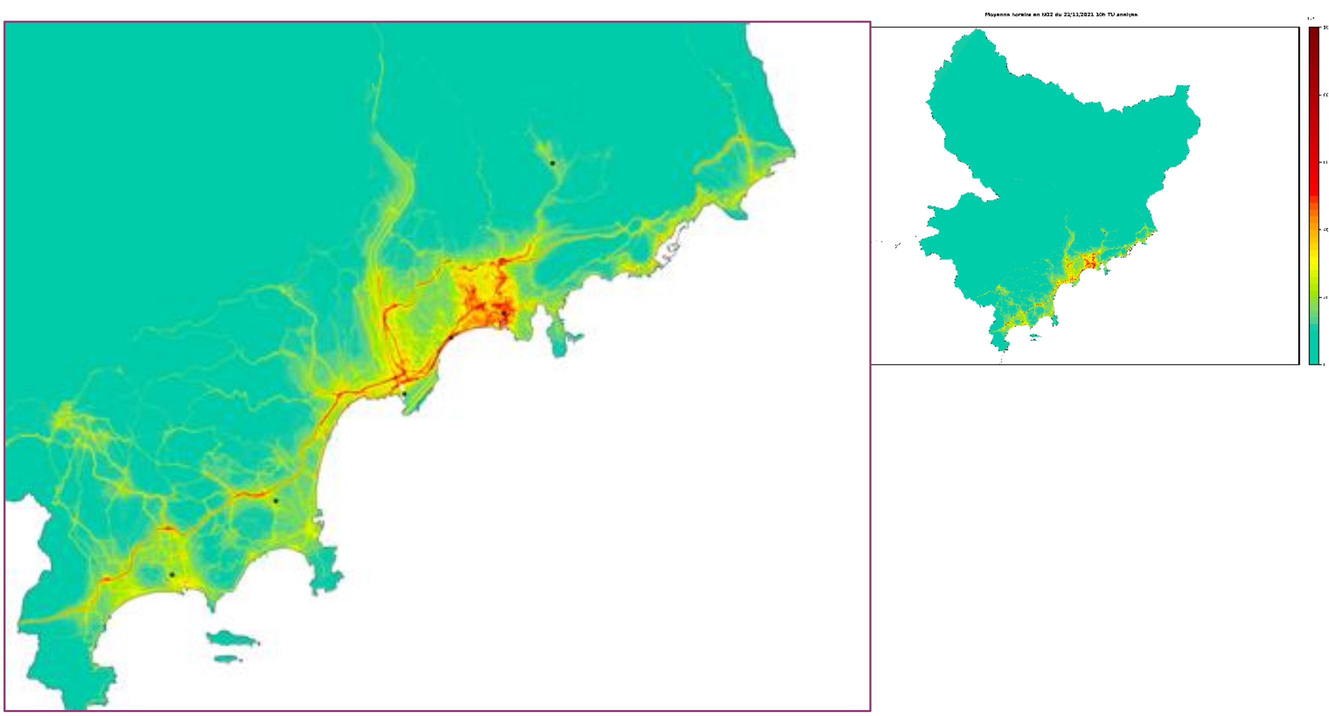


Figure 76 : example of weight in the vicinity of a traffic site

Air quality measurement in IMREDD building

As part of the experimentation in measure 1, IMREDD has equipped its building with two external air quality sensors. The first one is located on the roof and the other one is beside the road, near the traffic jam. These two sensors can measure a lot of parameters (temperature, humidity, atmospheric pressure, VOC, PM1 - PM2,5 - PM10, NO2, O3).

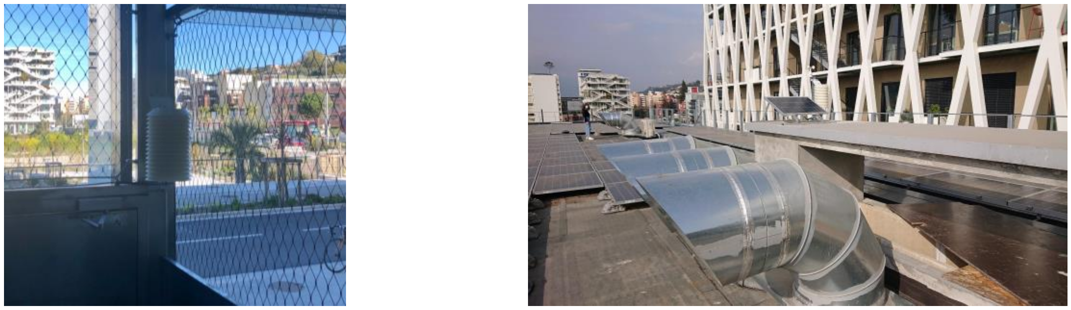


Figure 77 : Outdoor air quality sensors at IMREDD

Data from IMREDD sensors will be pushed to the CIP and crossed with data already owned by MNCA in order to enhance the awareness of citizen in the Meridia district.

The air quality from the inside of the building is also available and monitored locally at IMREDD. In a near future, such measurements could be corelated with the pollution outside the building and constitute a new indicator for the wellbeing of citizens.

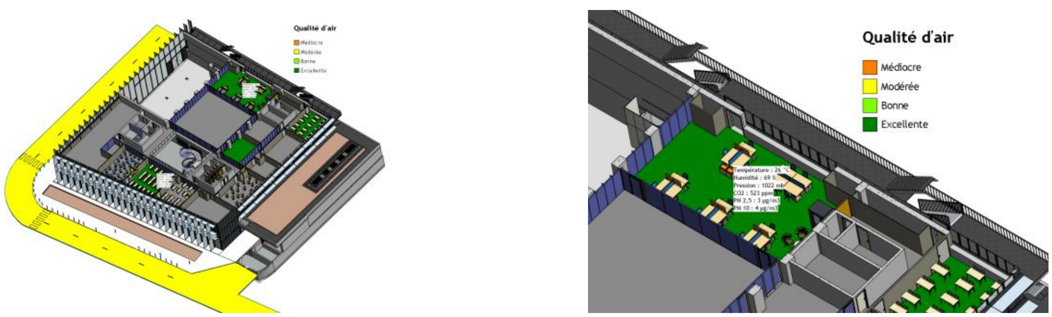


Figure 78 : Real time air quality visualization at IMREDD

5.2.2. Measure 2: BIM/CIM data display

The main goal of the measure 2, is to demonstrate the capacity of the multi-scale BIM and its ability to integrate real-time "hot" data from the CIP at the urban and building scale. The project is naturally divided into three distinct steps. The first one regards the conception of the 3D model of the IMREDD building as shown in figure 3.

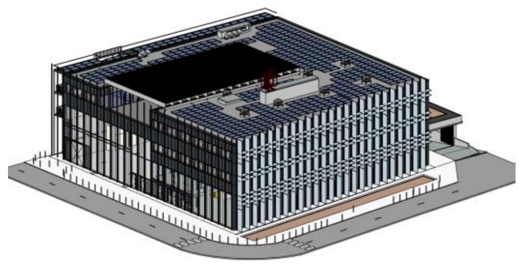


Figure 79 : 3D model of the IMREDD building

In a second time, live data coming from different equipment are displayed. An example of the irradiation and the atmospheric pressure measurement is given in figure 4.

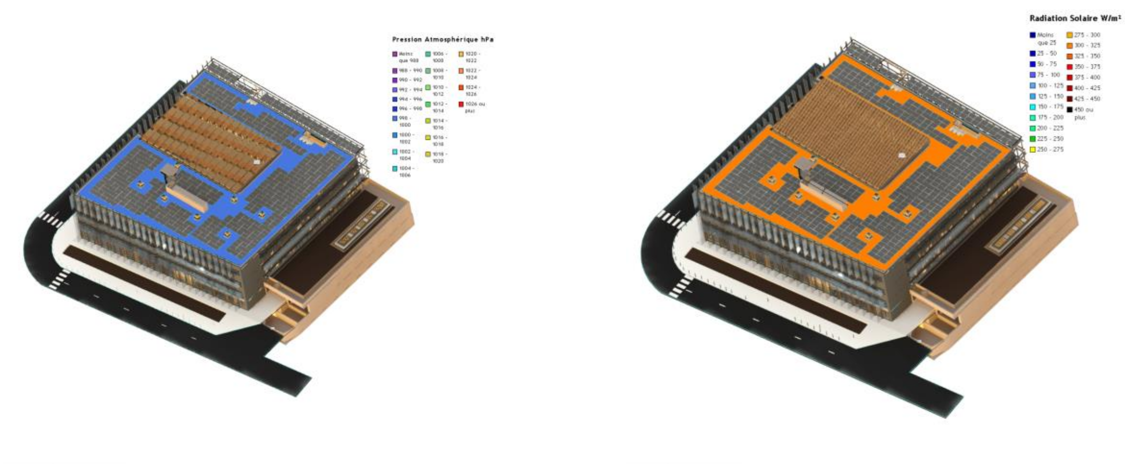


Figure 80 : Irradiation and atmospheric pressure real time visualisation at IMREDD

Those first two tasks have been already completed by the IMREDD engineering team and transferred to IRIS partners for further developments.
Finally, the model in figure 3 will be integrated at the neighbourhood scale, providing an adding building block to the BIM/CIM data display.

