IRIS

Integrated and Replicable Solutions for Co-Creation in Sustainable Cities

Project Acronym:	IRIS
Project Full Name:	Integrated and Replicable Solutions for Co-Creation in Sustainable Cities
Grant Agreement:	No 774199
Project Duration:	5 years (starting 1 October 2017)

Deliverable 6.3

Launch of T.T.#1 activities on Smart renewables and near zero energy district (Nice)

Work Package:	WP6: Nice Lighthouse City demonstration activities
Task:	T6.3: Demonstrating Transition Track #1: Smart renewables and near zero energy district
Lead Beneficiary:	CSTB
Due Date:	30 September 2019 (M24)
Submission Date:	10 January (M28)
Deliverable Status:	Final
Deliverable Style:	R +DEM
Dissemination Level:	PU
File Name:	D6.3 Launch of T.T.#1 activities on Smart renewables and near zero energy district - Nice.pdf

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No 774199

Authors

Surname	First Name	Beneficiary
BARRE	Pierre-Jean	UNS-IMREDD
BOCHETAZ	Ludovic	NEXITY
BREITWILLER	Antoine	CSTB
CACCAVELLI	Dominique	CSTB
CHATEAU	Alain	NCA
CHEA	Delphine	COFELY
DE CANSON	Sophie	COFELY
GUIOT	Thierry	CSTB
HUERRE	Gael	COFELY
KEIM	Christian	EDF
QUINARD	Honorat	UNS-IMREDD

In case you want any additional information or you want to consult with the authors of this document, please send your inquiries to: irissmartcities@gmail.com.

Reviewers

Surname	First Name	Beneficiary
TSARCHOPOULOS	Panagiotis	CERTH
PEEKEL	Arno	Utrecht University/Utrecht Sustainability Institute
HUERRE	Gael	COFELY
CHEA	Delphine	COFELY

Version History

Version	Date	Modifications made by
0.1	15/05/2019	First draft
0.2	17/09/2019	Second draft
0.3	25/09/2019	Third draft
0.4	18/10/2019	Fourth draft further to CERTH review
0.5	22/10/2019	Fifth draft sent to reviewing
0.6	25/11/2019	Sixth draft sent to reviewing
1.2	19/12/2019	Final version to be released to the EC

Disclaimer

Executive Summary

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**.**

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 applied solutions concern integrating (1) a new concept (in France) of collective self-consumption at building scale combining a high share of locally produced solar PV electricity and a battery storage system to increase the self-sufficiency rate, (2) a new smart control system enabling to adjust the heat supply to the individual demand in each apartment, (3) an innovative commissioning process to measure the real energy savings after a building is refurbished , (4) a dashboard to raise environmental awareness of public local authority, customers or citizens about the deployed energy solutions at the district level.

Measure 1 will be deployed and tested in 2 positive energy buildings under construction connected to a district heating and cooling network powered by renewable energy. Measures 2 and 3 will be deployed and tested in two 17-storey apartment buildings that have been partly refurbished. Measure 4 will be developed and then tested in the Grand Arenas district.

24 months after the project was launched, much progress has been made but not all objectives have been achieved.

The two new positive energy buildings are almost built. They are expected to be delivered before the end of 2019 and the experimental campaign, to test the concept of collective self-consumption at building scale, can begin in due course, i.e. by March 2020 at the latest.

On November 2018, VEOLIA indicated to the Nice LH manager and to the Project Coordinator that they had the intention to withdraw from the IRIS consortium. COFELY had been consulted and was willing to take over the tasks from VEOLIA related to TT#1. On May 2019, the CPB agreed with the decision to replace VEOLIA by COFELY. This change of partner resulted in a significant delay in the implementation of Measures 2 and 3. To catch up, COFELY proposed a new action plan to test a smart control system enabling to adjust the heat supply to the individual demand in each apartment. This action plan, made of 3 different solutions, is going to be implemented step by step over the next 2 years (the first step corresponding to the first solution is already operational), tested and assessed using the commissioning method developed by CSTB.

Implementation and testing of Measure 4 (the dashboard) is delayed. This is due to the fact that the low-temperature urban heating/cooling network is still a project and will not be realized until commercial success is guaranteed, i.e. as long as various buildings commit to connect to this network. The actual official development plan of the network is as follows: delivery of the recovery system, first network section with potentially 7 substations by 1st semester 2021. By end 2021, the second network section and 6 further substations should be delivered.

A full overview of all the demonstrators is given in Table 1 – Full overview of all the demonstrators in TT#1 – Nice LH.

Table 1 – Full overview of all the demonstrators in TT#1 – Nice LH

Demonstrator	In a nutshell
TT#1 - Measure 1	Brief summary: Measure 1 is based on a new concept (in France) of collective self-consumption at building scale combining a high share of locally produced solar PV electricity and a battery storage system to increase the self-sufficiency rate. Measure 1 will be deployed and tested in 2 positive energy buildings under construction connected to a district heating and cooling network powered by renewable energy
	Expected impact: Increase renewables: 360 kWp - Energy savings: 340 MWh/year – CO_2 reduction: 24 ton CO_2/year
TT#1 - Measure 2	Brief summary: Measure 2 is based on a new smart control system enabling to adjust the heat supply to the individual demand in each apartment of high-rise buildings. Measure 2 will be deployed and tested in two 17-storey apartment buildings that have been partly refurbished.
	Expected impact: Energy savings: 900 MWh/year – CO_2 reduction: 252-ton CO_2/year
TT#1 - Measure 3	Brief summary: Measure 3 is based on an innovative commissioning process to measure the real energy savings after a building is refurbished. Measure 3 will be deployed and tested in two 17-storey apartment buildings that have been partly refurbished
	Expected impact: Measure 3 will not provide any savings nor CO_2 emissions reduction but will offer a set of smart services to bridge the possible gap between forecast and measured energy performance.
TT#1 - Measure 4	Brief summary: Measure 4 is based on the implementation and testing of a dashboard to raise environmental awareness of public local authority, customers or citizens about the deployed energy solutions at the district level. Measure 4 will be developed and then tested in the Grand Arenas district

Demonstrator	In a nutshell
	Expected impact: Measure 4 will not provide any savings nor CO_2 emissions reduction but will allow awareness rising of the different users of the district, about low carbon district technologies.

Table of Contents

Executive Summary 3
Table of Contents 6
List of Figures 9
List of Tables....10
List of Abbreviations and Acronyms....11
1 Introduction 12
1.1 Scope, objectives and expected impact 12
1.2 Contributions of partners....13
1.3 Relation to other activities....13
1.4 Structure of the deliverable 14
2 Demonstration in a nutshell 15
2.1 Ambitions for TT#1....15
2.2 Demonstration area 16
2.3 Integrated Solutions in TT#1 20
2.4 Integration of Demonstrators 21
2.5 Deviations according to the Grant Agreement 21
3 Baseline / Drivers and Barriers 25
3.1 Baseline 25
3.2 Drivers and Barriers....25
4 Organisation of work 30
5 Measure 1: Collective self-consumption at building scale....31
5.1 Specification of the measure....32
5.1.1 Hardware 32
5.1.2 Software....35
5.1.3 Procurement of equipment and/or services 35
5.2 Societal, user and business aspects: 35
5.2.1 Citizen engagement 35
5.2.2 Business model 38
5.2.3 Governance....43
5.3 Impact Assessment 44
5.3.1 Expected impact 44
5.3.2 KPIs 45
5.3.3 Monitoring plan 46
5.4 Commissioning Plan 47
5.5 Implementation plan....48
5.5.1 Planning of activities....48
5.5.2 Planning of costs and (equipment) investments 48
5.5.3 Risk management 48
5.5.4 Progress achieved up to M24 52
5.6 Conclusion....52

6 Measure 2: Optimization of heating load curve 53
6.1 Specifications 53
6.1.1 Hardware 55
6.1.2 Software....57
6.1.3 Procurement of equipment and/or services 59
6.2 Societal, user and business aspects: 59
6.2.1 Citizen engagement 59
6.2.2 Business model 60
6.2.3 Governance....61
6.3 Impact Assessment 63
6.3.1 Expected impact 63
6.3.2 KPIs 64
6.3.3 Monitoring plan 65
6.4 Commissioning Plan 67
6.5 Implementation plan....67
6.5.1 Planning of activities....67
6.5.2 Planning of costs and (equipment) investments 68
6.5.3 Risk management 70
6.5.4 Progress achieved up to M24 70
6.6 Conclusion....70
7 Measure 3: Commissioning process from the design to the operation....71
7.1 Specifications 71
7.1.1 Hardware 71
7.1.2 Software....72
7.1.3 Procurement of equipment and/or services 75
7.2 Societal, user and business aspects: 75
7.2.1 Citizen engagement 75
7.2.2 Business model 75
7.2.3 Governance....75
7.3 Impact Assessment 76
7.3.1 Expected impact 76
7.3.2 KPIs 76
7.3.3 Monitoring plan 76
7.4 Commissioning Plan 76
7.5 Implementation plan....77
7.5.1 Planning of activities....77
7.5.2 Planning of costs and (equipment) investments 79
7.5.3 Risk management 79
7.5.4 Progress achieved up to M24 79
7.6 Conclusion....79
8 Measure 4: Dashboard....80
8.1 Specification of the measure....84
8.1.1 Hardware 84

8.1.2 Software 84
8.1.3 Procurement of equipment and/or services 84
8.2 Societal, user and business aspects: 85
8.2.1 Citizen engagement 85
8.2.2 Business model 85
8.2.3 Governance 85
8.3 Impact Assessment 86
8.3.1 Expected impact 86
8.3.2 KPIs 87
8.3.3 Monitoring plan 88
8.4 Commissioning Plan 88
8.5 Implementation plan 88
8.5.1 Planning of activities 88
8.5.2 Planning of costs and (equipment) investments 89
8.5.3 Risk management 89
8.5.4 Progress achieved up to M24 89
8.6 Conclusion 90
9 Summary on monitoring of KPIs 91
9.1 Expected impact 91
9.2 Aggregation of KPIs for each LH city 92
10 Ethics requirements 94
10.1 Overall lighthouse approach 94
10.2 GDPR compliance 94
10.3 Ethical aspects 96
11 Links to other work packages 97
12 Conclusions and next steps 98
13 References 99
14 Annex 1 - KPIs – detailed listing 100

List of Figures

Figure 1 - Relation of Deliverable D6.3 to other activities (source: Utrecht, mod by CSTB) 13
Figure 2 - Overview of the demonstration districts of Nice (source: MNCA) 16
Figure 3- Overview of Les Moulins area before renovation (source: MNCA)..17
Figure 4 - Les Moulins area after renovation (source: MNCA) 17
Figure 5 - Plan of the Nice Grand Arenas project (source: EPA plaine du Var)..18
Figure 6 - Land use plan of the Nice Méridia project - (D&A - Devillers et Associés) 19
Figure 7 - Rendering of the urban development in Nice Méridia after 2023 – localisation and contextualisation of the IMREDD and NEXITY case study buildings (source: UNS/IMREDD - modifications by EDF) 20
Figure 8 - Energy and data management system in the PALAZZO MERIDIA building (source BG21).........................36
Figure 9 - Energy and data management system in the IMREDD building...37
Figure 10 - Influence of the battery size on the self-sufficiency rate (in blue) for the PALAZZO MERIDIA building....38
Figure 11 - IMREDD's electricity consumption estimation during the year..39
Figure 12 - IMREDD's building electricity consumption distribution estimation..40
Figure 13 - Evolution of power and energy of the different components, for the days of 12th and 13th of January (source EDF – EDF S&F) 42
Figure 14 - Monotonic curves of the power extracted from the grid for the different hypothesis (source: IMREDD and EDF/EDF S&F)..42
Figure 15 - Governance – PALAZZO MERIDIA (source: PV-Financing project)...43
Figure 16 - Governance – IMREDD (source: PV-Financing project) 44
Figure 17 - Planning of activities – PALAZZO MERIDIA 50
Figure 18 - Planning of activities – IMREDD..51
Figure 19 - Risk assessment through the Bird's pyramid..52
Figure 20 – Measure 2 – Experimental area 54
Figure 21 - Scheme of regulation (solution1) 55
Figure 22- Scheme of regulation (solutions 2 and 3)...56
Figure 23 - Description and location of regulation equipment (solutions 2 and 3)...57
Figure 24 - Description of regulation (solution 2)...58
Figure 25 – Governance scheme 61
Figure 26 - Planning of activities..69
Figure 27 - Data loss detection with REPERE method 73
Figure 28 – Daily energy consumption calculated from REPERE method on a multi-apartment building with individual gas heating system...74
Figure 29 - Distribution plot that summarizes indoor temperature levels on multiple building grouped by their heating system type...74
Figure 30 - Planning of activities..78
Figure 31 : Screenshot of the home page of the prototype Dashboard. From this page, all main information and navigation links are accessible (source: EDF – ReUseHeat project) 81
Figure 32 : Screenshot of the page concerning pedagogic section of the prototype Dashboard. With the help of a video animation and some explanatory text, an overview is given on the implemented technological solution (source: EDF – ReUseHeat project)...82
Figure 33: Screenshot of the page data visualisation section of the prototype Dashboard. With the help of an integrated menu, the user can scroll among different aggregation option of the metered data (time: 10/30 min, daily, weekly, monthly and yearly view; scale: district and building level view) (source: EDF – ReUseHeat project).83
Figure 34 - Provisory concept scheme of the DHCN of the Grand Arenas (Source: EPA Plan du Var and modifications added by EDF)..89
Figure 35 - IRIS KPI-house. 92

List of Tables

Table 1 – Full overview of all the demonstrators in TT#1 – Nice LH....4
Table 2 – Task 6.3 – Action plan proposed by COFELY 22
Table 3 - Main features of the two buildings supporting the demonstration 31
Table 4- Measure 1 Hardware - PALAZZO MERIDIA building....32
Table 5 - Measure 1 Hardware - IMREDD building 33
Table 6 – Measure 1 - Expected impacts – Short term (2022) 45
Table 7 – Measure 1 - Expected impacts – Medium term (2030) 45
Table 8 - Measure 1 - KPIs 45
Table 9 – Measure 1 - Commissioning plan 47
Table 10 - Initial estimate of costs in industrial phase 60
Table 11 - Initial estimate of payback time....60
Table 12 – Measure 2 - Expected impacts – Short term (2022....63
Table 13 – Measure 2 - Expected impacts – Medium term (2030) 63
Table 14 – Measure 2 - KPIs....64
Table 15 - Measure 2 - Commissioning plan....68
Table 16 - Initial estimate of investment costs for the project 70
Table 17 - Measure 3 – Hardware 71
Table 18 – Measure 3 - KPIs....76
Table 19 – Measure 3 – Commissioning plan 77
Table 20 – Measure 4 - KPIs....87
Table 21 – Expected impacts – Short term (2022)....91
Table 22 – Expected impacts – Medium term (2030)....91
Table 23 table of GDPR topics per measure 95

List of Abbreviations and Acronyms

Abbreviation	Definition
B2B2C	Business to Business to Consumer
CIP	City Innovation Platform
DHCN	District Heating & Cooling Network
DoA	Description of Action
EU	European Union
EPC	Engineering, Procurement and Construction
FC	Follower City
IS	IRIS Solution
DJU	Unified Degrees-Day
KPI	Key Performance Indicator
LEM	Local Energy Management
LH	Lighthouse
LHCSM	Lighthouse City Site Manager
O&M	Operation and Maintenance
PV	Photovoltaic
RES	Renewable Energy Sources
TT	Transition Track(s)
WP	Work Package

1 Introduction

D6.3 aims at providing a detailed and **updated** (at M24) **overview** of the **demonstration activities** corresponding to IRIS **Transition Track #1**: Smart renewables and closed-loop energy positive districts performed in the **Nice Eco Valley district** (650ha), a multi-cultural densely populated district characterized mainly by social housing in its south area with a majority of low-incomes and multicultural households and at its north a larger living district with mainly individual houses and small buildings all along a well exposed hilly area.

1.1 Scope, objectives and expected impact

The **main objective** of **the IRIS** project 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**.**

In Les Moulins area, a district of Nice Eco Valley, Côte d'Azur Habitat (CAH), the social housing company, is steadily investing in the thermal refurbishment of degraded mid-rise and high-rise buildings. From 2011 to 2017, a NZEB renovation program was performed on various poor-efficient high-rise buildings with the objective to eradicate insalubrious housing and reduce the primary energy consumption of the buildings from 160 kWh/m² · year to 80 kWh/m² · year. However, CAH's ambition is to go beyond this objective and within the frame of the IRIS project, a new smart control system will be implemented and tested in two degraded high-rise buildings (132 apartments) enabling to adjust the heat supply to the individual demand in each apartment. An innovative commissioning process will be tested to measure the real energy savings induced by this smart control system.