5.2.3. Measure 3: Data control and monitoring for Smart e-mobility

This measure is related to the TT#3 demonstration activity in Nice which is focusing on building and optimally coupling systems operating both EVCIs and electric carsharing fleets over a city, aiming at implementing a “Smart Charging” management and testing various related use cases.

The private EVCI network of NCA is from now on controlled by a supervision platform provided by EDF partner. The EVCI supervision platform interface with the Smart Charging management platform to support an optimal charging plan in accordance with the operating requirements of the carsharing of the e-fleet and the instructions from the energy aggregator platform to comply with flexibility energy ser-vices such as peak shaving and shifting and tertiary energy reserve.

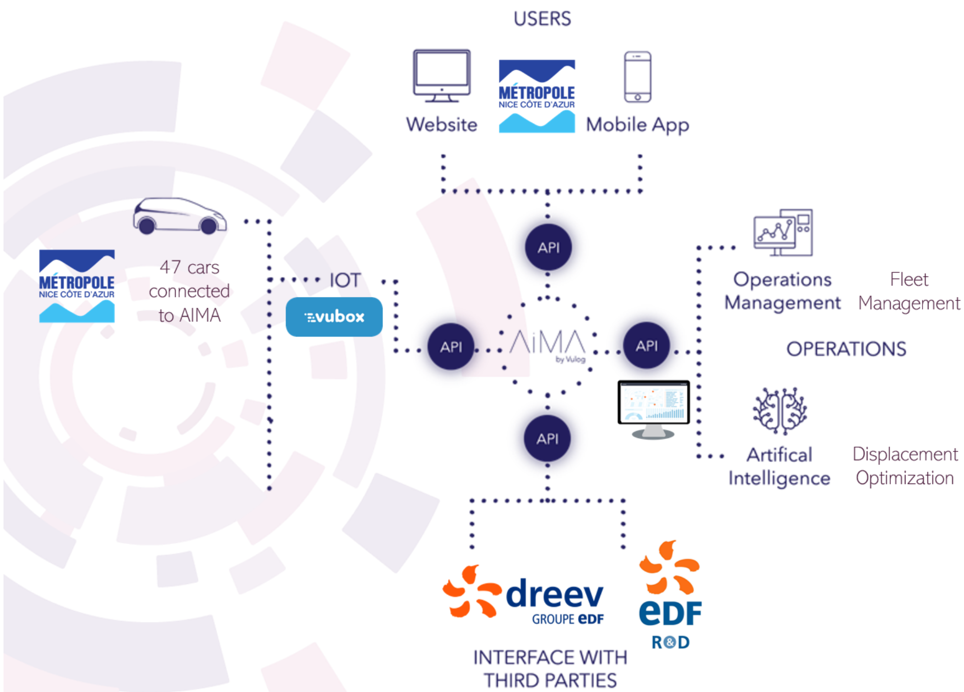


Figure 81 : Data flow diagram for the car-sharing platform "AIMA" (Source: VULOG)

5.2.4. Measure 4: Services for grid flexibility

Local energy data at IMREDD from the energy system like the lithium-ion battery, photovoltaic panels, EV charging infrastructure are gathered into the CIP and contribute to the creation of a new tool, the SMART CITY INNOVATION CENT (SCIC) will allow to see in real time the impact of the different energy scenarios on the building. The SCIC will also play an educational role and will raise the awareness of the various actors of the territory to energy.

On a technical point of view, data are pushed to the CIP using Node Red flows as illustrated in figure 2. Data mainly come from the energy management system that gathers data especially from the IMREDD energy devices. Then, data are available through EDF S&F API's.

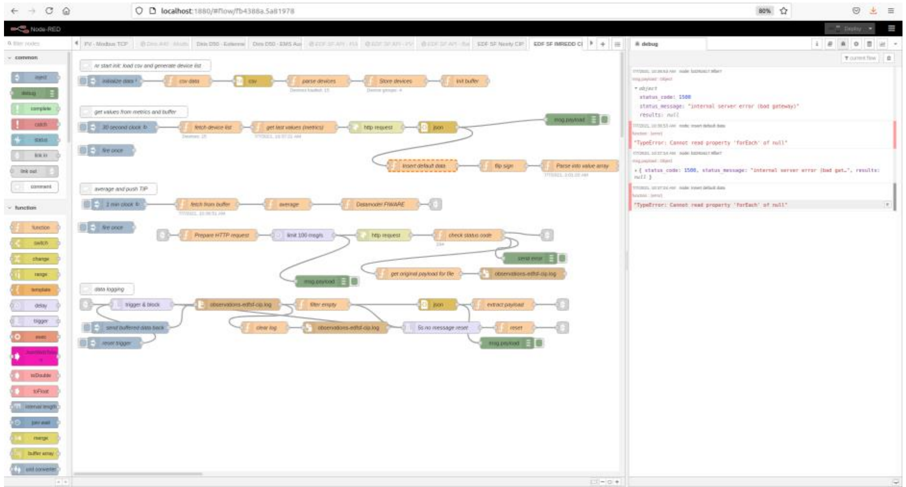


Figure 82: Node Red flow hosted at IMREDD that recover data from EDF S&F cloud to the CIP

The creation of dashboards using real data is still under development with already few realizations as shown in figure 7. Another part of the work is to imagine new scenarios by crossing data together.

Figure 83 : An example of energy data streaming at IMREDD SCIC's

5.3. Preliminary results

The BIM modelling associated to the IMREDD building is already presented in the SCIC. Visitors have the possibility to visualize "hot" data through different screens. International delegations are also invited to visit the showroom and share a unique experience based on innovation.

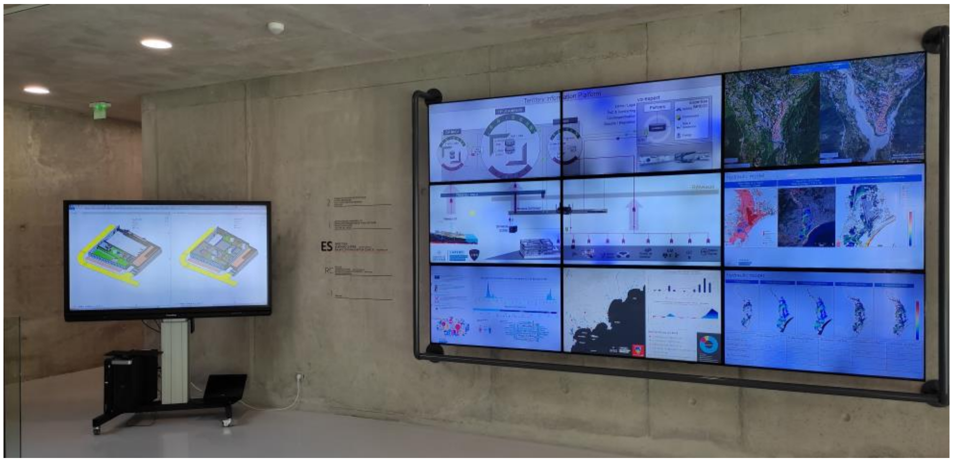


Figure 84 : An example of energy data streaming at IMREDD

6. Preliminary Results of Transition Track 5

Unfortunately Nice has been strongly affected by the Covid pandamic.

Several strong lockdowns have been applied in the Alpes-Maritimes department.

Date :

- **17/03/2020 - 11/05/2020 :** 1st National lockdown
  School / college / University were closed untill the end of the school year (01/07/2020)
- **30/10/2020 - 15/12/2020** : 2nd National lockdown
- **26/02/2021-19/03/2021** : Special lockdown for Alpes-Maritimes week-end
- **19/03/2021-03/04/2021** : Special lockdown for Alpes-Maritimes
- **03/04/2021 – 03/05/2021** : 3rd National lockdown

This situation has impacted the possibilities of meetings, interventions in schools, college or public area.

During 2020, school, college, lycée, university were closed from 17/03/2020 untill the end of the school year (01/07/2020).

During 2020/2021, the national anti-covid policy required that classes and even schools be closed when COVID cases appeared in the establishment. Many classrooms, if not entire schools, have been closed. The college has also been shut down several times.

The TT5 measures were very strongly impacted by all these events.

6.1. Overview

The measures described in this report for TT#5 are

4. **Measure 1: Public awareness campaign Air Quality :**
   corresponds to IS 5.1 Co creating the energy transition in your everyday life
5. **Measure 2: Public awareness campaign Energy – School & Collège; Youth & Family :**
   corresponds to IS 5.1 Co creating the energy transition in your everyday life
6. **Measure 3: Citizens individual engagement - IOT invoices**
   corresponds to IS 5.4 Apps and interfaces for Energy efficient behavior

6.1.1. Location of the measures :

The following table shows briefly the insights per measure:

Demonstrator	In a nutshell
#1 Public awareness campaign Air Quality	Brief summary: Three solutions will be implemented : urban awareness campaign, students training project and commuting to work by air quality mesurement to develop car-sharing.
	Expected impact: raise the awareness of various targets about the air quality : general audience, white collars, and young people to change the habits of mobility
#2 Public awareness campaign Energy – School & Collège; Youth & Family	Brief summary: The objective is to increase general knowledge of the world of energy and/or their environment in order to raise the awareness of different audiences and encourage them to change their behaviour.
	Expected impact: More acquaintance by children with the subject of sustainability, a positive vibe within youngsters about the IRIS-initiatives who will involve and help their parents.
#3 Citizens individual engagement – IOT	Brief summary: Integrate in the same IOT application the energy consumption of each tenant from different sources and deliver relevant messages related to their behaviour.
	Expected impact:. Increase understanding of the link between individual behaviour and its impact on personal energy bills.

The demonstration area for TT#5 is in the Nice Eco Valley district, a continuum of 2 homogeneous areas: Grand Arenas, and Les Moulins.

The TT#5 measures will be implement in different scale of area :

- For #1 : The actions will be implemented in the city of Nice into the tramway & in the Grand Arenas city affair quarter and the Moulin's Area.
- For #2 & #3 : The actions will be implemented in the Moulin's Area situated in the west of Nice near the airport.

The city of Nice and the neighbouring area Les Moulins and Grand Arenas are showed in the next figure.

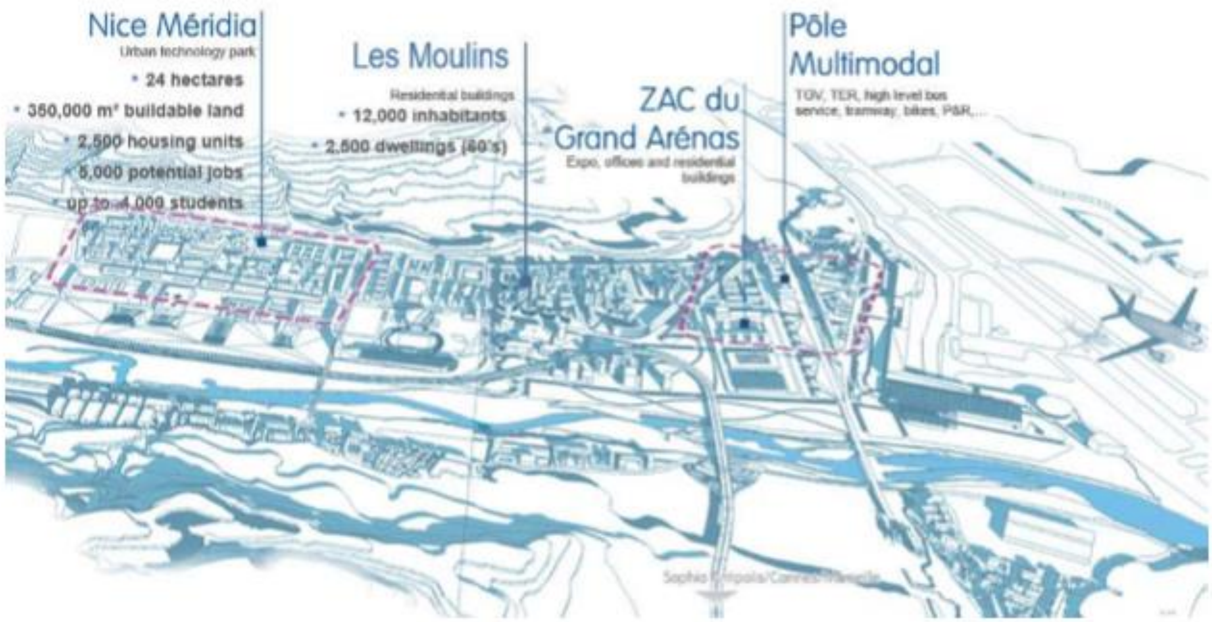


Figure 85 : Overview of the demonstration districts of Nice (source: MNCA)

Les Moulins

Nice Les Moulins is an income-deprived neighborhood in the west part of Nice (2 969 social dwellings built during the 70's, around 12 000 inhabitants) with degraded mid-rise and high-rise buildings and a shared district heating.

Cote d'Azur Habitat, the social housing company in charge of Les Moulins together with the municipality of Nice and the National Agency for Urban Renewal launched an ambitious renovation program with general objectives to demonstrate the feasibility (technical, financial and social) of innovative low energy renovation processes for buildings.

Started in 2011, the renovation program in Les Moulins is planned over 12 years, as a first step of a larger development in the Nice Eco Valley district, to be completed within 20 years (see Figure 3 and 4).

Figure 86 : Overview of Les Moulins area before renovation (source: MNCA))

Figure 87 : Les Moulins area after renovation (source: MNCA)

Grand Arenas

The new international business district of the Nice Côte d'Azur metropolis will be that of the “Grand Arenas”. The Grand Arenas represents a highly strategic sector, at the gateway to the city of Nice and in the immediate vicinity of Nice Côte d'Azur international airport. Its articulation with the international airport and the future multimodal exchange hub of Nice-Airport gives it exceptional accessibility and rapid connections with the whole of the Eco-Valley and the metropolitan area. To the existing tertiary site of 10 hectares, a complementary area of 49 hectares will be added, corresponding to potentially 700 000 m² of new floors-pace (see Figure 5).

Within the Eco-Valley, the goal of the Grand Arenas is to create a lively, innovative and eco-friendly neighbourhood, as the two driving principles of the new international business centres are urban diversity and eco-exemplarity. In addition to the offices and other facilities, a diversified housing offer is ensured (social mix), accompanied by services, shops, hotels or public facilities. The first development phase will be realized by 2021, achieving up to 140.000 m² of new mixed developments.

Figure 88 : Plan of the Nice Grand Arenas project (source: EPA plaine du Var)

6.1.2. Main activities and timeline

Measure 1: Public awareness campaign Air Quality :

Measure 1: Public awareness campaign Air Quality :

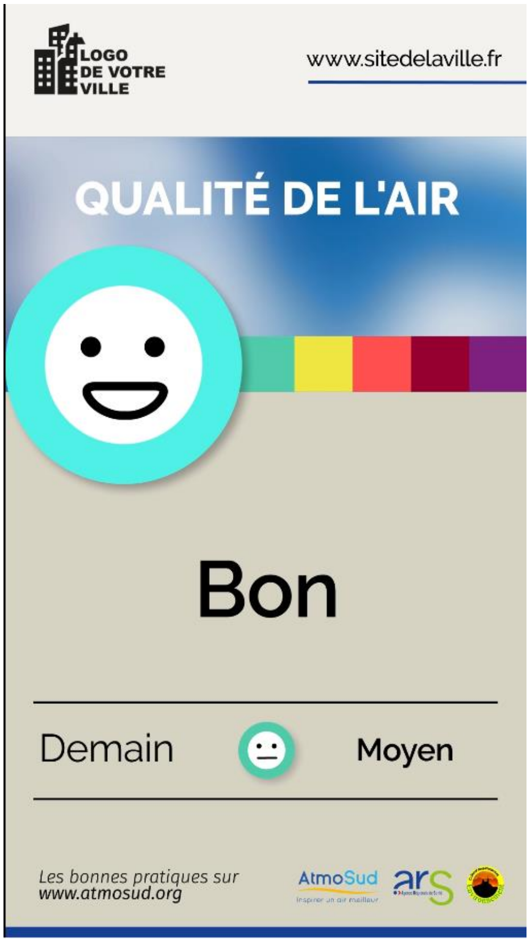
AtmoSud has scheduled an important awareness campaign for Air Quality for the city of Nice. Digital panels have been identified. Why digital numerical panel ? Digital signage is a communication tool that allows you to display any kind of content on a screen: text, images, videos, rich content.
Our brain understands, identifies and remembers visual elements more easily than text or sound elements. Studies by the American psychologist Jerome Bruner lead to the following figures: we retain 10% of what we hear, 20% of what we read and 80% of what we see and do. It is therefore images, videos and interactive content that have the best chance of being remembered. If static displays can display images, only digital signage screens can display videos or rich content.

- 75% of people remember a dynamic display
- 44% remember a static display

Compared to other broadcasting channels, digital signage also shows excellent performance. A message broadcast on the radio has a recall rate of 27% and a static outdoor display a recall rate of 30%. A message broadcast on television reaches 32% and 52% for a message broadcast on dynamic display screens. Thanks to the animation of the contents, but also to the possibility of precisely targeting a place or an audience, digital signage is extremely effective. 47% of people who have seen advertising on a digital billboard still remember it precisely 30 days later.
Digital signage is also a very attractive tool: 70% of people look at the displays on outdoor digital panels, compared to 43% of advertising content on the Internet, and 41% on Facebook. In addition to its attractiveness, induced by the possibility to animate the displays and the strong luminosity of the panels, this type of display is also appreciated by consumers and passers-by. Indeed, they can access up-to-date information (compared to posters), interact with the screens and get the information they want.