In Grand Arenas area, a low temperature district heating and cooling network is under development, using waste heat from sewage water treatment plant as main energy source. Thanks to the low temperature network, it is foreseen that energy can be exchanged between complementary end usages (simultaneous heating and cooling needs), reducing the overall energy production costs. The network is developed and invested by a third party to the project (DALKIA). EDF's ambition is to showcase a Dashboard, raising awareness of citizens, by displaying the energy and environmental performances of the Grand Arenas DHCN. Giving access to the wider public to real time data on the energy production and consumption, emissions and renewable energy shares, accompanied by complementary pedagogic information, the acknowledgement and acceptance of such renewable energy solutions is expected to be risen.

In Nice Meridia area, NEXITY, a private investor and the University of Nice Sophia-Antipolis (represented by IMREDD) are investing in 2 new positive energy buildings connected to a district heating and cooling network. This new emblematic high energy efficiency construction program will test the concept of collective self-consumption at building scale with a large local solar production and a Li Ion battery fitted with an Energy Management System (EMS).

1.2 Contributions of partners

Deliverable D6.3 has been authored by CSTB according to a standard template proposed by GOT and UTR and reviewed by CERTH, in compliance of Quality Assurance Management process of IRIS.

CSTB and IMREDD were the main contributors in the writing of §6 with specific contributions from NEXITY, the owner of the PALAZZO MERIDIA building and BG 21, NEXITY's design office.

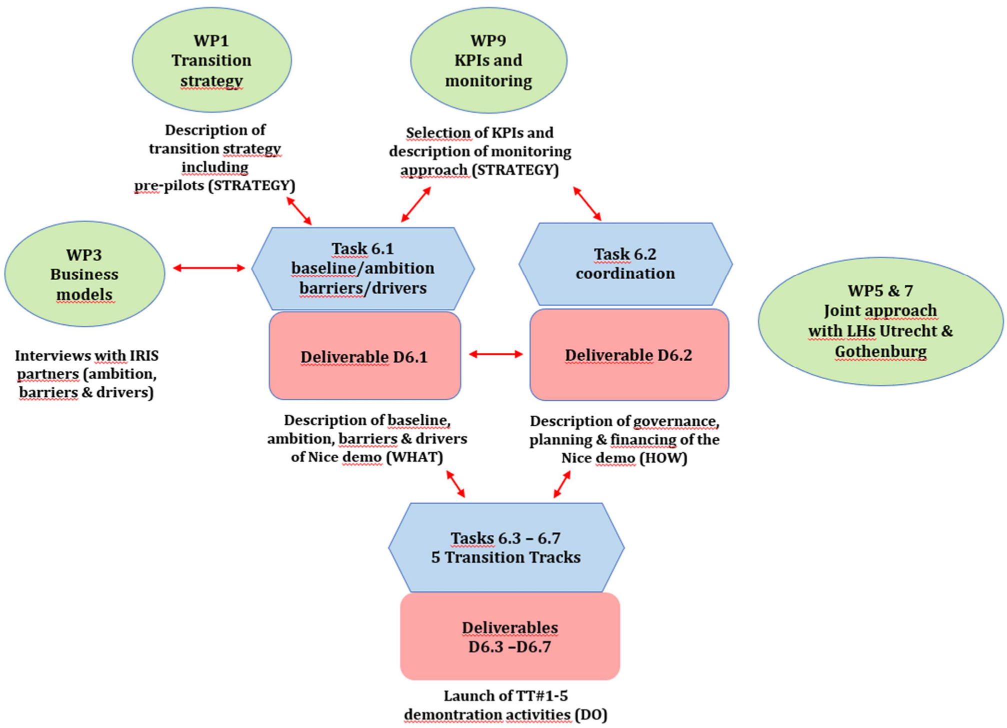
COFELY has entirely drafted §7 and CSTB §8. Finally, EDF was the unique editor of §9.

1.3 Relation to other activities

D6.3 is directly connected to all WP6 tasks (T6.1 as an input, and T6.2 to coordinate the tasks held in T6.3 to T6.7), but also related to horizontal WP, and recurrently to WP10 dedicated to communication activities. Later in the project, it will be used as an input for WP2 and WP8.

Figure 1 depicts the relation of this deliverable to other activities or deliverables developed within the IRIS project.

Figure 1 - Relation of Deliverable D6.3 to other activities (source: Utrecht, mod by CSTB)



1.4 Structure of the deliverable

This document contains the overall starting points for TT#1 activities carried out in the Nice LH, which consists of a description of the demonstration in a nutshell, the baseline for TT#1 and the organisation of work.

From chapter 5 to chapter 8, the four Measures deployed and tested within TT#1 in Nice LH are explained and the achieved results reported.

Chapter 9 contains a summary on monitoring of KPIs at Measure, Transition Track and City levels.

Chapter 10 contains the ethical requirements to deal with, when rolling out the activities and monitoring.

The last two chapters contains the output to the other Work Packages as well as a conclusion and next steps.

2 Demonstration in a nutshell

2.1 Ambitions for TT#1

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**.**

TT#1 will contribute to this ambition by developing and integrating:

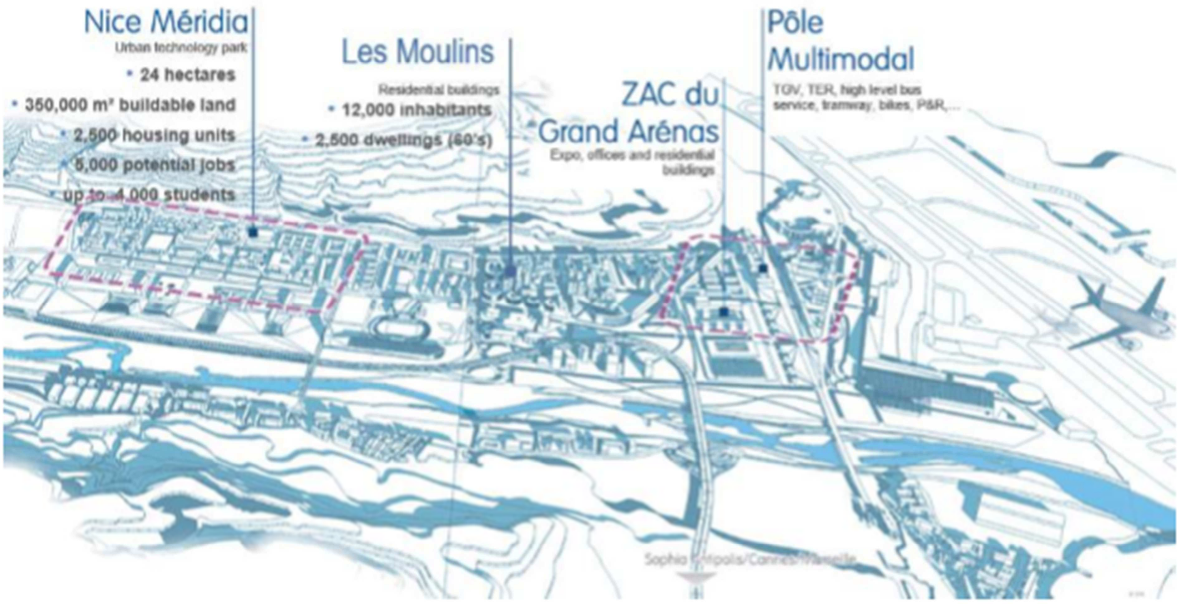
- A high share of locally produced and self-consumed solar energy in new buildings.
- Cost efficient energy saving measures adapted to the refurbishment of degraded and poorly efficient existing multifamily buildings.
- Smart information and communication technologies enabling to raise environmental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

The applied solutions concern integrating (1) a new concept (in France) of collective self-consumption at building scale combining a high share of locally produced solar PV electricity and a battery storage system to increase the self-sufficiency rate , (2) a new smart control system enabling to adjust the heat supply to the individual demand in each apartment, (3) an innovative commissioning process to measure the real energy savings after a building is refurbished , (4) a dashboard to raise environmental awareness of public local authority, customers or citizens about the deployed energy solutions at the district level.

Measure 1 will be deployed and tested in 2 positive energy buildings under construction connected to a district heating and cooling network. Measures 2 and 3 will be deployed and tested in two 17-storey apartment buildings that have been partly refurbished. Measure 4 will be developed and then tested in the Grand Arenas district.

2.2 Demonstration area

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



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).

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 m^2 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)

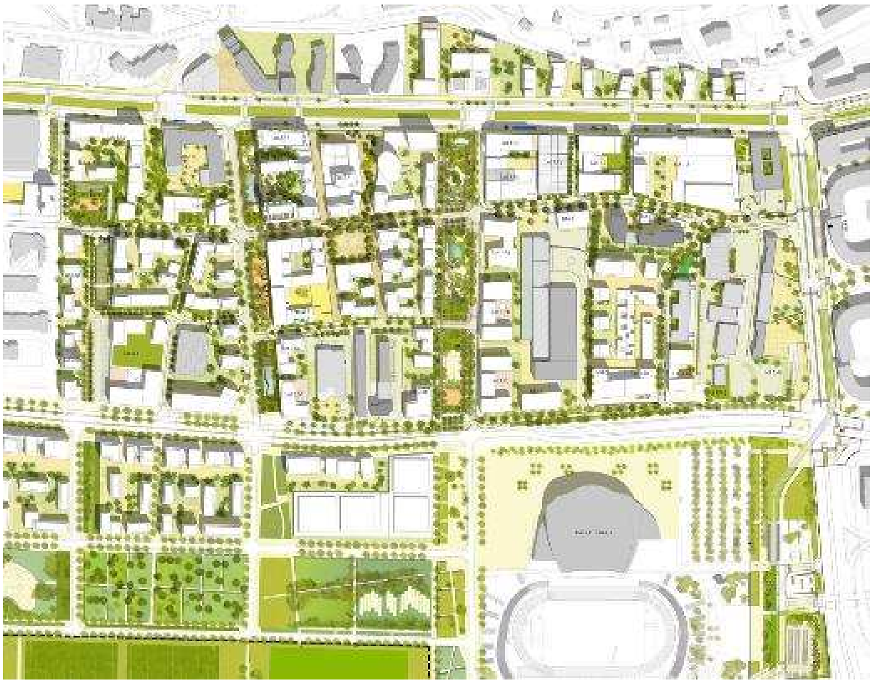


Figure 7 - Rendering of the urban development in Nice Méridia after 2023 – localisation and contextualisation of the IMREDD and NEXITY case study buildings (source: UNS/IMREDD - modifications by EDF)

2.3 Integrated Solutions in TT#1

The main objective of Transition Track #1 (TT#1) is the integration and demonstration of different Renewable Energy Sources (RES) based technologies and energy saving measures at building and at district scale including the symbiotic networks alongside with smart energy management systems (SEMS), in order to:

a. increase the share of locally produced and consumed renewable energy (self-consumption) for electricity, but also for heating and cooling purposes;
b. maximize the energy savings at building and district level reducing the citizen's energy bill and
c. define and evaluate the value-adding role of humans and of renewable energy-based solutions at the ecological system contributing to the reduction of air pollution, while at the same time the citizens benefit by increasing their comfort level and the quality of life.

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

IS-1.1: Positive Energy Buildings

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).

IS-1.2: Near zero energy retrofit district

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

IS-1.3: Symbiotic waste heat networks

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.

2.4 Integration of Demonstrators

Measure 1 (self-consumption coupled with storage) and Measure 4 (Local Energy Management Dashboard) are strongly connected to IS#2.1 (Local Energy Management system) as potential assets of a LEM which can increase the revenue streams of each individual asset, by offering flexibility services or products to different markets.

Thanks to the LEM, the demonstrations of TT 1,2 and 3 will be connected and optimized in terms of grid flexibilities, based on the IMREDD and NEXITY demonstration buildings and the further potential deployed EV charging infrastructure, by putting the related EMS in communication.

Measure 2 (optimization of the heating load curve) and Measure 3 (commissioning process) are interconnected as the second one is used to assess the energy performance expressed in terms of energy gains of the first one.

2.5 Deviations according to the Grant Agreement

Measure 1: Collective self-consumption at building scale

No deviation from the Grant Agreement. The construction of the two positive energy buildings was delayed (three months compared to the initial planning) but the demonstration phase will start as initially foreseen (March 2020).

Measure 2: New smart control system

In November 2018 VEOLIA indicated to the Nice LH City Site Manager (NCA) and Project Coordinator that they have the intention to withdraw from the IRIS consortium. The withdrawal decision was made in mutual agreement with NCA. The reason for their withdrawal decision was that due to internal restructuring they had to change business priorities and the IRIS activities did not fit in this scope. According to the structure and governance of the IRIS consortium the Lighthouse City Site Manager-Nice has the responsibility to find a suitable replacement for VEOLIA.

COFELY has been consulted and has accepted in taking over tasks of VEOLIA. COFELY is the current energy manager of the heating network of the demonstration site buildings, owned by IRIS partner Côte d'Azur habitat (CAH), and therefore is the most appropriate and legitimate partner to deploy the demonstration project.

During the "7th IRIS Nice ecosystem coordination meeting" held in Nice on March 20th, 2019 COFELY presented an ambitious action plan for IS-1.2: Near zero energy retrofit district (Task 6.3) and obtained a positive advice from the Nice Ecosystem partners. At 28 May 2019 the CPB agreed with the decision to replace VEOLIA by COFELY in the IRIS consortium.

The ambitions of the demonstrator (see Table 2) remain unchanged as well as the KPI targets.

Table 2 – Task 6.3 – Action plan proposed by COFELY

Original Demonstrator	New Demonstrator
Task T6.3: Optimization of heating load curve (GA T6.3: "Installing smart appliances for optimization of the heating load curve […] in refurbished apartment buildings") Cofely	COFELY will: - Install a new smart control system for heat load curve optimization - Split the heating distribution network, per facade, per flat (90 units) and per stage (13 units)

Measure 3: New commissioning process

No deviation from the Grant Agreement. However, as Measure 3 relies on the results of Measure 2, Measure 3 has been delayed and will start as soon as action plan proposed by COFELY is implemented.

Measure 4: Local Energy Management Dashboard

Problem statement

So far, the Grand Arénas project has experienced two exogenous (to IRIS) risks: the real estate development is slower than the foreseen pace; commercialization of the offer is also slower than expected as one potential client has opted to not subscribe the service from the DHCN, while other clients are under negotiation (also existing buildings), exercising a strong pressure on the operator on the commercial offer, as having no obligation for acceptance[1]. This has led to a first delay in the LT DHCN planning, postponing the project from 2nd semester 2018 to the 2nd semester of 2019. This delay is now overlapped by a second phenomenon, the French municipal public election period (01/09/2019 until 30/03/2020): in France, during such political phase, permitting of main infrastructures and related works are put to an halt or at least strongly reduced, to ensure that private and public interests do not come into any conflict. Therefore, the DHCN realization will have to postpose all major works towards the end of such period, so to the 1st semester of 2020. This delays the project further, which is at the time being foreseen to be delivered by end of the first semester 2021. This is the current official calendar for the undertaking, which is shared between the DHCN operator and Metropole Nice Cote d'Azur.[2]

[1] *Nota* : the Grand Arenas DHCN project, is by fact neither owned nor operated by any consortium member of IRIS, but invested and developed by DALKIA (subsidiary of EDF). The complete project is a private investment and not a "public delegation of service", which would regulate its deployment under pubic law. This implies that no defined distribution area is imposed by public law, neither connection and subscription obligation apply. The achievement of the project is the solely merit from the commercialization efforts of the project owner.

[2] Seen all those implications, the LT DHCN network project has yet not reached the needed commercialization rate and the decision of the DHCN Company for the approval to release the investment sum for the works has yet not

been achieved. A decision in these regards is yet open in terms of planning: a milestone is expected beginning of 2020.

Solution approach

The options in sight for achieving the set objectives and impact, without further delay, are basically two:

A) The Dashboard could be set up as a “virtual” version. More precisely: the public will be able to access the whole Dashboard functionality from M30 onwards. Nevertheless, they will be confronted with simulated data (coming from CSTB’s simulation platform DIMOSIM[3]) and with a district (and associated DHCN) which will yet not be set in place. By doing so, chosen demonstrator KPIs could be monitored as planned and realize the survey for the chosen social and acceptability related indicators. Once the DHCN is delivered, the Dashboard will be fed with real data from the DHCN’s SCADA system and thus, achieve the KPIs associated with the DHCN system’s exploitation. In this case, the overall impact of the demonstration is limited strongly by the fact that end-users are confronted with a simulated environment and that the overall technical solution’s impact will be scaled to the construction work progress of the district of Grand Arenas.

B) The Dashboard is in principle an independent service, which is not unique to the LT DHCN solution of the Grand Arenas: it’s actually associated with a high scalability and replication potential. Therefore, it is suggested, to develop and implement the product as foreseen nevertheless, to apply it onto an existing DHCN with similar characteristics but in a different demonstration site, from M30 onwards. This will ensure that no changes apply to the objectives and expected impact of the solution. To clarify, to apply the Dashboard to the existing similar LT DHCN, is seen as a temporary solution towards the achievement of the Grand Arenas DHCN delivery and operation. Once the Grand Arenas DHCN has been delivered, the Dashboard will also be implemented as planned originally. This is proposed as the most favourable option – option B).

At the time being, different LT DHCN projects in the Mediterranean region have been screened (operated by an affiliated company to EDF) and the current proposition is to apply the Dashboard to the “La Seyne sur Mer” (LSSM) LT DHCN, located in the homonymic municipality, within the Metropolitan Area of Toulon, located roughly half way on the coast between Nice and Marseille. The implemented solution is the most resembling one to that planned in the Grand Arenas: it’s a LT distribution loop, sourcing the energy from the sea. This means, the energy source, has exactly the same seasonal temperature fluctuations and ranges, as the Grand Arenas solution: this implies that after the source exchanger station (cleansed water for Grand Arenas and salt sea water for LSSM), the two networks share the same design principles, a LT DHCN distributing the exchanged water to building level substations equipped with HP. This makes the adaptation effort of the Dashboard almost negligible as the technical solution is identical in terms of data acquisition: the Dashboard will retrieve the monitoring data via a ftp data stream between EDF and DALKIA’s Regional Control Centre. Only graphic and textual elements of the Dashboard will have to be changed, which represents little additional effort.

[3] https://thermoss.eu/dimosim/#

3 Baseline / Drivers and Barriers

3.1 Baseline

The baseline is defined as the situation before any intervention has been made and against which the impact of interventions is measured. Assessment of the baseline is a very important step in any project or transformation process, as without it we are not able to judge a) where improvements are needed, b) what level of improvement or transformation has been achieved as the result of the intervention.

The descriptions of the baseline for each measure constitute the state of the practice prior to LH interventions.

For Measure 1, there is no prior state as buildings are new. The baseline will use reference data, i.e. values stipulated by national regulations (the French Building Regulation RT2012 requires to have a primary energy consumption lower than 50 kWh/m² · year).

For Measures 2 and 3, the two buildings (towers 13 and 14) that will be investigated have been recently refurbished with a large number of energy efficient measures. The baseline will correspond to their building energy consumptions measured (through energy bills collected during the 2018-2019 heating season) prior solutions 1 to 3 (see §6) are implemented.

For Measure 4, the baseline is represented by the usual method applied within the French district heating and cooling sector and accepted by ADEME: the reference is represented by decentralized gas boilers for heating and electric chillers for cooling. This provides the reference values to evaluate the performances of an alternative DHCN solution.

3.2 Drivers and Barriers

Measure 1: Collective self-consumption at building scale

Drivers:

- Self-consumption helps European consumers and businesses to control their energy bill. Self-consumption does not only provide cheap electricity to consumers; it also protects them against volatile energy prices.
- Self-consumption lessens the burden on regional medium and low voltage grids. Energy that is consumed at the same location where it is generated no longer has to be transported over the grid, reducing congestion issues and bottlenecks, for the benefit of Distribution System Operators (DSO).
- Self-consumption increases retail competition and helps market transformation. The relationship with the consumer is the most important factor of differentiation between energy suppliers. The winners will be those retailers able to deliver new services. Offering self-consumption solutions is an obvious pillar of such strategies.
- Self-consumption makes consumers active players of the energy transition, a key objective of the Energy Union.

Barriers:

- Electricity consumers and PV system must be on the same low voltage feeder.
- Reduced grid fees shall be granted only if the power of the PV system is lower than 100 kW.
- The DSO can get the excess of production free of charge if no other third party is willing to buy the energy surplus injected into the grid.
- Battery cost is still very expensive.
- Due to the small number of projects done in Europe, profitability of business models has not been validated so far.

Measure 2: New smart control system

Drivers:

- Controller takes into account weather corrective actions (wind, sun, outdoor air temperature);
- Controller can be individualized according to weather conditions and to building thermal inertia;
- Quick implementation of autonomous wireless sensors;
- Remote energy management for better reactivity from building keeper;
- Lower energy bill for the tenants;
- Less overheating leading to better-controlled thermal comfort.

Barriers:

- Investment cost;
- Approach implies to stop heating during a certain time (can be a barrier in countries where heating can't be stopped too many times);
- Sensors need to be installed in flats which can be considered by the tenants as a privacy issue;
- Difficulty to select the right position/place of the sensors in the flats.
- Bad-use of the sensors by the tenants (moving, breaks).
- Battery (of sensor) lifetime.

Measure 3: New commissioning process

Drivers:

- Identification and mitigation of any issues related to the process of building refurbishment is facilitated;
- A fair comparison between predictions in the design phase of the building's energy requirements with the real energy performance monitored is made possible;
- Differences related to poor implementation or defaults from differences related to occupants 'misbehaviour' are stressed out;
- Corrective measures designed to bridge the possible gap between forecast and measured energy performance are proposed;
- In the end, this new process will result in more stable and lower energy bills for the tenants, in combination with a higher thermal comfort and less draught and humidity in homes.

Nevertheless, there are still technical/ economic /social barriers that slow down the development of monitored commissioning process for renovation works:

- Cost of monitoring sensors is still high compared to the cost of refurbishment works (ideally it should be below 2% of the refurbishment work cost).
- Installation of sensors inside the apartments of a residential building can cause some privacy problems. Tenants are often reluctant to accept these sensors because of the privacy issue.
- Wireless sensors transmission might be problematic especially where boiler rooms are underground.
- Lifespan of the sensors inside the apartments can be short, especially when there is a significant turnover of the tenants.

Measure 4: Local Energy Management Dashboard

Technology

Drivers:

- Digital and metering technologies are becoming mainstream components of the district heating sector and mostly composed of market “mature” technologies.
- DHCN operators (but not only) are adopting service platforms to remotely monitor, and eventually control, their portfolio of assets, ensuring a continuous data stream among assets and a centralised platform.

Barriers:

- The current variety (and still emerging) protocols and standards is yet, for most part, not homogenized or standardized (yet mixed among property- and open-solutions).

Law and regulation

Drivers:

- French law n° 2015-992 of 17 august 2015, “Energy Transition Law for a Green Growth”[4] promoting decentralized and RES systems by imposing strong mid-term objectives for energy efficiency, carbon reduction and RES share. DHCN is hereby identified as a major lever for the decarbonisation of the French energy sector, aiming at multiplying by 5 the volume of heating and cooling energy delivered by DHCNs, based on renewable or waste heat sources, between 2012 and 2030.
- The related “Heating fund”[5] promoting via the ADEME (French Environment & Energy Management Agency) the deployment of RES and the decarbonisation of the DHCN sector.
- DHCN operated under a “Public Delegation of Service”, are owned by the public hand. Local authorities can thus define with a relatively high degree of freedom, the scope and perimeter of a DHCN endeavour. A Dashboard as provided via the project, could be integrated as basic requirement of the DHCN exploitation service.
- Since the adoption of the energy transition law for green growth, local authorities of more than 20,000 inhabitants, have to implement a Climate-Air-Energy Territorial Plan (PCAET). DHCN are

[4] https://www.ecologique-solidaire.gouv.fr/loi-transition-energetique-croissance-verte
[5] https://www.ademe.fr/expertises/energies-renouvelables-enr-production-reseaux-stockage/passer-a-laction/produire-chaleur/fonds-chaleur-bref

integral part of such local action plans and have thus potentially, high public visibility. It should thus be in the public interest to communicate, spread knowledge and raise awareness on tangible actions related to such development plans and their performances.

Barriers:

- No specific legal barriers are identified.

Society

Drivers:

- Studies show that in principle, projects implying sharing among neighbours of RES, should face a relatively high interest in current society, with a higher bias towards younger working class generations.[6] This shows a good potential acceptance of decentralized RES and potential energy sharing mechanisms, being achieved via thermal or electric grids.
- Public authorities are more and more adopting digital solutions to monitor exploitation results from operators of public infrastructure – as DHCN are. Similarly, operators of public infrastructures are adopting more and more, open data policies for ensuring transparent and reliable information exchange about their activity. It should thus be just a matter of time, until local authorities will be able to disclose and possibly trade, information and data concerning city and region wide public assets and infrastructures.

Barriers:

- Same studies show that society has different expectations towards their urban living environment: “smart” and “hyper-connected” city models are at the bottom of the ranking compared to the most accepted city models of the “green” and “renewable based” city model.[7] In other words, citizens seem to prefer to live in a “village like” green environment more than in hyper-dense and -connected city areas. This means that the technological and connectivity based aspects of solutions coming from advanced management system have a low associated value proposition for the wider public, and might thus have to be made less visible to the end users.

Finance

Drivers:

- Most elements related to financial tools favouring the proposed demonstrations are cited under the legal section, as related to law and regulation.
- The pricing stability that DHCN can provide, has important societal and financial implications. By definition geothermal, waste heat and thalasso (sea water) based sources have no intrinsic price for the energy source and can reach up to 70% of the total energy delivered to customers. This means, only 30% of the supplied energy is sensible to pricing increase (more precisely via the electricity price, related to the operation of the auxiliaries and HP). This gives a long-term

[6] https://lobsoco.com/lobservatoire-des-usages-emergents-de-la-ville/
[7] https://lobsoco.com/lobservatoire-des-usages-emergents-de-la-ville/

stability and visibility of the heating/cooling bill to end users, ensuring very low long-term pricing fluctuations.

- Public subsidies as granted under the “Heating fund”, are proportional to the foreseen energy and environmental efficiency indicators of a renewable or waste energy sourced DHCN project. After an upfront grant, the remaining subsidies are delivered, and adjusted, to the exploitation results from 1 to 2 years exploitation measurements. This implies that the valorisation of such data via a Dashboard, should not represent additional costs in metering equipment for the targeted DHCN segment (RES DHCN).

Barriers:

- In the case of DHCN, the long stability and visibility of the energy retail price, is counterbalanced by higher investment costs, compared to traditional solutions. This is not only reflected in the overall project costs, but also in the fixed connection cost that end-users have to bear for the heating/cooling provision. The direct financial value proposition is thus not always compatible with the perception and expectation of clients and end-users alike.

Environment

Drivers:

- Energy efficiency improvement, carbon footprint reduction and adoption of RES are surely the main drivers for the current regulations and reforms as cited in the “Law and regulation” section above.
- Similarly, environmental impact reduction via a more sustainable development model are a concern for the modern urban population.
- Specifically Nice has an interesting potential for DHCN technology, as it has a combined potential of geothermal, sea water, biomass and other industrial or process waste heat sources, which can potentially be locally exploited. Nevertheless, the accessibility of such sources has to be supported by local authorities and awareness be risen within the private sector.

Barriers:

- European and national regulations have already made big improvements towards the promotion of RES and low carbon solution. However, an overall strong signal is missing: the relatively low carbon tax and other tradeable related carbon bonds are still not effective to generate any direct market impact. This does not stimulate an uptake of low carbon technological solutions and reduce the environmental footprint of the energy system at the local level.

Nevertheless, no specific regional/local environmental barriers can be identified.

4 Organisation of work

CSTB is responsible for the overall coordination of demonstration activities in Nice LH for TT#1.

In Measure 1, CSTB is testing and analyzing the concept of collective self-consumption at building scale in the PALAZZO MERIDIA office building. NEXITY (owner of the PALAZZO MERIDIA building) is strongly associated to the demonstration as end-user and potential key-player for the replication of this concept in France. IMREDD (user of the IMREDD building) is performing similar activities with their own building but with a more academic perspective due to their educational role. EDF S&F, linked third party to EDF, who recently joined the IRIS project, designed and provided the Energy Management System aimed at optimizing the energy exchange in the two demonstrators. ENEDIS (the French Distribution System Operator - DSO) is in charge of electrical metering that will support electricity billing: PV production meters and splitting the energy production data among energy consumers of the buildings. ENEDIS is also supervising the compliance with the French legal framework.

In Measure 2, COFELY who replaced VEOLIA in May 2019, is testing different smart control algorithms and different sensor technologies in two degraded high-rise buildings owned by CAH, a social housing company, to reduce energy consumption.

In Measure 3, CSTB is testing the REPERE service, a dedicated commissioning process elaborated to check from the design to the operation that the energy efficient measures tested in Measure 2 have been correctly implemented and are efficiently operated in the two refurbished high-rise buildings.

In Measure 4, EDF is developing and testing new functionalities of an innovative district scale “Local Energy Management Dashboard”. This dashboard is intended to provide real time, or near to real time, information on the energy and environmental performance of a DHCN based on waste heat recovery to the community by mapping energy fluxes related to the district. MNCA is the owner of the Haliotis waste water treatment plant where the waste heat recovery system is located.

5 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 tested in Nice Meridia on two positive energy buildings under construction. Table 3 lists the main features of the two positive energy buildings under construction that will host the use case.

Table 3 - 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 (m²)	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 (m²)	412 m² on roof top	848 m² on roof top
Type of storage system	Electric battery	Electric battery (first and second life batteries)

The main objective of this use case is to assess the benefits and analyze the barriers (legal, financial, technical) that prevent the development of the collective self-consumption market at building scale. One sub-objective will be to experiment different technologies to increase the ratio of PV self-consumption.

5.1 Specification of the measure

5.1.1 Hardware

PALAZZO MERIDIA

Table 4 describes the technical equipment that will be integrated in the demonstrator.

Table 4- Measure 1 Hardware - PALAZZO MERIDIA building

Main component	Technical specification	Pictures
PV panels	Sunpower PSUNPOWER® X21 345 COM **Total :** 258 modules P : 89.01 kWp (412m^2) **1 Module :** Monocristalline – 92 cells P : 345 Wp Efficiency : 21.5% Dimensions : 1556mmx1046mm– 18.6kg Low carbon footprint	 MODULE X21 - 345
PV inverter	2 x HUAWEI SUN200-36KTL-A Power : 40 kVA per unit Efficiency : 98%	
Battery storage	LG CHEM Jp3-2P 92.3 kWh/66 kVA Composition:14 modules. Nominal Capacity:128 Ah. Energy:92,316 kWh. Nominal C-Rate:0,5 C Weight:~800 kg.	

Battery power conversion system	SOCOMEC SUNSYS PCS2 66 kW SOCOMEC SBCP Master (string battery protection cabinet)	

IMREDD

Table 5 describes the technical equipment that will be integrated in the demonstrator. A mix of energy sources has been chosen from a fuel cell to solar PV panels. It should be noted that some of the equipment is not included in the IRIS project like the windmill, the flywheel or the fuel cell and will constitute advanced integrations for further investigations.

The installation includes three clusters of electric vehicle charging stations controlled with different on the shelf or homemade solutions in order to deal with the smart charging perspective of the project. Additionally, a vehicle to grid technology with a dedicated 22kW charging station, has been proposed as a flexible energy storage.

A first life battery and a second life battery are going to store the energy coming from the photovoltaic panels in order to maximize the individual self-consumption.

Table 5 - Measure 1 Hardware - IMREDD building

Main component	Technical specification	Pictures
PV panels	Sunpower PSUNPOWER® X21 345 **Total :** P : 179.4 kWp (848m^2) **1 Module :** Monocristalline – 92 cells P : 345 Wp Efficiency : 21.5% Dimensions : 1556mmx1046mm– 18.6kg Low carbon footprint	

PV inverter	ABB-POWERONE ® Trio OUT-D Power : 27.6 and 20 kVA per unit Efficiency : 98%	
Battery storage	2 racks LG JH3-2P Total : 182.6 kWh JH3-2P module (1 rack) Composition: 2 x 14 cells Nominal capacity : 126 Ah Nominal C-rate : 0. 5 C Max C-rate : 1C Nominal voltage : 51.8V DoD : 80% EoL : 80% Cycles : 5000	
Battery power conversion system	Socomec Rated power: 100 kVA Max power: 110 kVA Rated voltage: 400 VAC 3PH Rated current: 144 A Max efficiency: 96.4% Dimensions: 1200 x 795 x 1400 (W x D x H) (mm) Weight: 770 kg	
EV charging units	IZIVIA: 2 EV charging point 22 kW AC 6 EV charging points 7 kW AC Schneider: 2 EV charging point 22 kW AC 8 EV charging points 7 kW AC Renault: 1 EV charging point V2G 22 kW AC	

5.1.2 Software

PALAZZO MERIDIA

Figure 8 represents the overall architecture of the communication system in the PALAZZO MERIDIA building. All measured data are stored in a Building Management System and can be visualized through a Supervisory Control And Data Acquisition (SCADA) system. Via a webservice, these data are then stored in the City Innovation Platform.