The city of Nice is equipped with 40 digital panels allowing a dynamic digital display. These panels are dedicated to general interest and advertising. The Metropolis of Nice Cote d'Azur has agreed to display information messages on air quality. A major campaign was planned for June 2021. The French regional elections in June 2021 have postponed the planned information campaign until the end of 2021.
The city of Nice is involved in digital information campaign called "RESPIRE". It deals with 3 specific themes: nature in the city, soft mobility, energy savings. These themes may be related to air quality information. It is therefore proposed that there be a synergy between the IRIS citizen information campaign and the "RESPIRE" information campaign. The digital panels are managed by a subcontractor: Jean Claude Decaux. Examples of animations have been developed and allow to display 2 pieces of information: the air quality index and a citizen commitment message. (see figures below). The logos must be modified (logo IRIS + Europe + logo NCA) and the contents validated by

the communication service of Nice Cote d'Azur. The citizen engagement messages were prepared by AtmoSud and communicated to NCA.



5 seconds

5 seconds

Once the information, awareness and citizen engagement campaign is underway, the number of people reached can be estimated (KPI). In parallel, surveys on citizen engagement will be conducted to verify the impact of the IRIS communication campaign on air quality.
Several thousand citizens of NCA should be aware and should be able to receive messages about their civic commitment to act.

Measure 2: Public awareness campaign Energy – School & Collège; Youth & Family :

Due to covid19, the schedule and the public target of this measure had to be changed.

Axis 1 - USAGE AWARENESS - COMPREHENSION AID

- ⇨ **SCHOOLS AND COLLEGE**
- ⇨ **ADULTS AND FAMILY : SMART FLAT – SOCIAL GROCERY STORE**

SCHOOL :

Initially, a first project should be implemented with schools in the Priority Education Zone. This project was builted around renewable energies with the manufacture of a model showing the different renewable energies in schools.

Initial program :

- ✓ 3 primary schools with each 4 classrooms were agreed for the IRIS program to begin in September 2020.

Target : Cycle 2 et 3 (7 to 10 years) - The schedule of the program was :

1. Increase the knowledge of energy in general –
   Duration: 1 sessions per class of 1h30
   How it's produced, transported, delivered…
2. Presentation of 4 renewable energy –
   Duration: 1 sessions per class of 1h30
   solar, wind, biomass, water
3. Focus to 1 renewable energy by school
   Duration: 2 sessions per class of 1h30
   This step will allow the new knowledge acquired during the first two stages to be applied directly and eco-gestures to be addressed via virtual game, or role play.

Figure 89 : e.g. of game for Energy Behaviour

4. From theory to reality - build of a 3D model – one by classroom.
   Duration: 2 sessions per class of 1h30

Figure 90 : e.g.: 3D models built by children

5. Presentation of 3D model during a special day of Energy with parents.
   Duration – one afternoon

NEW PROGRAM :

In France, the health crisis due to COVID made impossible the implementation of the initial project.

The schools were closed for 4 months (march2020/july2020). Then, at the start of the 2020/2021 school year, the restrictions on interventions in schools did not allow the project to be implemented.

So the project was reoriented towards children coming to the ADAM leisure center in the Moulins area and around the creation of advertising posters on energy savings.

TARGET PUBLIC :

- Age : 6 to 11 years.
- Numbers of children : 3 teams of 20 children.

The schedule of the work is :

⇨ 8 workshop : schedule from July 2021 to December 2021.

COLLEGE :

For the same reasons, the interventions in the college were not allowed either.

We have reoriented the actions toward the teenagers attending the ADAM Association leisure center :

- Co-creation of a communication flyer about heating and "ecogestes".

ADULTS AND FAMILY : SMART FLAT – SOCIAL GROCERY STORE

In order to reach families also, the approach is to utilize an existing structure in the neighborhood to which many families adhere: the "social grocery store".

This grocery store offers families food and hygiene products at very modest prices.

ADAM's family mediation unit manages this structure and home economics or cooking workshops are regularly organised for groups of adults, mostly women.

The grocery store room looks like a house and contains the various household appliances found in a home (oven, fridge, lamps, hotplates, computer, television, etc.).

For IRIS, the aim is to offer specific workshops focusing on energy in the home.

Axis 2 - AWARENESS OF INDIVIDUAL ACTS / COLLECTIVE FEEDBACK

YOUTH – 15 -18 years old – I like my substation

I like my sub-station : The association ADAM has a program of extracurricular activities that it sets up during the holidays. In order to awareness teenagers, 14-16 years old, to the Energy saving, it appears more relevant to explain them at first the specific aspect of their owned living area.

Visit of the central heating production and sub-station for delivery heating and hot water.

Before the visit, to capture public attention, a teasing is made with 2 surveys : one about energy, one about technical aspect. The answers are given during the visit by the technical professional Cofely. A shared lunch finish the activity.

These action are progressing as foreseen and almost achieved.

Due to covid19, the schedule has been shifted by 6 months and the actions will be completed on 31/10/2021.

Measure 3: Citizens individual engagement - IOT invoices

⇨ **FAMILY living in a collective building with common network of hotwater and heating**

In 2019, the lessor CAH developed an internal portal for all the tenants of its buildings in Nice. This portal allows tenants to dialogue with the Landlord, to visualize and pay their rent including their heating, hot water and cold water bills.

In addition to the grouping of invoices, we wanted to work on consumption data and process it electronically to deliver an individual report to each tenant. This report shall be elaborated with voluntary tenants in order to meet their expectations.

In addition, on the website, messages should be delivered on the good practices to adopt within a dwelling to reduce its energy and environmental impact.

This measure is still planned but we are having difficulties in implementing it.

Due to Covid, we were not authorized to organize information meeting with the tenants in a public area. This measure requires meetings to collect the agreement of the inhabitants, co-create the web application with future users. Most tenants were particularly frightened by the health crisis and were not receptive to door-to-door attempts.

By September 2021, the sanitary situation is become normally, it is expected to be deployed.

6.2. Implementations

6.2.1. MEASURE 1 : ATMOSUD

AtmoSud carried out a co-construction process with Master students from Nice Sophia Antipolis University. Two groups of MASTER students (MASTER COMEDD and MASTER DISTIC) realized a work on the citizen commitment in connection with the air quality.

MASTER DISTIC (https://univ-cotedazur.fr/offre-de-formation/distic-digital-studies-information-et-communication)

Air pollution awareness work requires, as stated in the SWOT analysis, online awareness campaigns, but also on the ground with technical tools, making it as easy as possible to understand. However, with the health crisis, doing events to raise awareness and find out the level of student engagement seems very difficult. Knowing that AtmoSud has a digital terminal, the question is: **How can we convert this digital terminal into a tool to raise awareness and engagement on air pollution among Nice students, while taking into account the COVID-19 health crisis ?**

Targets

The main target is the students of Nice in the Provence-Alpes-Côte d'Azur region. The age range varies between 18 and 26 years. The students, less affected until now, will be the actors concerned by the awareness campaign. It will therefore be an inter-student event, followed by a survey (https://docs.google.com/forms/d/e/1FAIpQLScK6pgaejhZu9dmE-84EqDyW8Pd-1azB0D3ResYV37cX--zoA/viewform), organized in faculties and private schools. Their motivations would be related to the world of ecology and well-being, the free services of AtmoSud and the organization of inter-student projects. The obstacles would be the university slump and the pandemic period which constrain the travel and the presence of the students, some concepts such as the proposed survey which can seem quite intrusive or not very innovative and the low notoriety of AtmoSud. With few students present in the faculties and schools and the lack of awareness of the AtmoSud association, the use of social networks seems obvious. Although students are the main target, there are also secondary targets such as teachers present on campus, journalists who will cover the event, students' families.

Objectives

The objectives of the survey we conducted is not only to facilitate and know the rate of engagement of students in the fight against air pollution. The survey will allow us to collect data on the digital terminal that will be made available to participants during the event. And then, use this data to set up communication and awareness actions. But also, share this survey on digital platforms to compensate for the lack of students on campus and to have the maximum data. Propose alternative online solutions to fight against air pollution.

More broadly, the planned communication actions will aim to raise awareness of air pollution issues and arouse students' curiosity. This will encourage them to change their behavior and communicate in turn within their families and with other students. This will allow us to promote and measure the rate of engagement, collect data in order to set up communication and mediation actions. In terms of brand identity, this is an opportunity to develop AtmoSud's visibility, make its role and actions visible. Finally, we will propose innovative digital solutions.