IMREDD

Figure 9 represents the overall architecture of the communication system in the IMREDD building.

The Building Management System, provided by Schneider Electric, allows the supervision of all the sensors of the building. On the other hand, the Energy Management System, designed by EDF S&F is going to optimize the energy exchange in the demonstrator. Then, data are shared through a Supervisory Control And Data Acquisition (SCADA) system. Both the EMS and the BMS have webservices where data can be collected and are going to be stored in the City Innovation Platform.

5.1.3 Procurement of equipment and/or services

A call for tender has been launched in June 2019 for the PALAZZO MERIDIA and in August 2019 for IMREDD to purchase and install equipment.

5.2 Societal, user and business aspects:

5.2.1 Citizen engagement

PALAZZO MERIDIA

Self-consumption helps European citizens and businesses to control their energy bill. In a context of increasing energy prices, households and businesses using solar PV electricity rely on a power source the cost of which will remain fixed for the decades to come. Self-consumption does not only provide cheap electricity to people; it also protects them against volatile energy prices.

To raise awareness and promote behavioral change, an information campaign will be carried out before the end of 2020 by NEXITY addressing the building's future occupants. They will be informed and hopefully aware of the expected benefits of self-consumption and the opportunities this measure offers in the development of future new services.

Figure 8 - Energy and data management system in the PALAZZO MERIDIA building (source BG21)

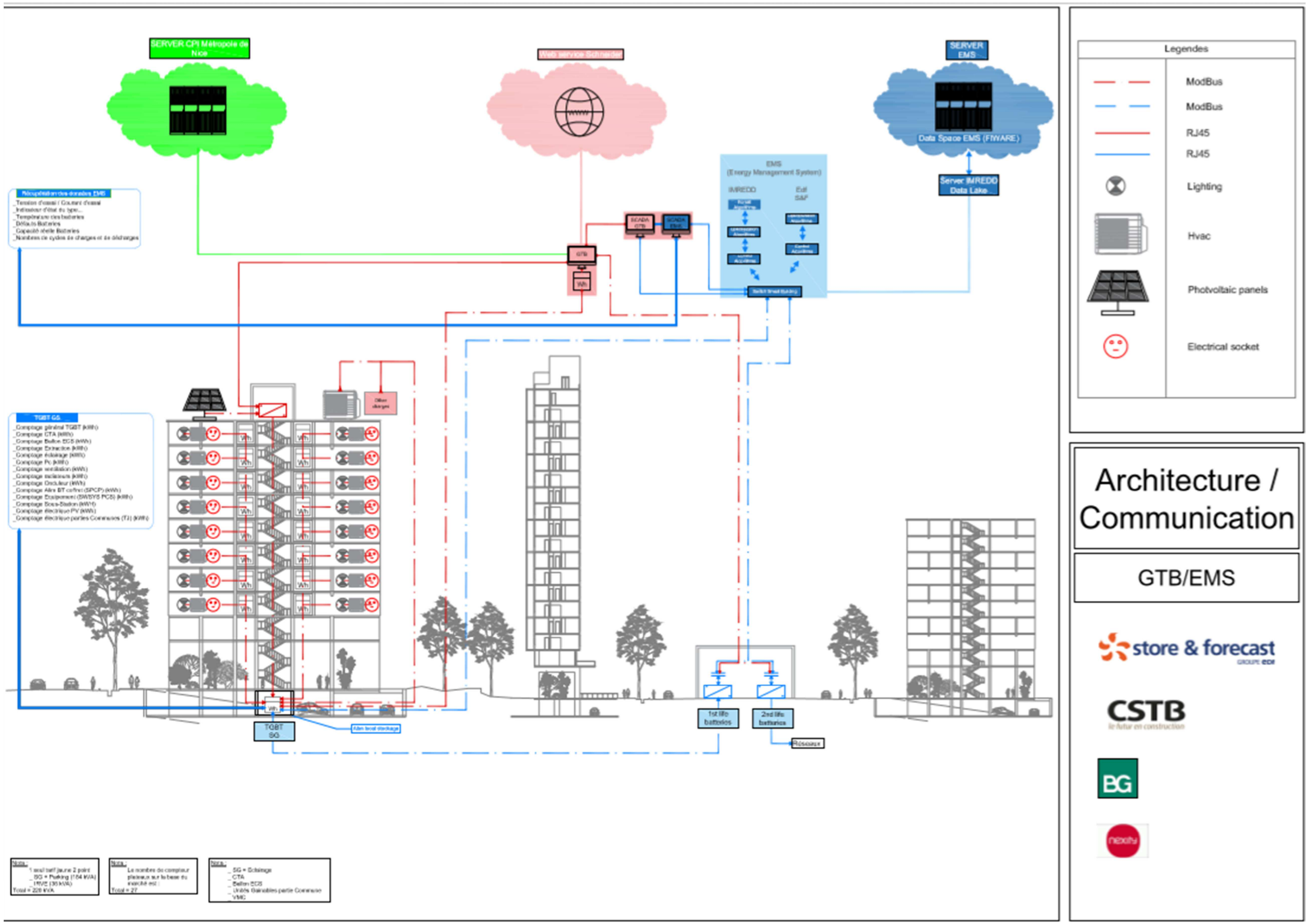
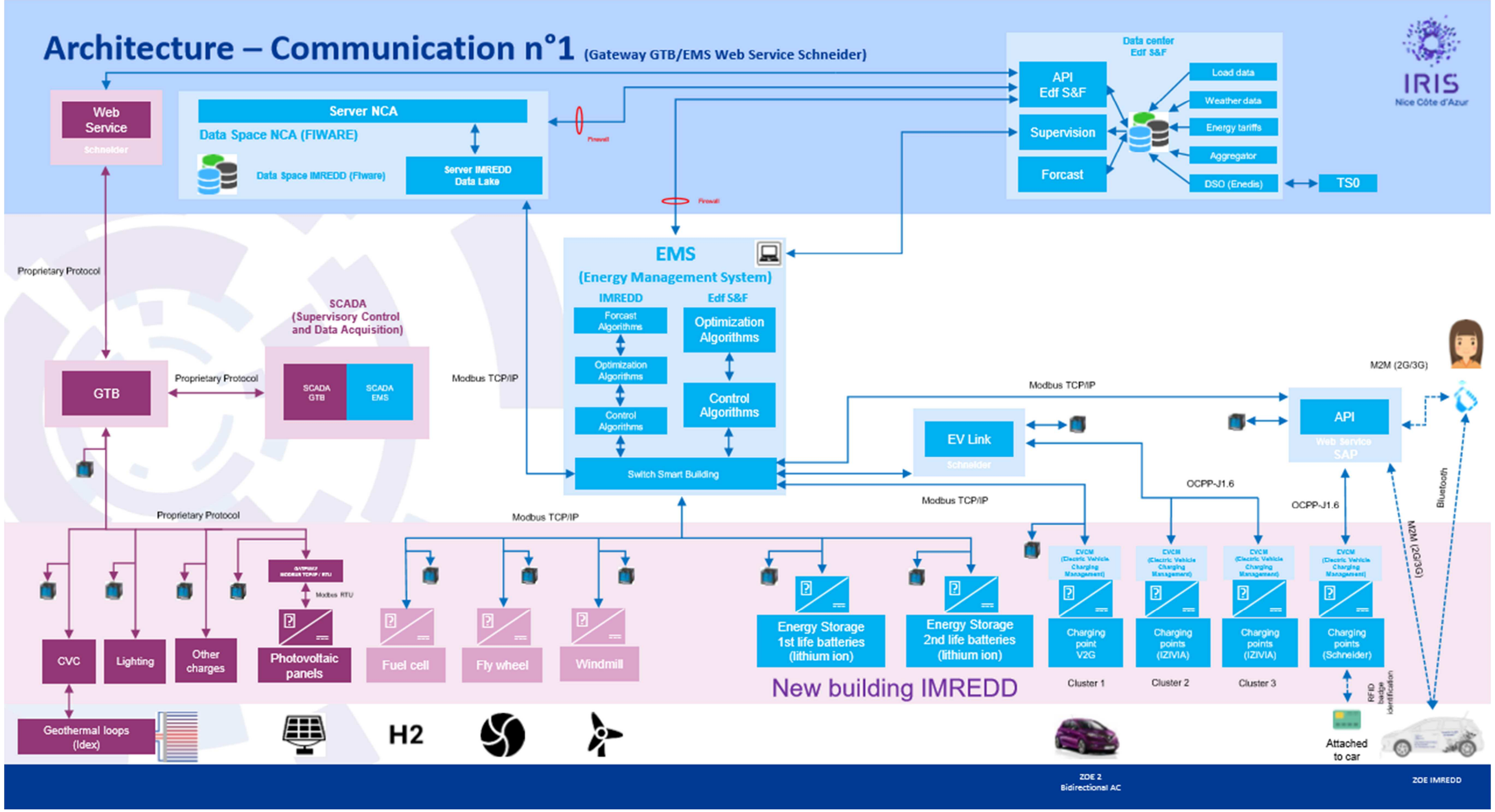


Figure 9 - Energy and data management system in the IMREDD building



IMREDD

In order to ensure an optimal use of the building, education and information is key. All the citizens inside the building must have access to the best practices and to the energy consumption level. There will be small screens at the entrance of each room (classrooms, offices, meeting rooms) with messages and alerts to use the spaces efficiently and have an optimal use of energy. The energy consumption level will be displayed in the building, and also the energy savings realized compared to the day or month before. IMREDD's idea is also to make the energy pedagogy as interactive as possible. Small challenges will be organized, in which the offices are in competition and the office that has the lowest consumption will win the challenge.

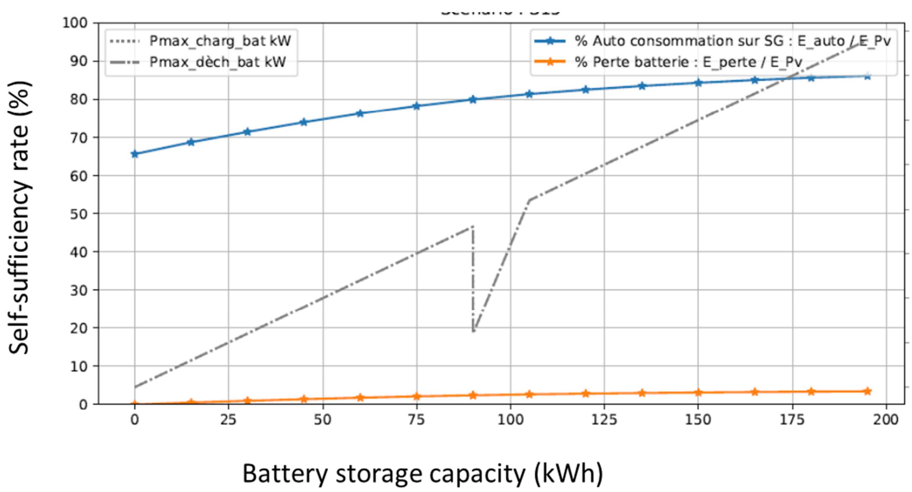
IMREDD's building is one of the flagship architectural projects of the Nice Eco Valley district, therefore it seems important that the users have a certain knowledge level on their building. There will be several visits organized of the technological platform, the different floors but also of the electrical facilities, with deep explanations on the building design and concept and on its energy specificities. The more knowledge they have on their building, the more they will feel personally engaged in its optimal use.

5.2.2 Business model

PALAZZO MERIDIA

Very few office buildings are equipped with photovoltaic panels and a battery storage system in France. Adding a battery to the system allows increasing the self-consumption as it can be shown in Figure 10 where the battery size is varied (in this case, from 60% to 90%).

Figure 10 - Influence of the battery size on the self-sufficiency rate (in blue) for the PALAZZO MERIDIA building



With a 100-kWh battery capacity, the PALAZZO MERIDIA self-sufficiency rate is estimated at 80%. This calculation has been performed considering that the photovoltaic installation produces electricity only used for the communal parts of the building. The rest of the produced electricity is sent to the grid with no feed-in tariff.

A profitability analysis has been carried out on this business model with the following hypothesis:

- Investment cost for photovoltaic panels (89 kWp), incl. installation: 149 520 €.
- Investment cost for battery storage system: 69 000 €.
- Specific monitoring system: 8 600 €.
- Total investment cost: 227 120 €.
- Investment subsidy: 150 000 € (estimation).
- Total investment cost including subsidy: 77 120 €.
- 80% of the produced electricity is consumed and 20% is sent to the grid.
- Imported electricity tariff: 0,11 €/kWh.
- Specific annual PV system performance: 1350 kWh/kWp.

Based on these hypotheses, **the internal rate of return** considering only the project cash flows is **7,6%** and the **payback period of up to 19 years**.

IMREDD

IMREDD's building electricity consumption has been estimated by an engineering consulting company (see Figure 11 and Figure 12). The simulations were done with the hypothesis of an optimal use of the building. A scenario of EV charging has been chosen:

- for a weekday :
  - from 8 am to 7 pm : load factor of 0.4 on the whole power installed (172 kW),
  - from 7 pm to 8 am(+1) : 3*7=21 kW (3 EV charging points in use).
- for the weekend :
  - no charging.

Figure 11 - IMREDD's electricity consumption estimation during the year

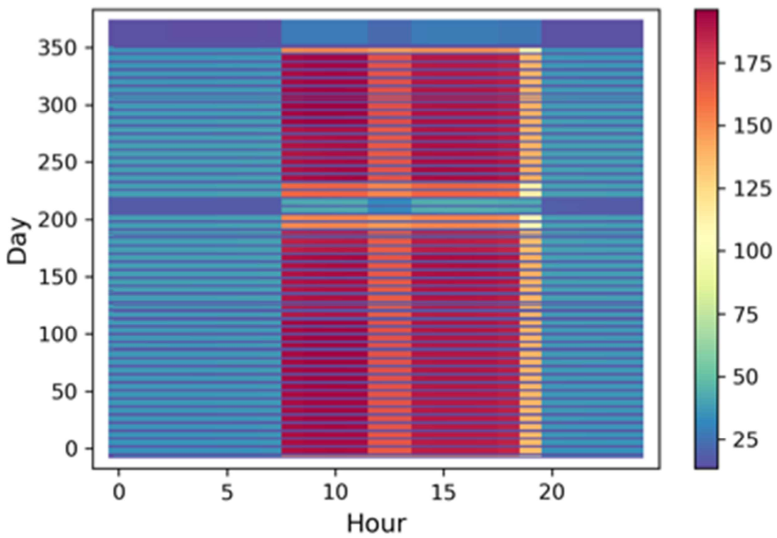
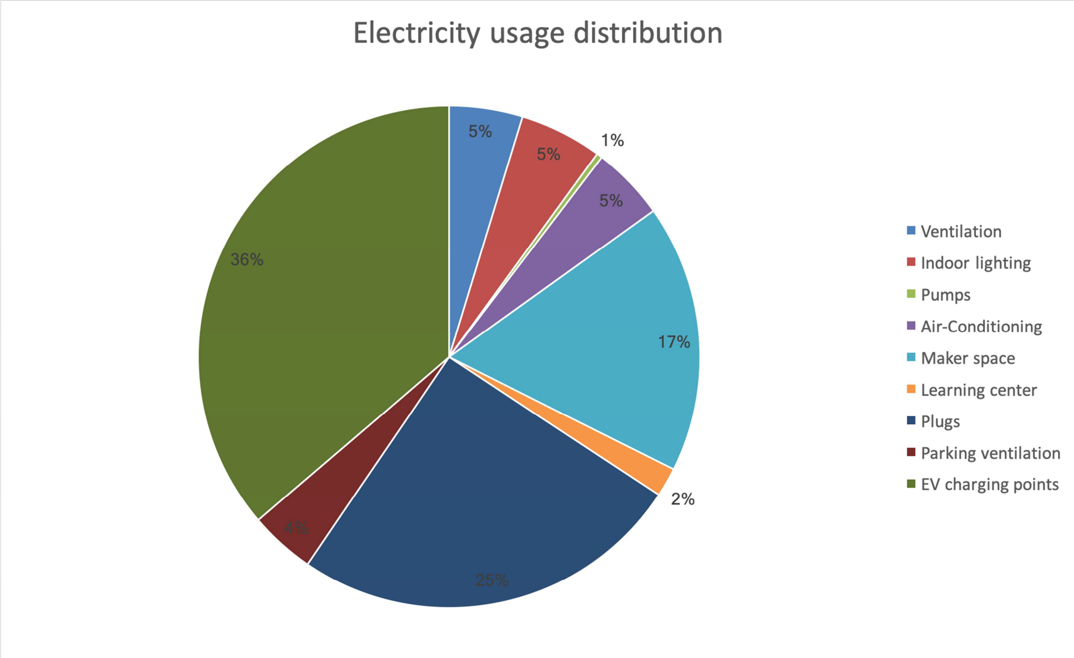
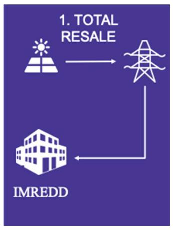


Figure 12 - IMREDD's building electricity consumption distribution estimation

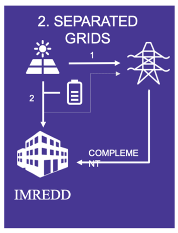


IMREDD’s building will self-consume its local electricity production. However, 3 scenarios were simulated in the studies, for a research point of view, with different system configurations:

The first scenario is the total resale. The whole PV generation is sold to the grid. There is no self-consumption. The result of the simulation shows the evolution of the return on investment with the resale price.

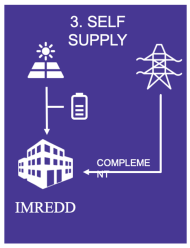


The second scenario was interesting as there is a threshold in France under which the PV generation must be bought by EDF OA[8] at an interesting price (with a contract of 20 years). The threshold is 100 kWp hence the idea to simulate the return on investment in the case of separating the installation in two.



[8] EDF Obligations d'Achat (EDF OA) is EDF's entity in charge of purchasing energy from producers: an online platform, provided with a customer service, through which producers carry out billing and follow the progress of their production. Since Feb. 2000, EDF and the local distribution companies (LDC) have had to buy energy produced by renewable energy production facilities. The purchase price can be either "set by the government by tariff orders or by the producer via a call for tenders decided by the government. and organized by the Energy Regulatory Commission. "

The third scenario is the self-consumption of the whole PV generation, with a battery storage system. It is the configuration that will be effective in the building.



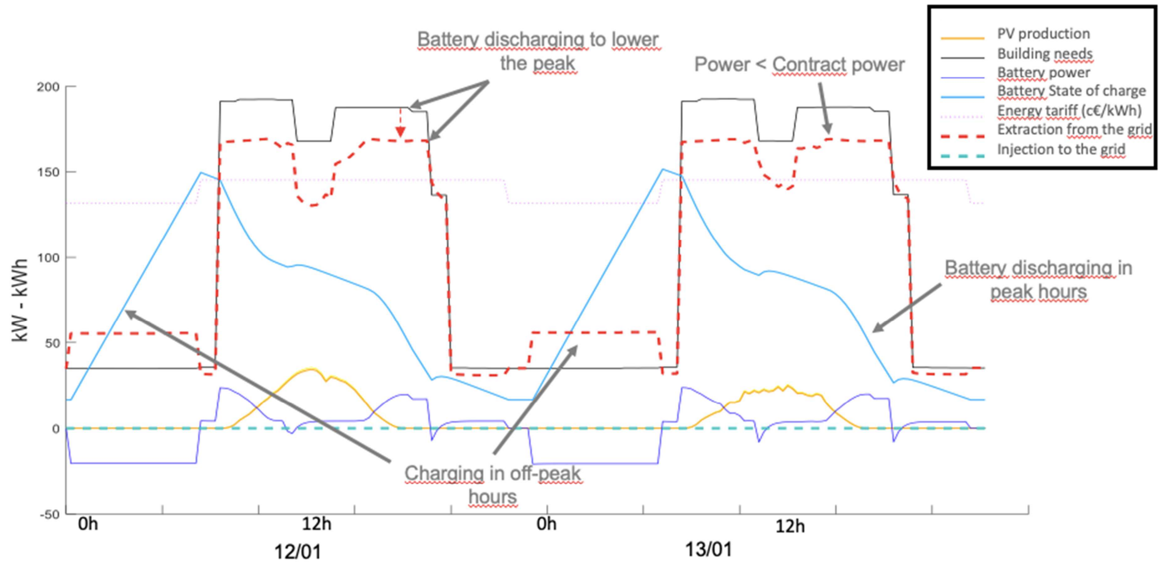
Several hypotheses have been modeled for the use of the battery storage system.

- The first hypothesis is the maximization of the self-consumption rate, it is the basic use of the battery. If the PV generation is lower than the building needs, the whole generation is consumed directly by the building. Otherwise, when the PV generation is higher than the building needs, part of it covers the building needs, and the other part is stored in the battery. If the battery is full, the PV surplus is injected to the grid. This surplus is sold on the market through an aggregator.
  The results of the simulations showed that in the whole year, the battery is used only 20% of the time. Indeed, the weekdays, the PV generation is on average lower than the needs. The battery is used during weekends and holidays. There is a necessity to add other services to use the battery more.
- The second hypothesis added to the first one is the tariff optimisation service. It is a simulation in which the algorithm optimises the charge and discharge of the battery depending on the electricity tariff and the balance between generation and consumption.
- The third hypothesis added is the peak shaving service offered by the battery. The optimisation of the battery charging and discharging is done with another constraint, to limit the maximum power extracted at 170 kW (30 kW less than the maximum building needs).

All the results are summed up in Figure 13 and Figure 14

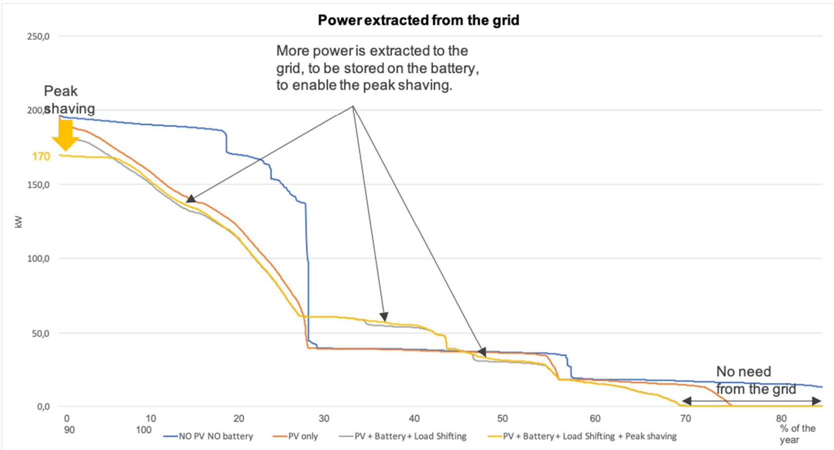
The first graph shows the evolution of the power and energy of the different components, during the days of the 12th and 13th of January. The building needs are represented by the black curve and the PV generation is the yellow one. The battery state of charge (in kWh), in blue, shows that the battery is charging during the night (off peak hours) and discharging during the day (peak hours), in order to lower the maximum power extracted (red curve). The injection power is null as the building absorbs all PV generation those 2 days (green curve).

Figure 13 - Evolution of power and energy of the different components, for the days of 12th and 13th of January (source EDF – EDF S&F)



The second graph represents monotonic curves of the power extracted from the grid. They are drawn by classification of the power points by descending order, on a whole year. The blue curve represents the building needs in normal use. The orange curve represents the extracted power from the grid, for the building equipped with PV panels. The PV generation reduces the extracted power from the grid. The grey curve represents the extracted power from the grid, for the building equipped with PV panels and a battery. The battery offers tariff optimisation service, hence a period where the extracted power is higher than the building needs. It also increases the time where the building is in autonomy. The yellow curve corresponds to the same system as the one before (PV + battery). It highlights the effect of the peak shaving service that reduces the maximum power extracted by the building.

Figure 14 - Monotonic curves of the power extracted from the grid for the different hypothesis (source: IMREDD and EDF/EDF S&F)



All the simulations were run with an optimisation algorithm in order to find the optimal battery capacity and power, for all hypothesis taken into account. The analysis of the results leads to the choice of a 150 kWh / 100 kW battery storage system.

5.2.3 Governance

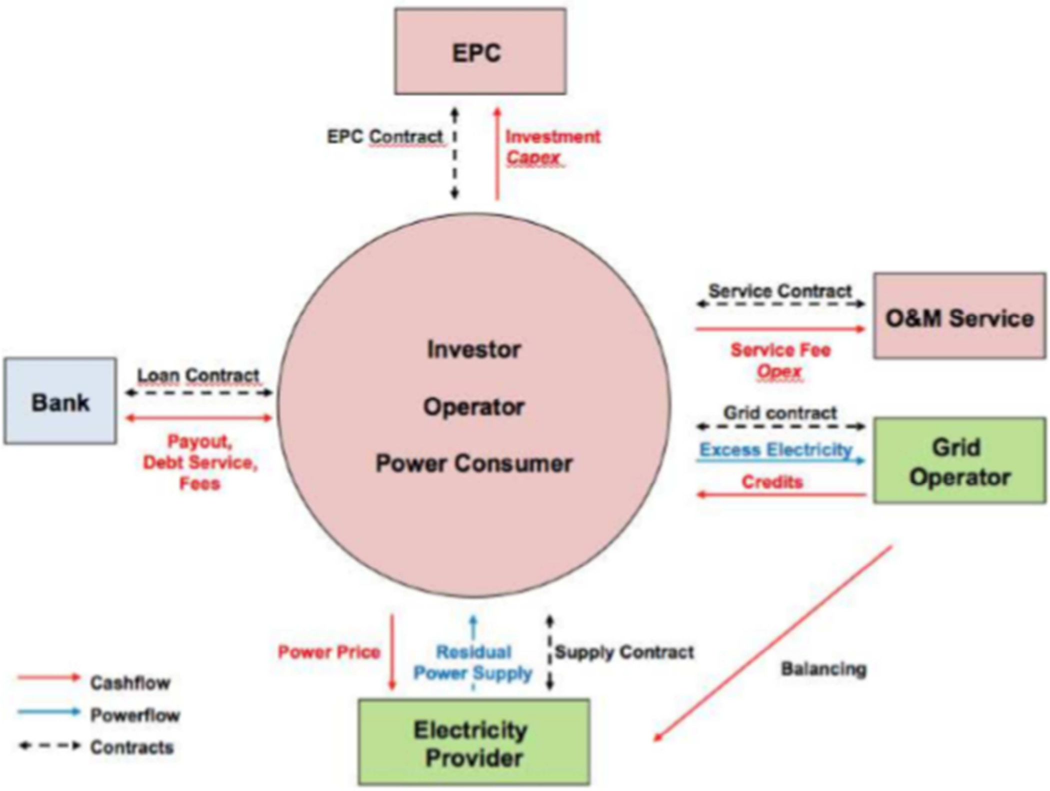
PALAZZO MERIDIA

Figure 15 extracted from the deliverable D2.6 Business Model Report- FRANCE of the PV-Financing EU project shows the relationship between the different actors involved in the financing and operation of an office building in France equipped with a PV installation and (optionally) a battery storage system.

In the PALAZZO MERIDIA building, the investor is NEXITY, a private entity. As the initial investment is significant, a bank participates in the project financing. The power consumers are the future customers (when the building will be delivered and sold) and the operator, the future property agent that will manage the office building. The O&M and EPC are the same operator, DALKIA. DALKIA will contract with the future customers represented by the property agent an Energy Performance Contract that will fix a self-sufficiency rate to be achieved during the operation of the building.

ENEDIS is the French DSO (the grid operator).

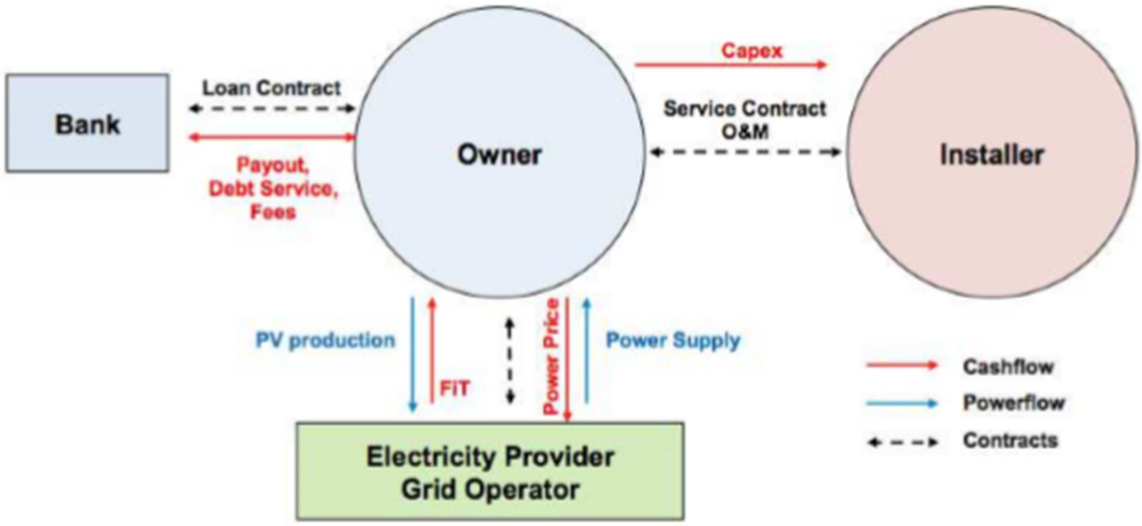
Figure 15 - Governance – PALAZZO MERIDIA (source: PV-Financing project)



IMREDD

The scheme for an educational building in France is even simpler as the investor, the operator and the power consumer are the same legal person: the State represented by the Nice Sophia Antipolis university (seeFigure 16).

Figure 16 - Governance – IMREDD (source: PV-Financing project)



In this scheme, part of the electricity produced by the PV panels is self-consumed. This can be the electricity produced during the days of the week, excluding the holidays. The rest of the electricity is injected in the grid and bought for a fixed price negotiated prior to the photovoltaic installation.

5.3 Impact Assessment

5.3.1 Expected impact

By increasing the share of locally produced and consumed renewable energy (installation of PV panels) Measure 1 will decrease the amount of electricity imported from the grid and hence reduce the CO_2 emissions associated with the centralized electricity generation from power stations especially when these stations are powered by fossil fuels.

Expected impacts must be estimated in the short term (at the end of the IRIS project, i.e. in 2022) and in the medium term (beyond the end of the project, i.e. in 2030). These estimates have been calculated on the demonstration area for Measure 1.

Table 6 and Table 7 show the expected impacts for Measure 1 in the short term and the medium term.

Table 6 – Measure 1 - Expected impacts – Short term (2022)

	Expected impacts		
	Increase renewables (kWp)	Energy savings (MWh/year)	CO2 reduction (ton CO2/year)
Measure 1	360	340	24

Table 7 – Measure 1 - Expected impacts – Medium term (2030)

	Expected impacts		
	Increase renewables (kWp)	Energy savings (MWh/year)	CO2 reduction (ton CO2/year)
Measure 1	4030	5300	371

5.3.2 KPIs

The list of KPIs that will be used to quantify and qualify the performance of Measure 1 for both PALAZZO MERIDIA and IMREDD buildings is given in Table 8.

Table 8 - Measure 1 - KPIs

KPI	Unit	Definition	Target
Local renewable energy production	MWh/year	Produced energy from renewable production over a year	360
Degree of energy self-supply by RES	%	Ratio of locally produced energy from RES and the energy consumption over a year	80%
Storage capacity installed	kWh	Total electrical battery capacity installed in the project	300
Carbon dioxide emission reduction	tons CO_2/year	Total reduction of emissions of carbon dioxide per year after Measure 1 is implemented	24
Energy savings	MWh/year	Total reduction of the building energy consumption per year after Measure 1 is implemented	340
CO_2 reduction cost efficiency	€/ ton of CO_2 saved/year	Costs in euros per ton of CO_2 saved per year	Not fixed yet

5.3.3 Monitoring plan

Monitoring plan aims at calculating KPIs above mentioned.

KPIs deal with services provided by the battery. For PALAZZO MERIDIA and IMREDD buildings, battery storage system is foreseen to increase natural self-consumption of the building (communal parts of the building for PALAZZO MERIDIA). Therefore, monitoring plan is based mainly on electrical power measurements located at convenient places.

In addition, it is appropriate to measure the real battery efficiency (auxiliary consumption, non-ideal inverter and non-ideal discharge/charge behavior) but also to evaluate KPIs for the whole building.

The metering system will be made of electric meters (electronic) measuring voltage and current at 10 mn timestep (10 min averaged power).

Electric meters will be used to measure and monitor:

- Building electricity loads separately (private spaces, common spaces, park areas …).
- Electricity generated by the PV panels.
- Electricity imported from the grid.
- Electricity exported to the grid.
- Electricity provided by the battery to the building.
- Level of charge of the electric battery relative to its capacity, SoC (provided by the battery management system).
- Electricity demand from auxiliary system (ventilation, lighting, micro controllers from EMS and BMS etc.).

In addition, electric meter for the total building electricity demand (measured at the electrical transformer every 10 mn timestep) and energy meter for the total building heat and cool demand (measured at the DHC network substation on a monthly basis) will complete the monitoring plan.