Short-term actions

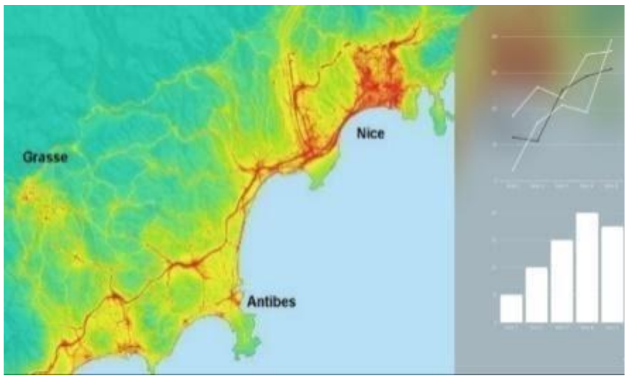
Survey: This anonymous questionnaire was completed by nearly **100 students** in order to extract representative statistics. Our objective, beyond this data collection, was to perceive the degree of awareness and commitment of students regarding air pollution. The survey lasted 5 minutes (about 10 questions) and was proposed online via the Google Form tool. It was relayed on the student messaging system and on student Facebook pages. We obtained results from all horizons, as many men as women, first year students as well as fifth year students. We notice that a majority of students are concerned about the environment, without always really knowing how to do it. According to them, it is mainly the industries and the automobile which pollute. Finally, we note that they generally do not know AtmoSud. This is why more communication actions could be envisaged.

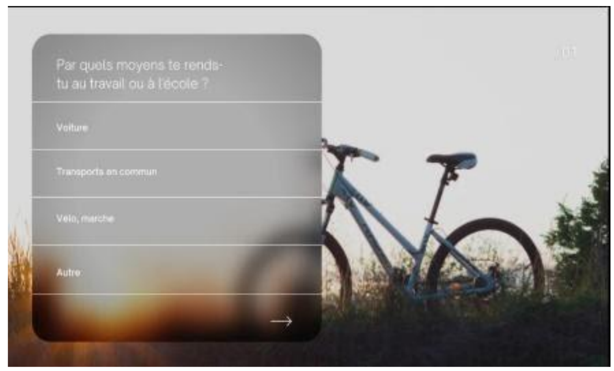
Long-term actions

To improve the notoriety of the association and to spread the communication and the sensitization on the air pollution, we propose you several actions of communication.

Functionalities of the digital terminal :

The touch digital terminal of AtmoSud is a tool on which one can use and work on several software because it is like a computer. However, to be able to work on this digital instrument, it is necessary to feed it by installing what you need to carry out your various activities and your various projects. It is in this perspective that we propose you the installation of tools which seems relevant for the association in a short, medium and long term. In the short term, we propose the installation of the map indicating the level of pollution in real time, in order to know which are the places where there is the most pollution, the causes and the consequences of that. And therefore find solutions to reduce pollution. In the medium term, we recommend a connected mirror showing the negative consequences of pollution on the human face and quizzes in the form of a game on human activities related to pollution, especially transport. This is to collect data and deepen the analysis of pollution control.





In the long term, we suggest the creation of an interactive and fun game application to show the causes and consequences of air pollution and to provide advice on how to reduce air pollution as much as possible. This game takes the form of a quiz with single choice questions on the modes of transport used in particular, the commitment of people in the fight against pollution.

Event-based actions:

The event communication follows regulations and technical and logistical constraints, proposes animations relevant to the target audience, an adequate decoration and sometimes takes care of the catering (buffet) and the security. We will try to propose the most adapted solutions of scientific mediation and data collection for the organization. An event is divided into three temporal parts: the preparation of the event, the D-day and the evaluation phase that follows. These three stages take place more or less as follows. Upstream, it is necessary to communicate about the event at least six months beforehand. To do so, it is necessary to set up a web and print campaign (posters and flyers to be placed in strategic points such as universities or nearby cafés-bars). It is also necessary to prepare visuals, distinctive signs such as AtmoSud t-shirts and goodies to be distributed (pens, key rings, etc.), to recruit staff, and to foresee hygiene and safety measures if necessary. On the day of the event, the team will set up the event, take pictures and videos and set up a reward system for the participants (goodies, buffet, etc.). Afterwards, the team makes a qualitative and quantitative assessment of the event and can publish, on social networks and on its website, posts related to the event or an Aftermovie, i.e. a film that would summarize the past event with the aim of arousing the emotion and commitment of participants. For an optimal communication, we recommend AtmoSud to organize three events per year.

Some key events will further raise awareness among the student target group and develop AtmoSud's visibility. First, AtmoSud can ensure its presence by participating in local festivities. These festivities include science festivals in October (such as the one organized on the Valrose campus) and local festivals such as Play Azur (February, a science and fiction convention that highlights workshops and conferences) and the Pint of Science (May, scientific exchanges in bars). During these events, AtmoSud could prepare lectures and large quizzes through the interactive online application Kahoot. In this perspective, AtmoSud would create events outside of its premises in order to reach directly the student target, who is fond of this kind of events. Secondly, scientific events generally consist of science cafés, either in person or live via YouTube, Twitch or Zoom platforms. The latter would include exchanges with researchers and speakers as well as concrete experiments or demonstrations since air is painless, colorless but it is not a vacuum, which we could easily demonstrate through experiments similar to those of the Petits Débrouillards (odors, breath and wind, smoke, colorizations, etc.). The third type of event that would be appropriate for AtmoSud is based on partnerships with universities and other schools and local associations that could make their own premises available, especially through the creation of tutored projects, partners with whom the team could run workshops, scientific "treasure hunts" or training booklets. Other events are more about collecting and sharing data. A key example is the micro-trottoir which relies on interviews of researchers in-house or in Universities, but also of students directly on campuses, equipped with a microphone, a camera and measurement stations to be tested (concept "Learning by doing"). AtmoSud should set up a contest, relayed on the university messaging system and social networks by creating a hashtag #ProtegeTaPlanete or #PlaneteAtmosud on Instagram and Twitter, in which students could send a photograph of their journey to class. The student posting the most aesthetically pleasing or relevant photograph would win a prize related to the issues of the contest such as a camera or a measuring station, as well as products regarding the protection of strong and explicit message arranged in the middle of the street, set up via a visualization of the effects of air pollution. This could be a giant sculpture of cotton lungs, the environment and organic products. The most striking event actions are street marketing actions. We recommend AtmoSud to implement one in the coming years. They consist of a car whose color would become gray over time or a car with a giant black bubble coming out of the exhaust pipe, presenting statistics on CO2 emissions by cars and their impact on our health and our planet. It is also possible to conduct a survey using a survey ashtray, which allows both waste reduction and data collection in the form of a game. Above these ashtrays would be a question, such as "How do you get to class?" with one ashtray corresponding to the answer "Car," another for "Public transportation," and a final one corresponding to the answer "Walk, bike.

Off-line communication

The university radio: Radio-Campus-Carlone.fm

Presentation of the radio: In order to reach our objective of sensitization of the students in relation to the atmospheric pollution, and in order to allow a better circulation of information and knowledge and to dynamize the life of the university community. We are considering in our communication strategy, the creation of a radio station driven by students for a student audience, in particular. Our radio station will be called Radio-Campus-Carlon.fm and will be broadcast from a workshop that we will set up in one of the rooms of the Faculty of Arts and Humanities at the University Côte d'Azur. The radio will also be broadcast online on the official website of the UCA.

The main objectives of the station will be :

- To stimulate an exchange of information within the university community;

- To share the state of air quality in Nice with the university community on a daily basis;

- To organize seminars and meetings, as well as to share knowledge, especially research and discoveries related to air pollution;

- To put at the disposal of the students in communication an audio-visual workshop allowing them to have a practical approach of the media.

Regarding its implementation. First of all, and within the framework of the agreement between ATMOSUD and the university, we will ask the university to provide a broadcasting room. This room will be the headquarters of the radio-Campus-Carlone.fm. Thus, within the framework of the same convention, we will propose to ATMOSUD to take charge of the supply of the necessary equipment for the installation of a radio station according to a detailed estimate (see the estimate of the radio). Then, we will propose to the students, in particular the students in communication and media to take in charge the management and the broadcasting of the radio programs. This will be for bonus points (+ 0.25 on each semester GPA). The students who intend to participate and take charge of the management of the station, will be invited to propose a quarterly program for the radio.

6.2.2. MEASURE 2 : Cofely

SCHOOLS :

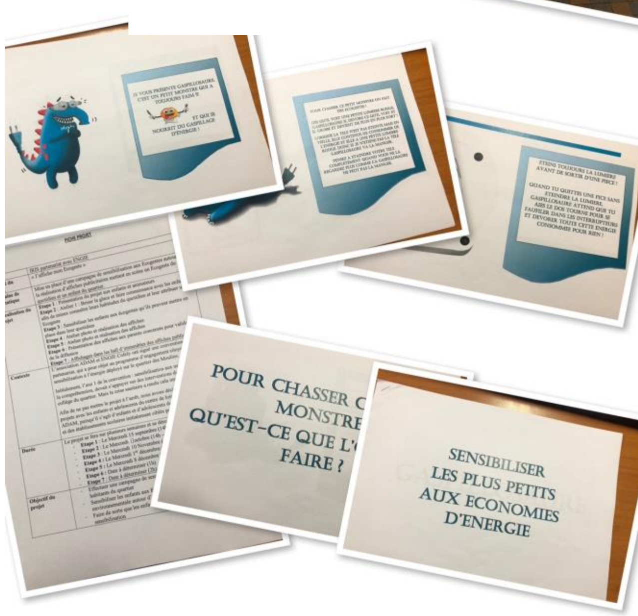
<u>Schedule :</u>

8 workshop : schedule from July 2021 to December 2021. Work in progress.