5.4 Commissioning Plan

The purpose of commissioning is to verify and record that equipment and/or systems comply with the design specification and that construction is done accordingly. This process considers all the process steps from design till completion.

Table 9 shows the high-level commissioning plan for both PALAZZO MERIDIA and IMREDD buildings.

Table 9 – Measure 1 - Commissioning plan

Phase		Activity	Parties involved		Responsibility
			IMREDD	PALAZZO MERIDIA	
1	**Design**	Set up list of requirements	• IMREDD	• NEXITY	• Initiation and coordination of works
		Set up preliminary design	• IMREDD/EDF S&F • ValEnergies • SOCOMEC • Schneider • IMREDD	• NEXITY/EDF S&F • EDF ENR • SOCOMEC • NA • NEXITY/BG21	• Coordination and input • Draw the design (PV) • Draw the design (Battery) • Draw the design (Charging stations) • Assess the design
2	**Engineering**	Elaboration of the design	• IMREDD • ValEnergies • SOCOMEC • SOCOMEC • Schneider • Schneider • IMREDD	• CSTB • EDF ENR • CSTB • SOCOMEC • NA • NA • NEXITY/BG21	• Input for design (PV) • Draw the design (PV) • Input for design (Battery) • Draw the design (Battery) • Input for design (charging station) • Draw the design (Charging stations) • Assess the design
		Revenue calculations	• IMREDD/EDF S&F	• NEXITY/EDF S&F	• Set up calculation
		Construction costs calculations	• IMREDD	• NEXITY/BG21	• Construction costs calculations
3	**Contracting**	Contracting works	• UNS/IMREDD	• NEXITY/BG21	• Set up and sign contract
4	**Realization**	Preparation of the PV panels	• ValEnergies	• EDF ENR	• Prepare the hardware
		Preparation of the charging stations	• UNS/IMREDD	• NA	• Prepare the hardware
		Preparation of the Battery	• UNS/IMREDD	• SOCOMEC	• Prepare the hardware
		Installation of the PV panels	• ValEnergies	• EDF ENR	• Installation on the roof

		Installation of the charging stations	• IMREDD	• NA	• Connect all items in the parking lot
		Installation of the battery	• IMREDD	• NEXITY/ENGIE INEO	• Connect the battery
5	**Testing**	Test of Measure 1	• IMREDD/ValEnergies • IMREDD/SOCOMEC • IMREDD • IMREDD	• CSTB/EDF ENR • CSTB/SOCOMEC • NA • CSTB/EDF S&F • CSTB/EDF &SF	• Test and report (PV) • Test and report (battery) • Test and report (charging stations) • Test and report (self-sufficiency) • Assess the report
6	**Completion**	Accept the executed works	• UNS/IMREDD	• NEXITY/ENGIE • NEXITY/BG21 • BG21/NEXITY	• Handover the installation • Assess the executed works and as-built documents • Accept the installation

5.5 Implementation plan

5.5.1 Planning of activities

The revised planning of activities is given in Figure 17 for the PALAZZO MERIDIA building and Figure 18 for the IMREDD building.

5.5.2 Planning of costs and (equipment) investments

No other costs than those entailed in the GA are foreseen.

5.5.3 Risk management

PALAZZO MERIDIA

From a technical point of view, the installation of a 100 kWh electric battery in the basement of a wooden frame building raised fire hazard problems (this kind of configuration is for the time being unique in France) but these problems were resolved. The room where the battery is installed was fitted with all necessary safety equipment, such as alarms, smoke detectors, dedicated ventilation shafts that open straight into the outdoor air, and the room itself is built as a separate fire compartment.

The main risk is that NEXITY is only the investor and that the PALAZZO MERIDIA building will be sold to different buyers once the building is delivered. It will therefore be necessary to be vigilant that the new owners (assembled in condominiums) commit to join the IRIS project at least for the duration of the experimental follow-up.

IMREDD

IMREDD is an entity of the university Cote d'Azur. From an economical point of view, due to its public status, there is no possible direct financial issues around the construction of the building. But when it comes to the risk management, the economical aspect is not the only possible source of difficulty.

As shown in Figure 19, the human resources turnover, the service provider default and the safety of the different technical solutions could potentially be another risks encountered during the IRIS project.

Indeed , as we recently noticed, embedded lithium-ion battery faced some fire issues especially with Tesla's car. Those accidents highlighted the need of specific safety protocols if we want to use this kind of technology in the IMREDD building and constraints around that question are pretty restrictive. As for the PALAZZO MERIDIA, a dedicated room for the battery storage will be implemented and equiped with different safety equipments.

Moreover, service providers face new challenges since the construction of the new demonstrator is very technical. Every step realized is sometimes the first ever done in its field, and as everyone knows prototypes are very time consumming leading probabily to an additional delivery delay.

Figure 17 - Planning of activities – PALAZZO MERIDIA

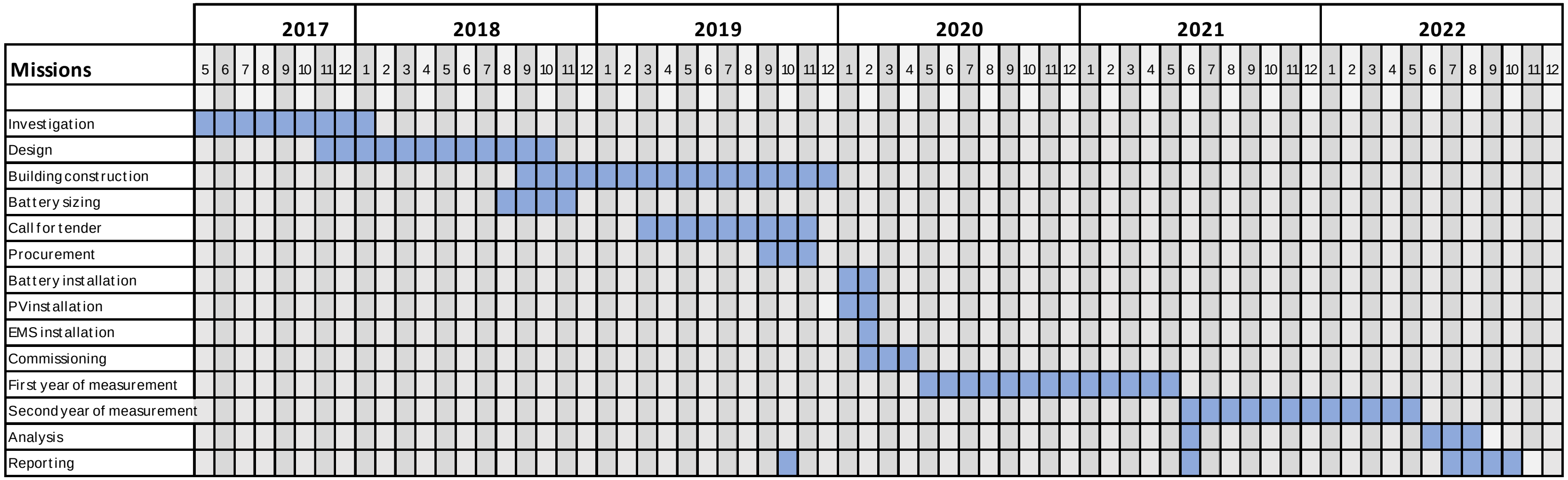


Figure 18 - Planning of activities – IMREDD

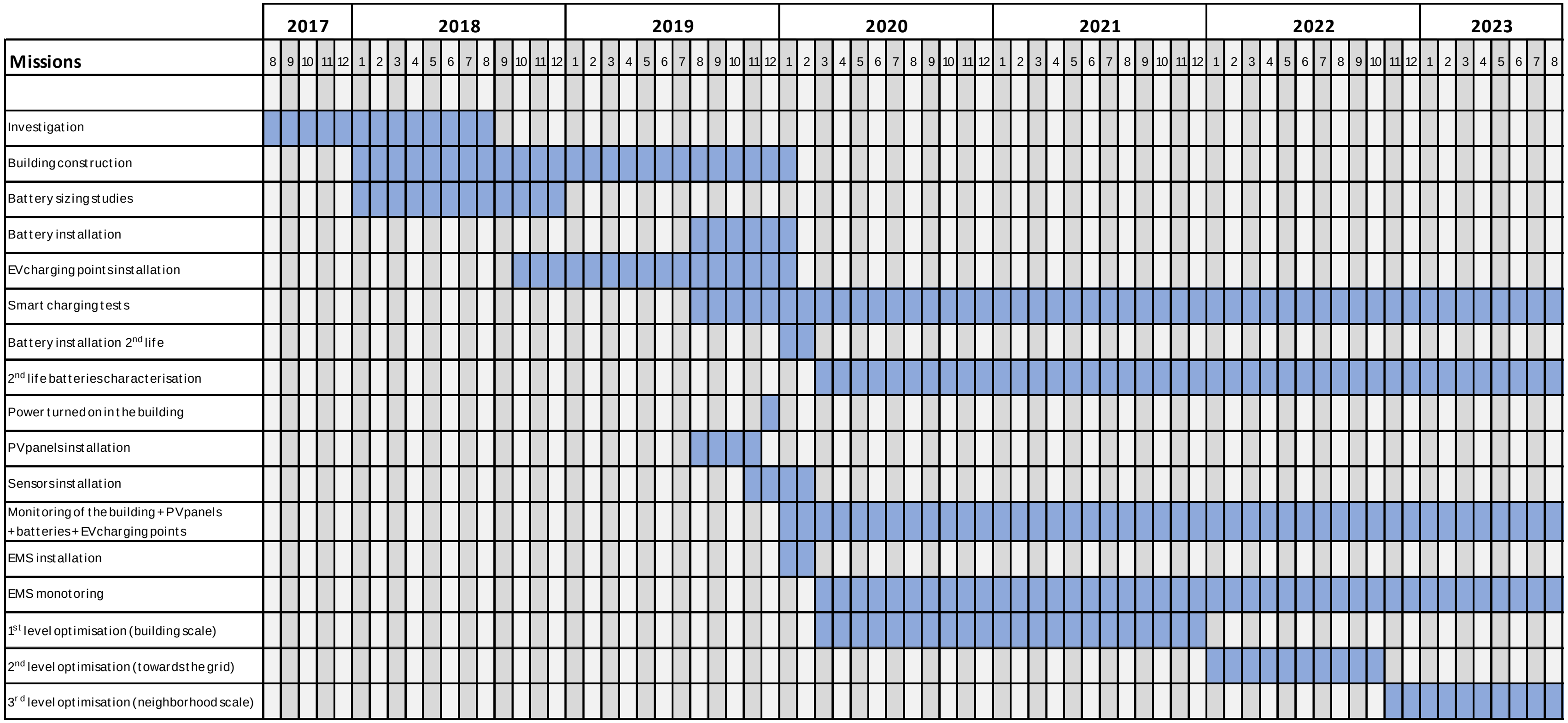
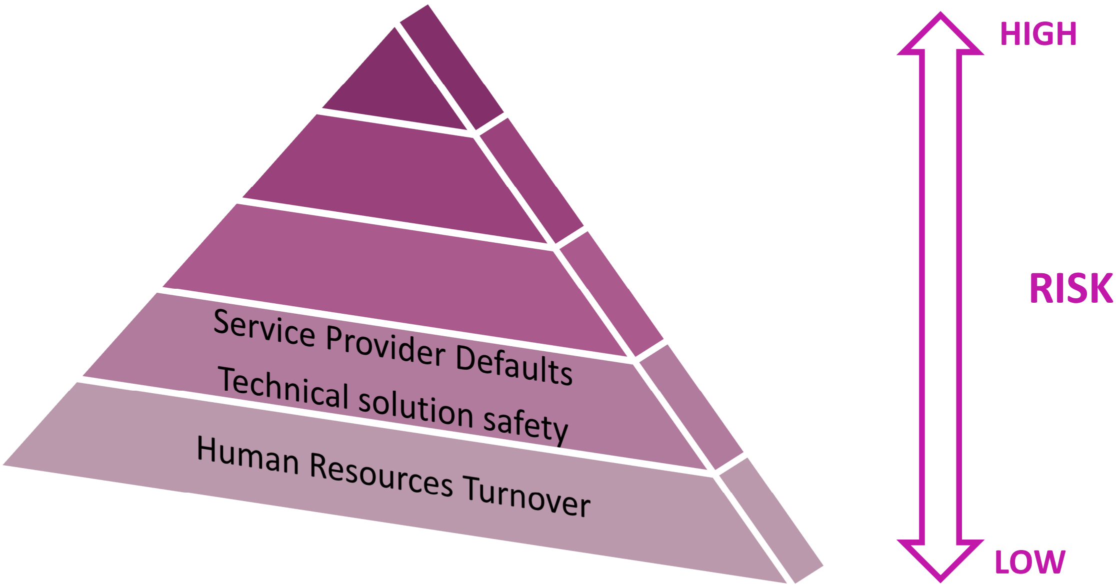


Figure 19 - Risk assessment through the Bird's pyramid



5.5.4 Progress achieved up to M24

Since the beginning of the project, all the different studies regarding the future demonstrators, have been completed.

From Oct 2017 to Sept 2018, different strategies to maximize the ratio of PV self-consumption have been studied with or without energy storage. Software to size electric battery has been developed and used on the two buildings supporting the demonstration. Finally, the sizing and the choice of all the components have also been realized. The metering system needed to assess the impact of different technologies (energy storage, active load shifting) to increase the ratio of PV self-consumption has been defined.

In April 2019, a call for tender has been launched to select companies providing and installing the different equipment. In August 2019, the PV panels have been partially installed on the roof and the full completion is expected by end of September 2019.

The 2 buildings are still under construction, but they should be inaugurated by December 2019 for the PALAZZO MERIDIA building and February 2020 for the IMREDD building.

5.6 Conclusion

As required by the Grant Agreement, the test campaign is going to start at the latest on March 2020 in order to fulfil the two years data measurement period. Data analysis will be performed for the 2 buildings on a regular basis (every 3-months) and data will be processed and forwarded to the CIP.

6 Measure 2: Optimization of heating load curve

Renovation of existing buildings is generally limited to the refurbishment of the means of production or insulation of buildings. Heating control remains centralized according to a single heating scheme for the entire building, which depends only on the outside air temperature and on an internal room measurement. Some houses are overheated while others are underheated, leading to overconsumption (overheating, opened-windows, …) and discomfort.

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.

6.1 Specifications

The selected experimental area is in the social housing area of Nice Saint Augustin in two neighboring towers named 13 & 14 (see Figure 20). These buildings equipped with underfloor heating (high inertia system) will permit to test meteorological regulation within an optimal context.

In addition, different control algorithms will be tested simultaneously on the seventeen floors of each building in order to weigh the impact of each variable, and to test different sensor technologies.

Figure 20 – Measure 2 – Experimental area

Towers 13 and 14

- Date of construction: 1968
- Living area: 5342 + 5342 = 10,684 m2
- 17-storey building
- Total of 132 apartments (66 per tower)
- Collective heating connected to the "Moulins" heating network (one substation per tower)

The "Load curve" project is divided into 3 solutions to adjust the different regulatory models and evaluate the profitability of the different investment stages.

- Solution 1: Separation within the sub-station of production from north and south distribution - analysis of the profits and establishment of reference consumptions data for the performance analysis of solution 2.
- Solution 2: addition of regulators to solution 1, valves and thermal sensors per housing. Adjusting the distribution to individual needs, taking into account the actual temperature of each dwelling.
- Solution 3: technical and economical optimization of solution 2 - definition of the best performing individual control grid (housing / floor) according to technical and economic considerations.

Solution 1 will be implemented in both towers 13 + 14 and during the first year ie for the first winter time (season 2019-2020).

Solution 2 will be implemented at the same time in tower 13 so as to compare the associated profits of each solution 1 and 2.

The first winter time (season 2019-2020) will help to define the best technical and economical optimization which will lead to solution 3 from results of solution 2. Solution 3 will then be implemented in tower 13 in season 2 (season 2020-2021).

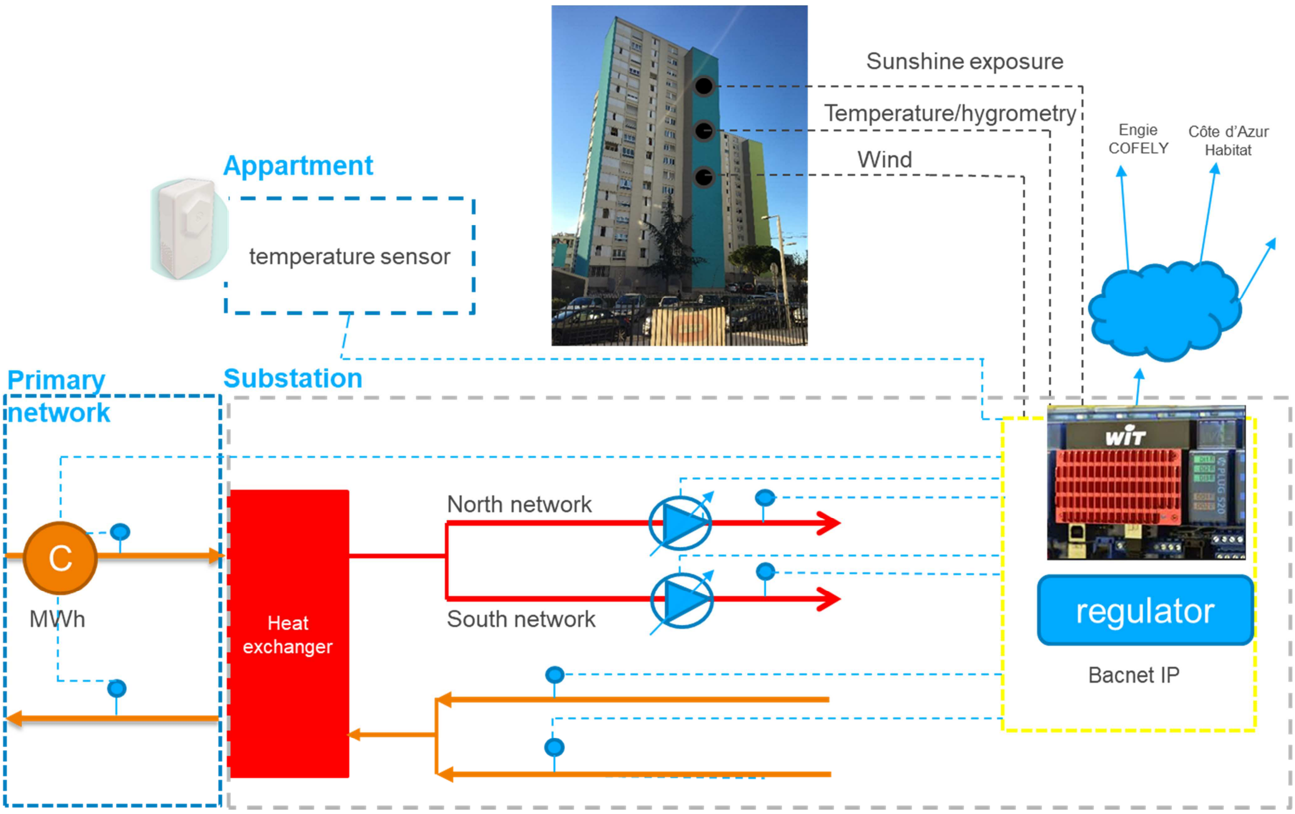
6.1.1 Hardware

Solution 1 : Regulation in substation according to sun exposure

Solution 1 includes (see Figure 21):

- Installation of two variable flow pumps (one for each column outlet – North/South).
- Installation of an electronic regulator in each substation.
- Installation of LORA platform.
- Installation of sensors:
  - Temperature on each heating departure and return.
  - 2 sunshine exposure sensors (North and South).
  - 1 wind sensor.
  - 4 temperature sensors.

Figure 21 - Scheme of regulation (solution1)

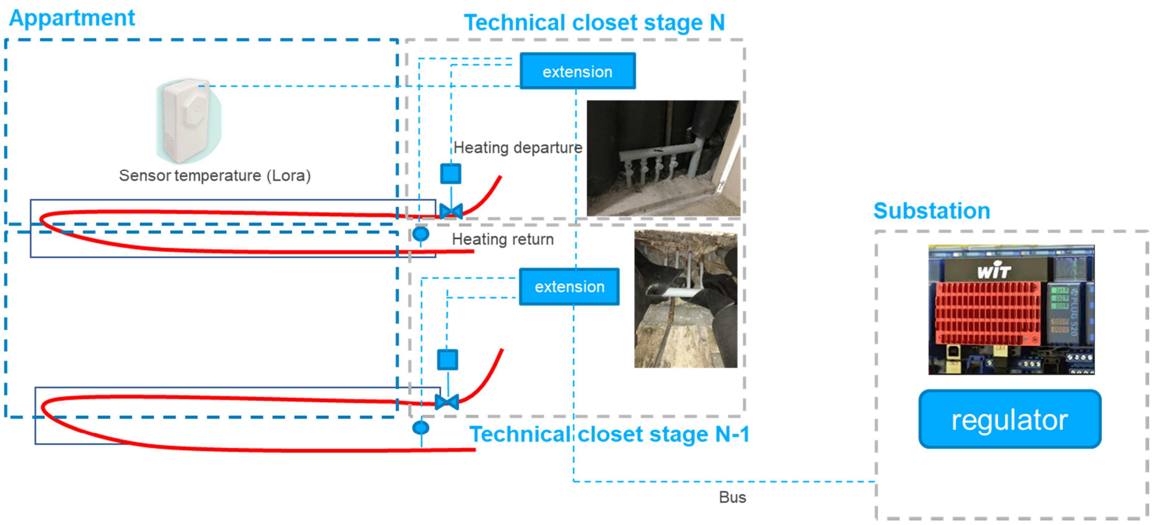


Solution 2 and 3 : Regulation by flat or stage according to indoor temperature

Solution 2 and Solution 3 include (see Figure 22):

- Installation of one two-way valve on each network departure in technical closets (power supply 230V).
- Installation of 1 temperature IOT in each flat.
- Installation of a wired extension (power supply 230V) to the substation regulator from the electrical closet of each stage.

Figure 22- Scheme of regulation (solutions 2 and 3)



Development of an autonomous and secure temperature sensor

Individual valves will be controlled from the temperature sensor of each flat. The reliability of the regulation implies a reliability of those sensors. Durability also implies longevity of the battery and discretion, so as to limit maintenance in the flat and vandalism.

For first experimentation (solution 2), temperature sensors available on the market will be used, a study has been made to choose the best market product. Solution 2 will permit to evaluate the efficiency and the limits of the model. For the second phase of experimentation (solution 3), COFELY will work on the sensor definition, with eventually the conception of a new product.

6.1.2 Software

Connections with the regulators will be as follows:

Solution 1: Regulation in substation according to sun exposure

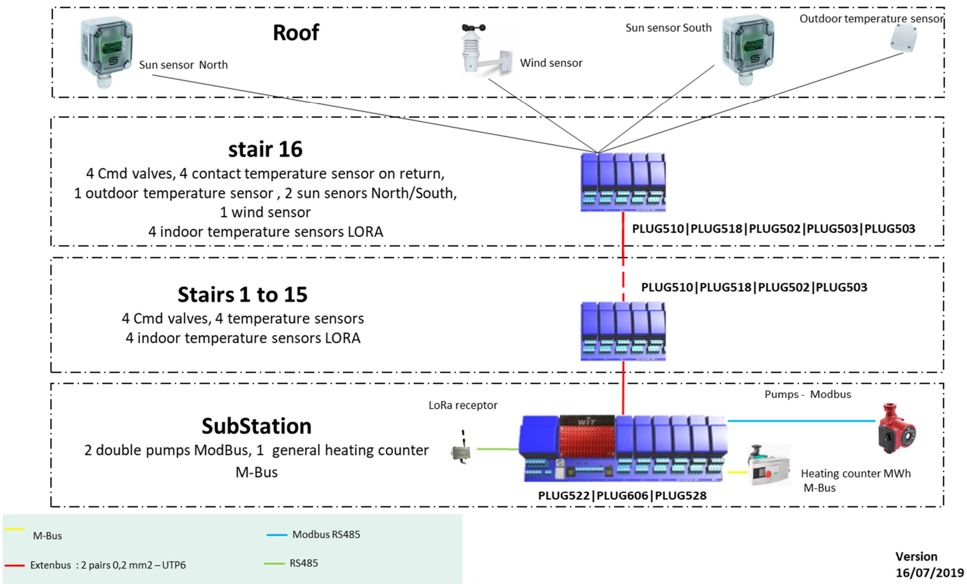
- modbus pump North / South.
- information of working state of the pump.
- information of pumps default.
- departure and return temperature.
- Mbus connection to MWh counter.
- primary network temperature.
- 1 outdoor temperature sensor.
- 2 sun sensors (North/south).
- 1 wind sensor.

Solutions 2 and 3: Control by flat or stage in technical closets according to indoor temperature

The elements in each technical closet are as follows (see Figure 23):

- 4 temperature sensors heating return network (one per flat).
- 1 Lora temperature sensor per flat.
- Installation of a bus linking all the extensions to the substation regulator.
- Plug for wind sensor, sun sensors and outdoor temperature in the last floor.
- LORA platform and connection to the regulator.

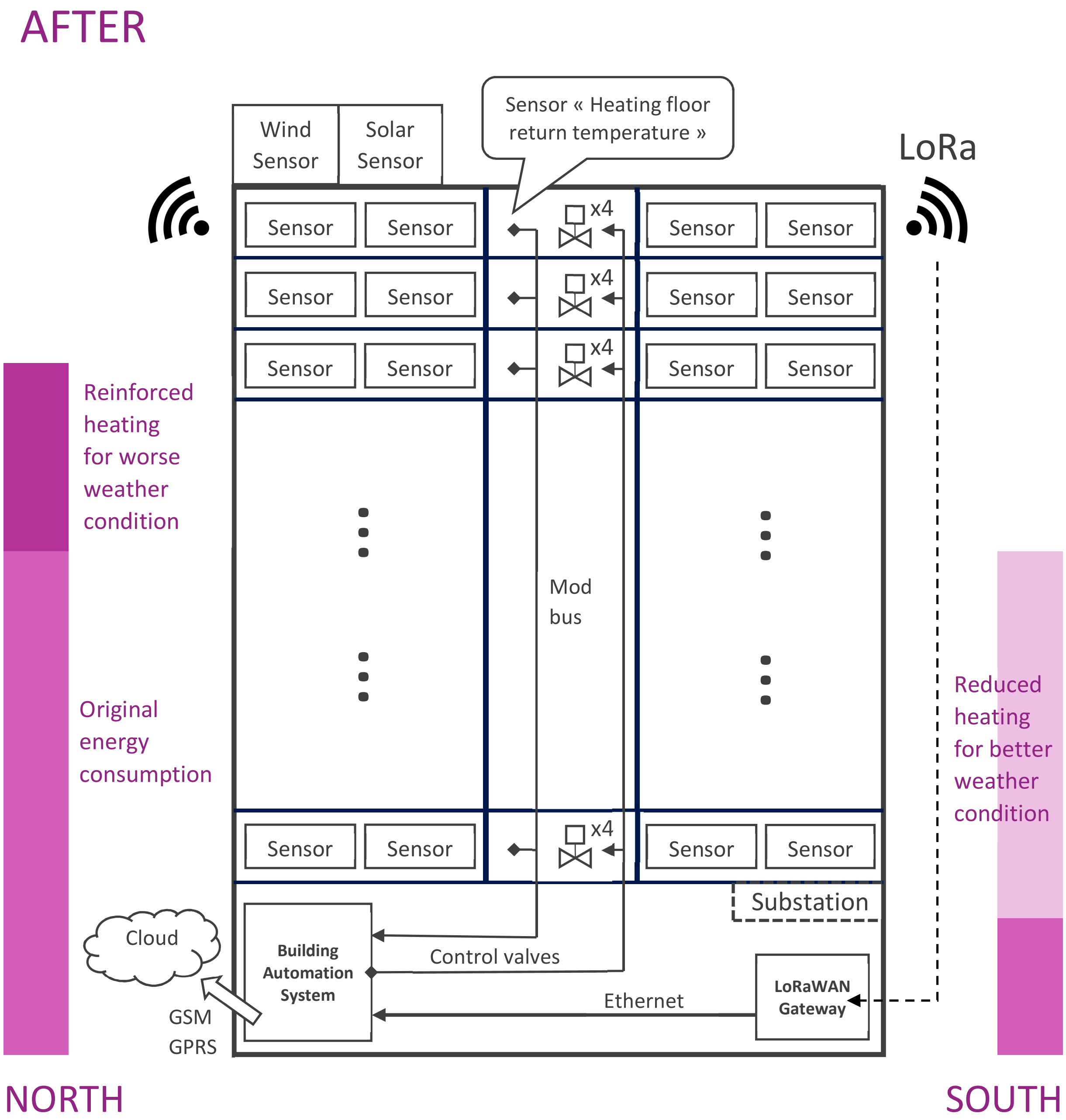
Figure 23 - Description and location of regulation equipment (solutions 2 and 3)



A specific description of solution 2 is given in Figure 24.

The 17 floors of each building will make it possible to simultaneously test and adjust different control algorithms in order to weigh the impact of each variable.

Figure 24 - Description of regulation (solution 2)



6.1.3 Procurement of equipment and/or services

COFELY will purchase different batches of equipment and services in order to implement solutions 1, 2 & 3.

The main categories are listed here below:

- Hydraulic: heating/sanitary/plumbing materials, plumbing subcontracting.
- Regulation: sensors, regulation subcontracting.
- Electric: materials, electrical subcontracting.
- Thermal camera, sonar, flow meters.

For each of those batches, a request for quotation has been sent to different suppliers mainly from ENGIE Energy Services supplier framework agreements (i.e. for materials).

For subcontracting, local companies have been consulted including site visits for accurate quotations. Many subcontractors consulted refused to work on site due to planning and security issued.

COFELY has finally managed to find subcontractors. They have started to work on site (from August 2019).

6.2 Societal, user and business aspects:

6.2.1 Citizen engagement

The Citizen engagement activities include "awareness of energy use", and "awareness of individual acts" (with both collective and individual returns). Measure will be deployed with the support of neighbourhood association to be contracted through subcontracting. This organisation will implement "I'm learning energy" sessions with their social animators.

- Awareness of energy use understanding the different consumption (heating, ECS, electricity,) appropriation of invoices, control of budget.
- Awareness of individual acts to collective return, Sense of the common use.
  Example: respect the substation, no degradation and no heating break or ECS.
  Improved comfort, lower costs.
- Awareness of individual acts to individual return Example: the impact of my actions on my electricity or my individual water consumption.

"I'm learning energy" sessions will be implemented:

- To children at school and college.
- To adults by workshops.

Besides, a dedicated online web portal for social landlord will be implemented in order to provide individual coaching for the tenants so as to improve their awareness of energy usage. (the digital solution called VERTUOZ Habitat & Community in the CAH portal). Measures are explained in D6.7.

6.2.2 Business model

The expected investments (excluding charges linked to the development part in the IRIS project), associated annual costs of maintenance, annual replacement costs of defective devices (batteries, …) are presented in Table 10.

Table 10 - Initial estimate of costs in industrial phase

	Solution 1	Solution 2	Solution 3
Investments	20 060	58 769	23 507
Maintenance	0	1 254	627
Defective devices	0	1 650	850

The annual cost of defective device has been estimated to take into account a long life-cycle of 5 years for batteries and 10 years for valves.

The cost of energy is based on the gas price of May 2019. Performance of heating production in the central boiler room as well as the performance of the distribution in the network till the substation, lead to a final cost of 61,8€/MWh (all taxes included) for heating consumption in the buildings.

The estimated profits, considering the reference consumption of winter 2018/2019, are presented in Table 11.