DATE	ATELIERS
September 2019 /march 2020	**Creation of the project around renewable energies**
NEW PROJECT	
15/09/2021	**Workshop 1** : Definitions (energy savings, energy waste, etc.) Presentation of the project to children Animation I learn energy (smartchef la maison toquée)
13/10/2021	**Workshop 2 :** Get to know the children, in order to better know their daily habits and that they choose an Ecogeste
10/11/2021	**Workshop 3 :** Continue the group work, reflect on the staging of the posters and ecogests assigned
01/12/2021	**Workshop 4 :** Shooting photo and realization of posters

08/12/2021	**Workshop 5 :** Shooting photo and realization of posters
17/12/2021	**Workshop 6 :** Presentation of the posters to the parents concerned for validation of the distribution
January 2021	**Workshop 7 :** Displays in building lobbies of posters
January 2021	**Workshop 8 :** Assessment of the action/return of families
TOTAL	**8 new workshop / Beneficiaries : 2417 flats**

Workshop for ADVERTISING POSTER



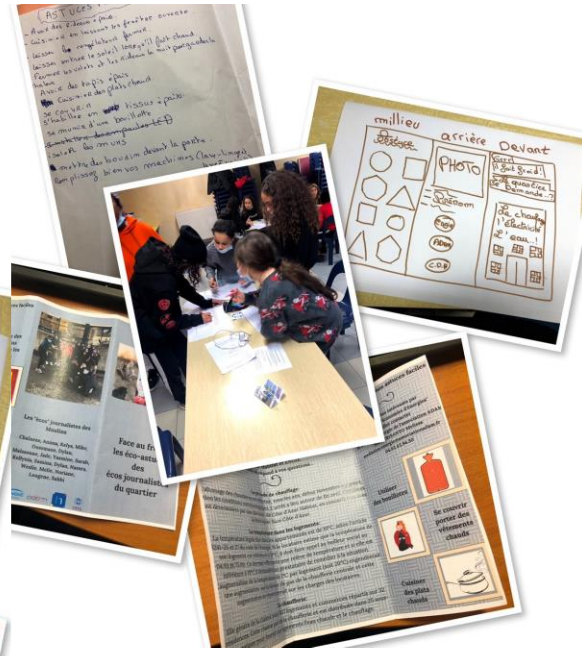
COLLEGE :

Schedule :

DATE	ATELIERS
28/10/2020	**Workshop 1** : Project presentation, Brainstorming to find a name for the project, prepare the micro-sidewalk
29/10/2020	**Workshop 2 :** Visit of the boiler room, Micro-sidewalk, shared meal with JALE animation and sorting of the questions listed
04/11/2020	**Workshop 3 :** Answers to the questions identified during the micro-sidewalk with ENGIE technicians
02/12/2020	**Workshop 4 :** Reflection on the construction of the booklet
21/12/2020	**Workshop 5 :** Realization of the booklet
Janvier 2021	**Workshop 6 :** Editing of the booklet based on the ideas and drawings of the teens
February 2021	Validation of the booklet by the Engie & CAH
September 2021	Printing of the booklet
20/10/2021	**Workshop 7 :** Presentation by teenagers of the booklet produced to partners
29/10/2021	**Workshop 8 :** Distribution of the booklet in all CAH residences
3/11/2021	**Workshop 9 :** Distribution of the booklet in all CAH residences
24/11/2021	**Workshop 10 :** Assessment with the inhabitants to know their feelings about the booklet (micro-sidewalk)
TOTAL	**Beneficiaries : 2 417 flats**

Workshops :


ASTUCES POUR SE Réchauffer
millieu
arrière
Devant
PHOTO


millieu
arrière
Devant
PHOTO

Booklet :

Avoir chaud nos astuces faciles

Mettre des boudins derrière les portes

Fermer les volets la nuit

Laisser entrer le soleil lorsqu'il fait chaud

Mettre des rideaux épais aux fenêtres

Les "écos" journalistes des Moulins

Chaïneze, Anissa, Kelya, Mike, Oussmane, Dylan, Maïssoune, Jade, Yasmine, Sarah, Kellynia, Samina, Dylan, Nassra, Weslie, Melie, Noriane, Lougene, Sahbi

adam

IRIS

Face au froid les éco-astuces des écos journalistes du quartier

La jeunesse, ENGIE et leurs idées de génies

Avec l'arrivée de l'hiver et du froid, il est important de communiquer autour du chauffage.
Les petits journalistes des Moulins sont allés à la rencontre des habitants pour recenser leurs questions et y répondre avec les équipes techniques de Côte d'Azur Habitat et ENGIE.
Aujourd'hui, on répond à vos questions...

La période de chauffage:
L'allumage des chaudières est effectué, tous les ans, début Novembre ou avant, selon les conditions météorologiques. L'arrêt a lieu autour de fin avril. Ces dates sont déterminées par une décision de Côte d'Azur Habitat, en concertation avec la Métropole Nice Côte d'Azur.

La température dans les logements:
La température légale due dans les appartements est de 19°C, selon l'article R241-26 et 27 du code de l'énergie. Si le locataire estime que la température de son logement est inférieure à 19°C, il doit faire appel au bailleur social au 04.93.18.75.00. Ce dernier effectuera une relève de température et si elle est inférieure à 19°C il demandera au prestataire de remédier à la situation. L'augmentation de la température de 1°C par logement (soit 20°C) engendrerait une augmentation sur la facture de gaz de la chaufferie centrale et cette augmentation se répercuterait sur les charges des locataires.

La chaufferie:
Elle génère de la chaleur pour 2417 logements et commerces répartis sur 32 bâtiments. Cette chaleur part de la chaufferie et est distribuée dans 25 sous-stations pour fournir aux logements l'eau chaude et le chauffage.

Avoir chaud nos astuces faciles

Si vous êtes intéressés par des ateliers "économies d'énergies" veuillez contacter la médiatrice énergie de l'association ADAM
Mme CRISANTO Melissa
mediation.energie@associationadam.fr
04.93.83.94.30

Utiliser des bouillotes

Se couvrir porter des vêtements chauds

Cuisiner des plats chauds

ADULTS AND FAMILY : SMART FLAT – SOCIAL GROCERY STORE

Schedule :

Date	Workshops
16/01/2020	Energy transition
30/01/2020	Energy transition
26/05/2021	Water a rare energy
9/06/2021	Water a rare energy
15/07/2021	The energy cost of food waste
22/07/2021	The energy cost of food waste
16/09/2021	The Electrical consumption at home
TOTAL	**7 Workshops**

Workshops

7.1.1.1. YOUTH – 15 -18 years old – I like my substation

4 sessions have been implemented with a large public.

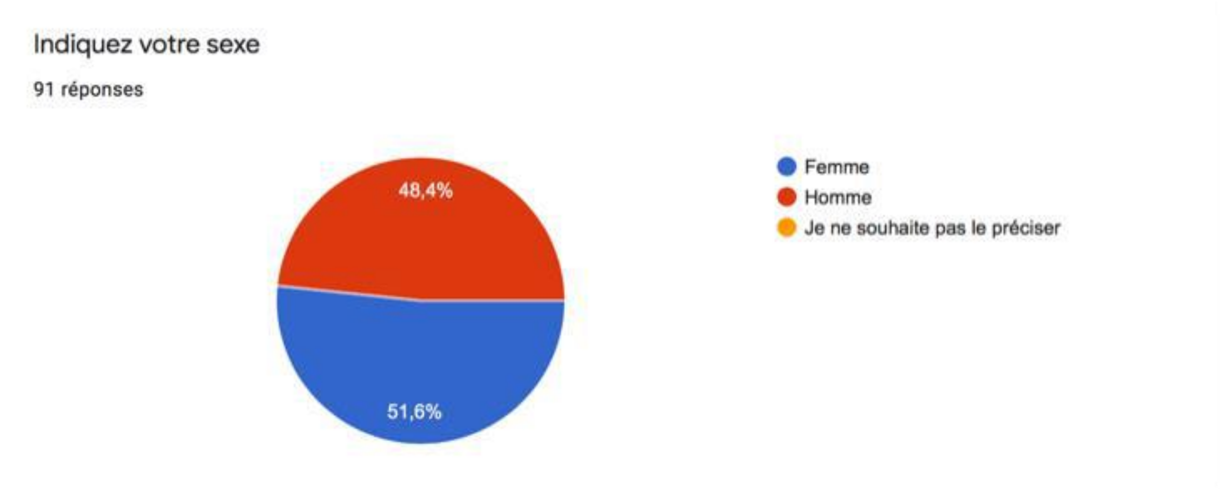
DATE	Workshop	Number / Age
18/02/2020	Site visit / workshop with youth (usage of Time's up energy)	12 adolescents / 12-17 ans
09/07/2020	Site visit / Burner ignition procedure/ Boiler room questionnaire understand network specificities	10 adolescents / 12-17 ans

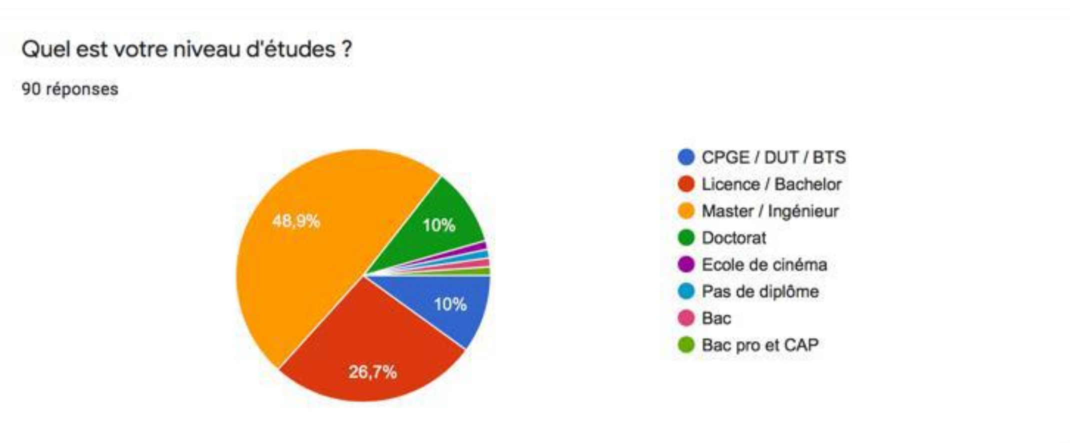
07/10/2020	Site visit / Burner ignition procedure/ Boiler room questionnaire understand network specificities	16 enfants / 6 - 11ans
29/10/2020	Site visit / Burner ignition procedure/ Boiler room questionnaire understand network specificities	19 adolescents / 12-17 ans
TOTAL	**4 visits**	**57 Beneficiaries**

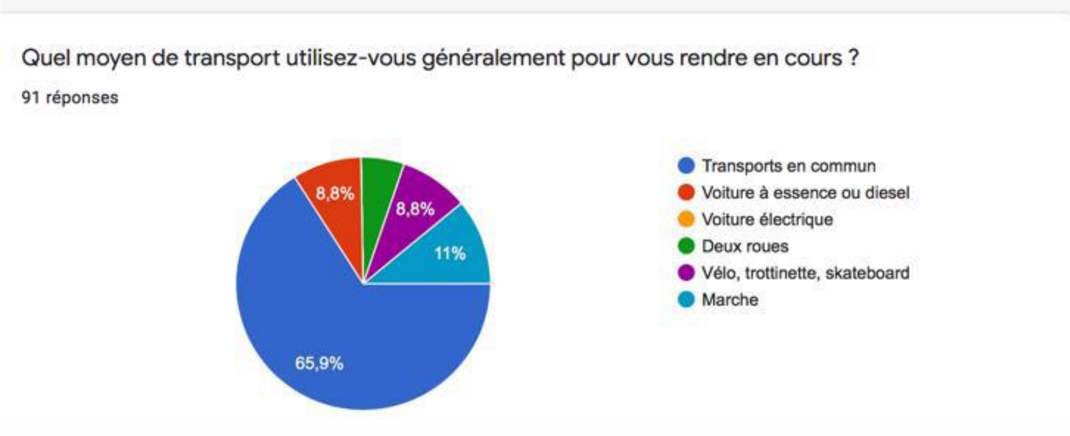
6.3. Preliminary results

6.3.1. Preliminary results MEASURE 1 : ATMOSUD

Results of the survey conducted among more than 100 students of the University of Nice Sofia Antipolis

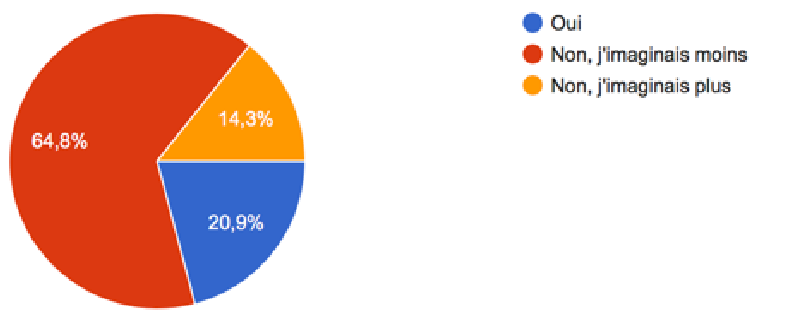






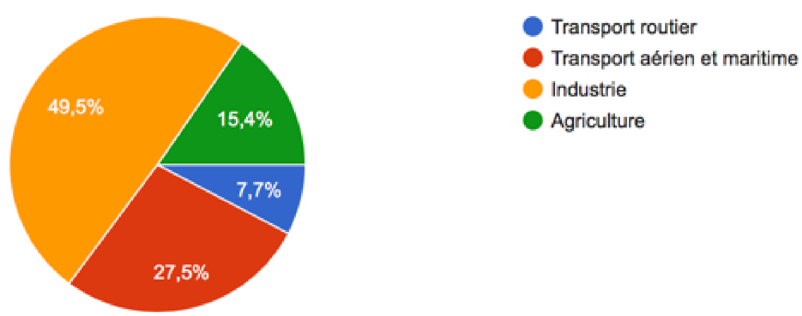
En France, un décès sur cinq est dû à la pollution de l'air. Le saviez-vous ?

91 réponses



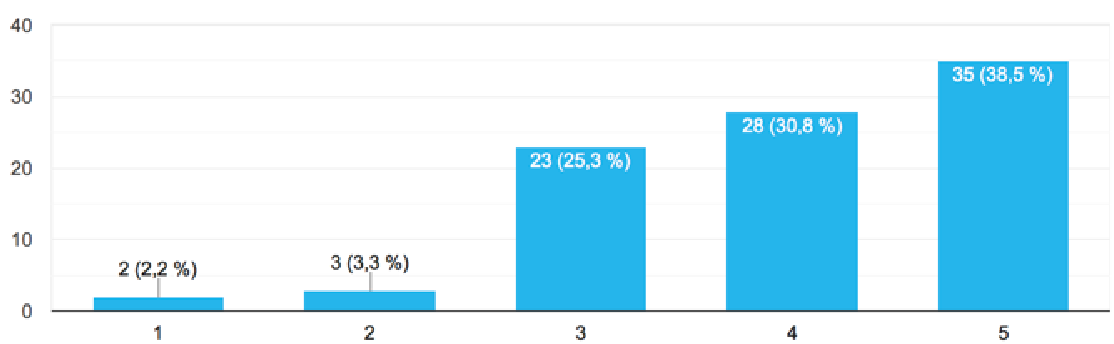
Selon vous, quel secteur pollue le plus ?

91 réponses



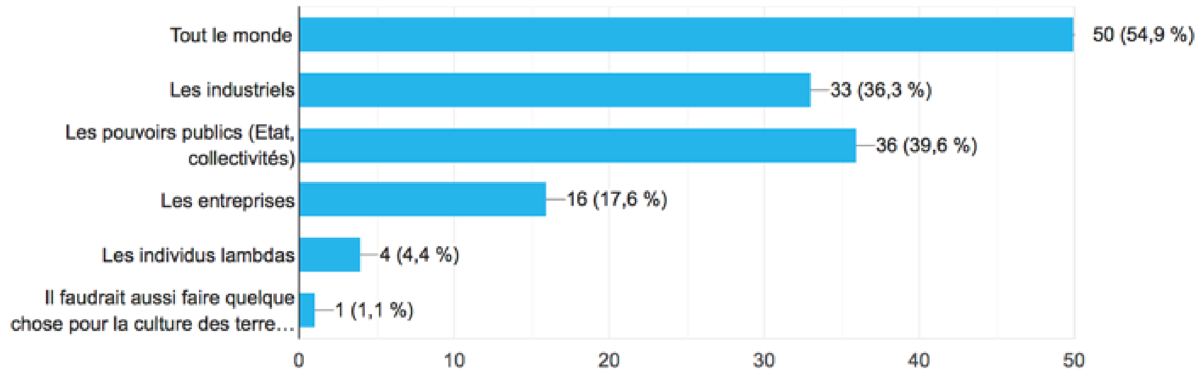
Sur une échelle de 1 à 5, à quel point vous sentez-vous concerné(e) par les problématiques environnementales ?

91 réponses



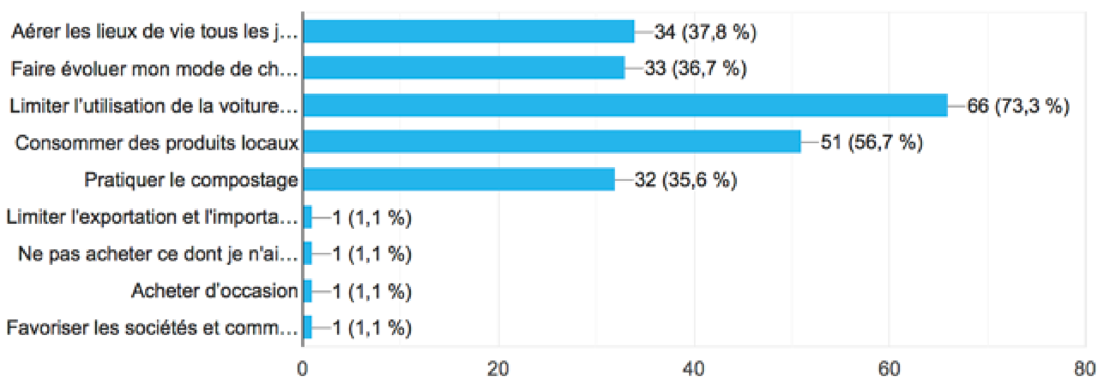
Selon vous, quel acteur doit agir en premier pour améliorer la qualité de l'air ?

91 réponses



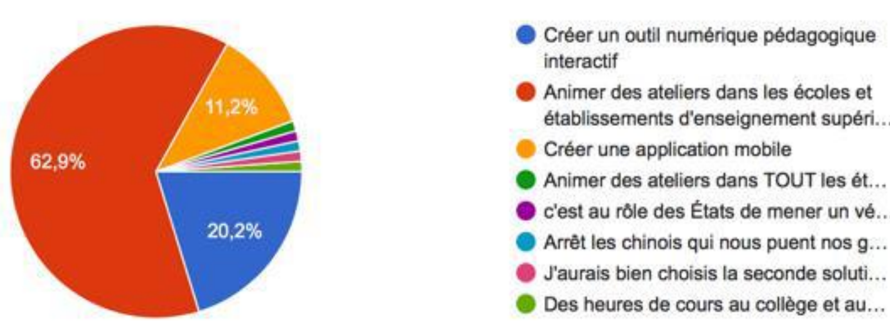
Quelles actions pourriez-vous mettre en œuvre afin d'améliorer la qualité de l'air ?

90 réponses



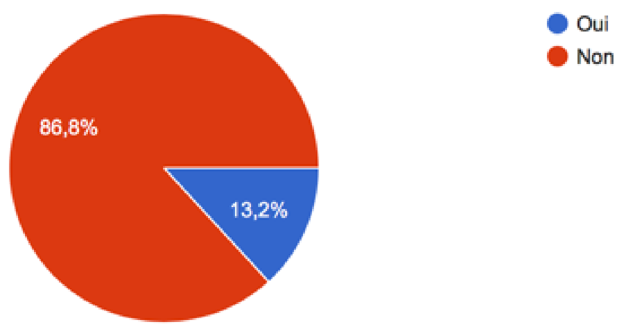
Parmi les propositions suivantes, laquelle vous semble la plus pertinente pour faire évoluer les comportements individuels ?

89 réponses



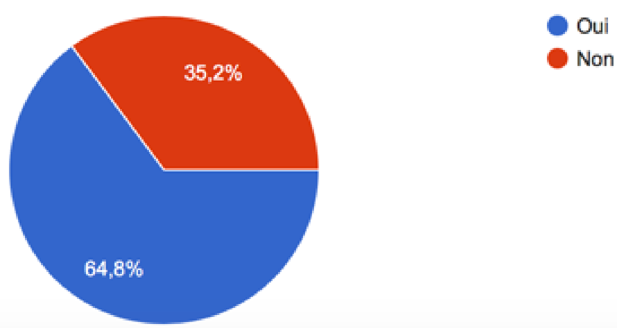
Connaissez-vous AtmoSud, l'organisme régional chargé de mesurer et surveiller le niveau de pollution de l'air ?

91 réponses



Après ce sondage, pensez-vous vous documenter sur la pollution de l'air, par curiosité ?

91 réponses



Avez-vous des commentaires, suggestions, écogestes ou solutions à nous proposer ?

17 réponses

Non

Non

non

Ils faut des solutions globales et mondiales car nous vivons tous sur la même planète. Demander aux autres pays de réduire leur pollution alors que certains dit très développé se sont bâtis en polluant l'environnement et continuent de le faire à travers leur industrie sans être sanctionné.

Je trouve votre recheche très important surtout ave ce changement climatique.
Votre recheche permettra de préserver notre environnement contre les catastrophes naturelles si nous respectons et combattons ensemble.
Vraiment votre recherche est à l' actualité.

Le monde doit ensemble agir pour faire face aux conséquences de la pollution.

les solutions sont politiques et idéologiques, on ne va pas sauver le monde par des actions individuelles.

6.3.2. Preliminary results MEASURE 2

The measures are encouraging and allow to mobilize the inhabitants around the notions of heating and economy.

6.3.3. Preliminary results MEASURE 3

Given that we cannot be able to implement these measure yet, we are not in a position to establish a preliminary result.

6.4. Business models and exploitation

Given that we cannot measure the financial impact of these measure in terms of savings, we are not in a position to establish a business model.

6.5. Lessons learned and next steps

The main lessons learned during the described implementation phases are the followings:

- In a sanitary context normal, we must work well in advance with all stakeholders to gain their support and build the project together.
  The stakeholders are Directors of school, Coordinator "REP+ Educational Area", Teachers, Parents, Childrens…
- The administration is quite difficult to convince and it takes time.
- Working with associative organizations has allowed us to implement actions much faster and to reach like even a large number of children and adolescents.

The next step is to finish the action of the different measure planned untill the end of December 2021.

7. Preliminary Results at the Lighthouse City Level

7.1. Impact on the Lighthouse City Level

The conclusion of the whole, is that all the robotic actions could be maintained thanks to the remote work of each party and the citizen actions had to be stopped. The CPB allowing the 6 months delay have been accepted and are more than necessary to lead the projects until their goals. The changes into the ecosystem, departure of the Chief project officer in 2019, year 2, and then of the executive chief officer Alain Chateau year 3, and the arrivals of the two new leaders, year 3, into the project and within the covid context was not that easy in terms of tracking of the project.

The change of partners on the citizen engagement part, from Veolia to Engie and Atmosud, have already registered 2 years delay. They entered may 2019 and met the Covid 19 lockdown a year later... 12 months to build and almost none to explore.

The stop of meetings, the lack of interactions, the fact of not being able to travel anymore, to cancel events, converged to lowered the general coordination.

But situation is evolving, thanks to the sanitary pass, citizens can live almost normally and all the activities are now undertaken their progress. To let you go deeper in each part, please find below their actions done and foreseen. We therefore, would like to underline the involvement of our advisors to keep us motivated and to help us in order to fill out the reports, explain our partners the expected results and to build a friendly professional community !

7.2. Preliminary Results at the Lighthouse City Level

The establishment of demonstrators on the territory of the Metropolis has already made it possible to obtain results but also to learn lessons from these implementations.

Thus, we can already noted that:

TT1: The PV installation on the IMREDD building demonstrates a gap between actual and theoretical production, but also highlights the impact of shading and dust on the installation as well as the importance of maintenance.

The installation of the sensors in the apartments of the towers of the Moulins district has raised the problem related to the behavior of users who degrade or move the equipment with the aim of biasing the sensors and overheating.

The realization of the Dashboard highlights the importance of using simple vocabulary and setting up graphical interfaces in order to convey messages more easily to the population.

TT2: Data collection and EMS are operational on both buildings. The implementation of this demonstrator has shown us the difficulties of working on different and closed systems and required additional work in terms of coordination.

The IMREDD and Palazzo buildings are now connected to the DHCN network which will be fully operational shortly.

The second life battery demonstrator shows the difficulties in finding components for the implementation of such a system

TT3: Despite a complete restructuring of the demonstrator compared to the initial commitment, the planned measures are progressing well. We have now been able to learn lessons from our pitfalls. In particular, the difficulties of implementing such a device on an existing network (obsolescence of installations, upgrading, etc.) which generates additional costs and additional delays. It also showed the need to have a global vision on the future deployment of charging stations.

TT4 : The data collected by the various demonstrators made it possible to develop visual tools which are available to visitors, students and delegations within the IMREDD SCIC.

7.3. Next Steps

The next stage of the project will enable the data to be analysed in order to make the best use of the demonstrators, but also to imagine new services that could be implemented based on these.

A reflection will be undertaken on the replication of the solutions on the territory of the Metropolis with, in particular, a choice of demonstrators and the most appropriate zones because since the beginning of the project certain points must be updated.

The next steps will be to remove certain difficulties:

- Collective self-consumption agreement with Nexity
- Implementation of the Smartéo solution
- Launch of the air quality awareness campaign in line with the Metropole's policy