Table 11 - Initial estimate of payback time

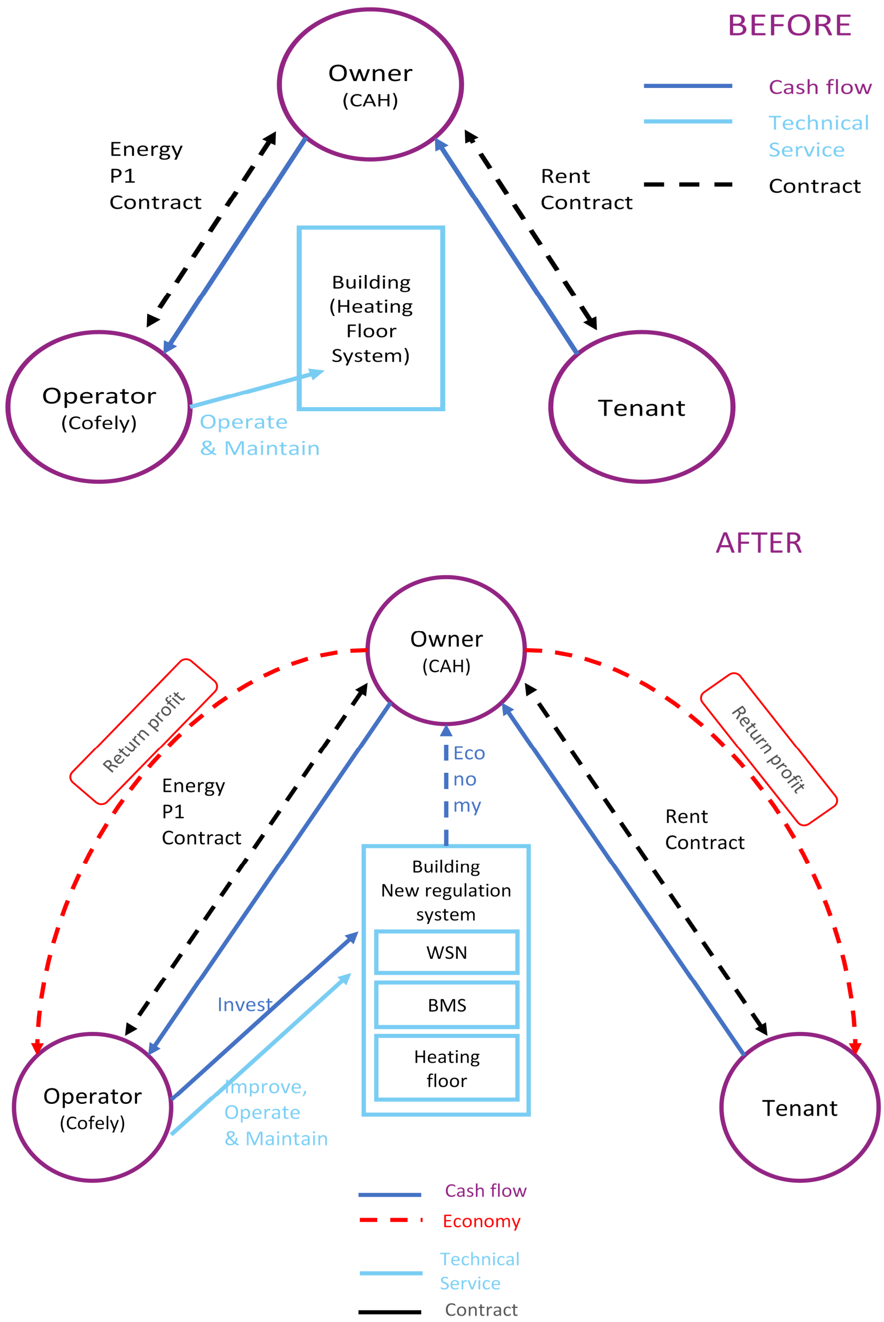
	Reference energy consumption (MWh)	Annual energy cost (€)	Energy performance (%)	Annual energy savings (€)	Payback time ROI (year)
Solution 1	406	25 094	5	1 255 €	16
Solution 2	497	30 718	20 / 6 143 €	3 240 €	18
Solution 3	406	25 094	15 / 3770 €	2 312 €	10

Costs as well as annual energy savings will have to be readjusted thanks to the feedback of the IRIS project.

6.2.3 Governance

The governance scheme associated to IS#2 is given in Figure 25.

Figure 25 – Governance scheme



COFELY commits to improve the heating performance of the building by deploying IoT technology and using optimized heating load curve. To achieve this goal, an investment has been put by COFELY including a building automation system (BAS), a heating system, sensors, wireless sensor network etc.

The initial standard regulation strategy is changed to a case-to-case individual regulation strategy which leads to a better understanding and optimization of energy consumption and occupant comfort.

The basic workflow is as follows:

1. obtain information on temperature, humidity, wind speed, solar radiation;
2. transfer data to BAS controller via a private LoRaWAN;
3. develop the room/building model;
4. adjust heating floor according to the room/building model.

The whole system research and development have been done by COFELY and COFELY keeps improving it by operating and maintaining the system for the upcoming years.

Once the implementation is done, each occupant will have the use of a heating system based on their local weather condition. Thus, the overall energy and resource efficiency will be increased, and a huge economy could be obtained. This gain should be justified by a monetary benefit for all participants: the lessor, the operator and the tenants.

6.3 Impact Assessment

6.3.1 Expected impact

By splitting (on two high-rise buildings) the heating distribution network per façade (solution 1) and installing a new smart control system for heat load curve optimization operating per flat (solution 2) or per floor (solution 3), Measure 2 is expected to achieve important energy savings (and thus reducing CO_2 emissions).

Expected impacts must be estimated in the short term (at the end of the IRIS project, i.e. in 2022) and in the medium term (beyond the end of the project, i.e. in 2030). These estimates have been calculated on the demonstration area for Measure 2.

Table 12 and Table 13 show the expected impacts for Measure 2 in the short term and the medium term.

Table 12 – Measure 2 - Expected impacts – Short term (2022

	Expected impacts		
	Increase renewables (kWp)	Energy savings (MWh/year)	CO_2 reduction (ton CO_2/year)
Measure 2	0	900	252

Table 13 – Measure 2 - *Expected impacts – Medium term (2030)*

	Expected impacts		
	Increase renewables (kWp)	Energy savings (MWh/year)	CO_2 reduction (ton CO_2/year)
Measure 2 Solution 1+2 (40%) and solution 1+3 (60%)	0	1300	364

6.3.2 KPIs

The list of KPIs that will be used to quantify and qualify the performance of Measure 2 for both towers 13 and 14 is given in Table 14.

Table 14 – Measure 2 - KPIs

KPI	Variables, baseline	Unit	Target
Energy savings	E_{st} : Thermal energy savings	%	
Based on	T_{ec} : thermal energy consumption	kWh/m^2 year	
Solution 1 (sstation 14)	E_{st1} E_{c01}= 406 MWh		5%
Solution 1+2 (sstation 13)	E_{st2} E_{c02}=497 MWh		20%
Solution 1+3 (sstation 14)	E_{st3} E_{c0}=406 MWh		15%
Carbone dioxide reduction	m_{co2}	teqCO_2/year/building	
Based on	E_c : energy consumption E_{c0} : initial energy consumption	kWh/year kWh/year	
Solution 1 (sstation 14)	$m_{co2}1$		9
Solution 1+2 (sstation 13)	$m_{co2}2$		45
Solution 1+3 (sstation 14)	$m_{co2}3$		27
Return on investment	*ROI*	%	
Solution 1 (sstation 14)	$PG0$ = 39,62€/MWh; PH0 = 61,8€/MWh;		
Solution 1+2 (sstation 13)			
Solution 1+3 (sstation 14)			
CO2 reduction cost efficiency	$m_{co2}RCE$	€/teqCO2/y/building	
Based on			
Solution 1 (sstation 14)	$m_{co2}RCE\ 1$		
Solution 1+2 (sstation 13)	$m_{co2}RCE\ 2$		
Solution 1+3 (sstation 14)	$m_{co2}RCE\ 3$		

6.3.3 Monitoring plan

Each substation is already equipped with a thermal counter which permits to define the historical heating consumption (consumption in MWh). Historical data are based on winter 2018/2019 (from 25/10/2018 to 14/05/2019).

Influent parameters are:

- DJU with DJU_0 = 1196 the value for winter 2018/2019 in Nice.
- *S* the heating squared meter of the building. S = 5 342 m2 for each building.

Considering:

- E_c the heating consumption measured on the MWh in the current year for *DJU.*
- E_{c0} the heating consumption measured on the MWh counters on season 2018/2019 for DJU_0 = 1196.

6.3.3.1 Calculation of the energy savings

The energy saving is calculated as follows:

Considering:

- *DJU* : the current climate rigor.
- E_{st} : Thermal energy savings (kWh).
- T_{ec} : thermal energy consumption (kWh/m2.year).
- E_{rt}: Thermal energy reference consumption (winter 2018/2019) the demonstration-site (kWh/m2. Year) measured on the substation counter for DJU_0 and readjusted at *DJU.*

$$E_{st} = 1 - \frac{T_{ec}}{E_{rt}}$$

with

$$E_{rt} = \frac{E_{c0}}{S} \; X \; \frac{DJU}{1196}$$

$$T_{ec} = \frac{E_c}{S}$$

E_c and *DJU* will be measured each month.

6.3.3.2 Carbon dioxide emission reduction

Heating providing from a network, consumption directly on substation have to be corrected with on-line distribution heating losses so as to evaluate the properly carbon dioxide reduction.

Those heating losses have been evaluated up to *30%* on the reference year.

The evaluated performance of the central gas boiler on the reference year is *95%* (*kWh/kWhPCI*).

The carbon dioxide emission reduction m_{co2} per building, considering *0,331t teqCO₂/MWhPCI* gas.

$$m_{co2} = K \text{ X} \left(E_{c0} \; X \; \frac{DJU}{1196} - E_c \right)$$

with

$$K = \frac{0{,}331 \; X \; (1 + 30\%)}{95\%} = 0{,}453 \; teqCO2/MWhc$$

m_{co2} will be calculated each month.

6.3.3.3 Return on investment

Business plan has been defined in §6.2. 2.

Previous year energy savings of the IRIS project will be considered as the definitive performance associated to each solution. Indeed, first year of experiment will allow to adjust the regulation formula and associated parameters. IRIS will normally lead to a complete management of the load curve associated to individual ambient temperature, wind and sun influences.

ROI will be readjusted each year with:

- AI The initial investment for energy savings:
  - purchase of material,
  - installation,
  - programming (addressing objects, adjustments of parameters).
- *TAC:* The annual maintenance costs:
  - annual maintenance of valves and electrical equipments,
  - replacement of defective equipments,
- *PG:* price included taxes (€/MWh) in front of the boiler room actualized in January 2019, *PGO = 39,62€/MWh.*
- *PH0:* price of heat in front of the substation actualized in January 2019, *PH0 = 61,8€/MWh*; PH includes the heating losses between the boiler room and the substation.
- *Ln:* the final annual energy saving.
- *T:* duration of the investment.

$$ROI \quad = \frac{\left(PH0 \frac{PG}{PG0} X \; Ln - TAC\right) X \; T - AI}{AI}$$

6.3.3.4 CO_2 reduction cost efficiency

The CO_2 reduction cost efficiency $m_{co2}RCE$ takes into account:

- AI_{co2}The investment for energy savings annualized:
    - purchase of material,
    - installation,
    - programming (addressing objects, adjustments of parameters).
- TAC : The annual maintenance costs:
    - annual maintenance of valves and electrical equipments,
    - replacement of defective equipments.

Their values are defined presently with theoretical values. Both will have to be adjusted according to the feedback.

$$m_{co2}RCE = \frac{TAC + AI_{co2}}{m_{co2}}$$

with

$$AI_{co2} = \frac{AI}{T}$$

$m_{co2}RCE$ will be calculated each year.

6.4 Commissioning Plan

The commissioning plan for Measure 2 is indeed embedded in Measure 3 and is described in Table 15.

6.5 Implementation plan

6.5.1 Planning of activities

The revised planning of activities is given in Figure 26 for the implementation and test of solutions 1 to 3.

Table 15 - Measure 2 - Commissioning plan

Phase		Activity	Parties involved	Responsibility
1	**Design**	Analysis of technical requirements for energy savings	• COFELY	Consideration on energy performance regarding aging building part of the renovation plan for the social area "Les Moulins"
2	**Engineering/ Installation**	Definition of technical specifications for the Separation of north/south heating networks	• COFELY	Hydraulic, electricity & regulation specifications
			• SUPPLIER	Integration of local partner for regulation part (WIT)
		Purchases of equipments/subcontracting	• COFELY	Quotation sent to several local partners
		Installation of equipments / subcontracing	• COFELY	Installation, support and coordination on site
			• CAH	Coordination with tenants
			• SUPPLIERS/SUBCONTRACTORS	Installation and implementation on site
3	**Testing**	System testing	• COFELY	Assessment of results according to the initial expectations (technical solutions)
4	**KPI**	KPI	• COFELY	KPI Definition with European team
5	**Monitoring maintenance**	Maintenance follow-up	• COFELY	Site management on energy performance Review on data collection

6.5.2 Planning of costs and (equipment) investments

The initial estimate of investment costs for solutions 1 to 3 is given in Table 16.

Figure 26 - Planning of activities

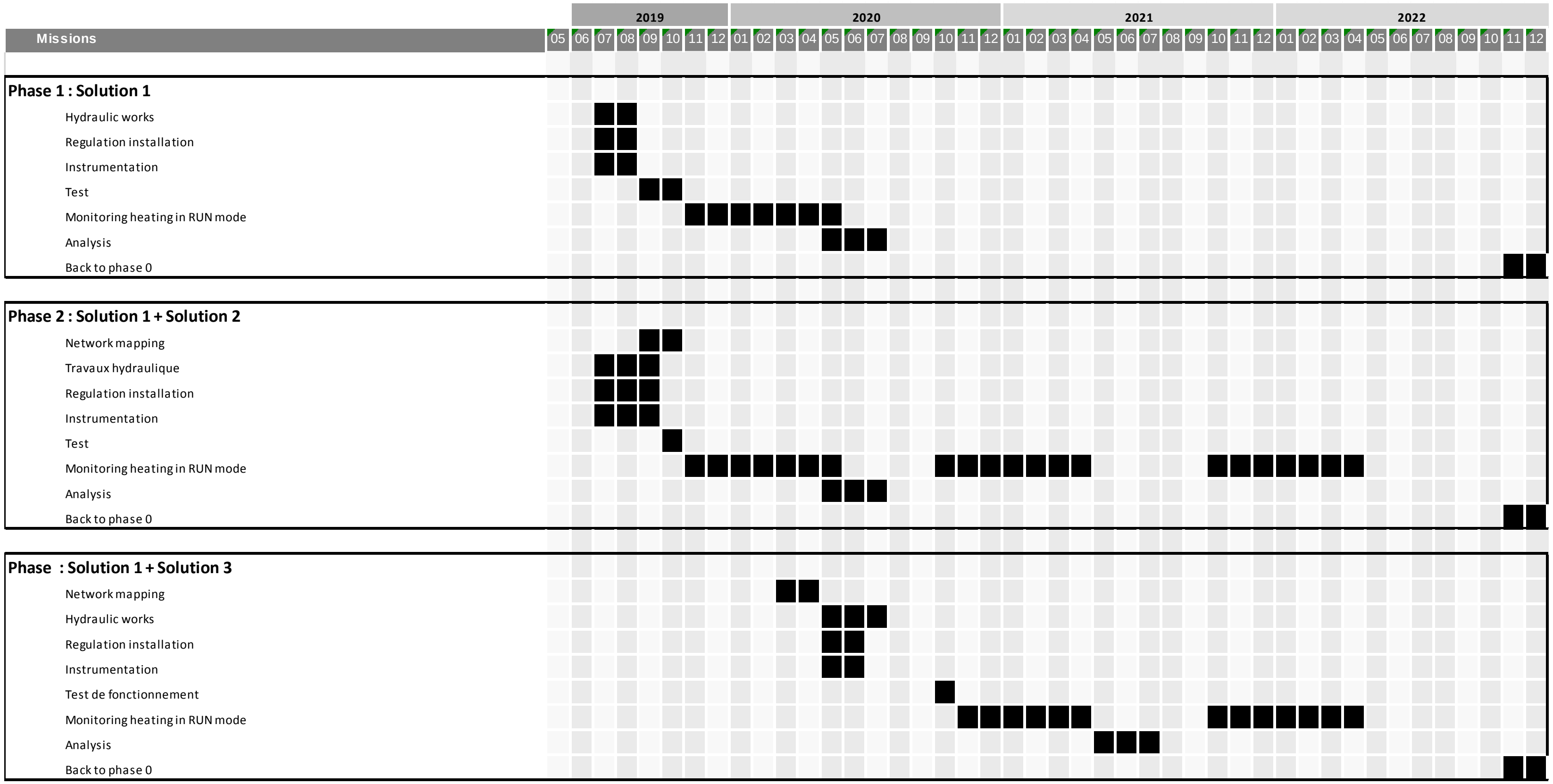


Table 16 - Initial estimate of investment costs for the project

			2019	2020	2021	2022
Subcontracting costs (EUR)	**253 500 €**					
Load curve	**155 700 €**	**TOTAL**	**138 700 €**	**17 000 €**		
Solution 1	121 700 €		121 700 €			
Solution 2						
Solution 3						
Engineering	34 000 €		17 000 €	17 000 €		
Equipment (EUR)	**215 010 €**					
Load curve	**170 010 €**	**TOTAL**	**132 648 €**	**37 362 €**		
Solution 1	15 510 €		15 510 €			
Solution 2	117 138 €		117 138 €			
Solution 3	37 362 €			37 362 €		
Engineering						
DIRECT COST (EUR)	**192 692 €**					
Load curve	**164 092 €**	**TOTAL**	**111 261 €**	**48 981 €**	**3 850 €**	
Solution 1	9 790 €		9 790 €			
Solution 2	89 471 €		89 471 €			
Solution 3	36 981 €			36 981 €		
Engineering	27 850 €		12 000 €	12 000 €	3 850 €	

6.5.3 Risk management

The risk is related to:

- the difficulty of finding and having the subcontractors working in these social areas (deterioration, incivility) ;
- the behavior of tenants who may give up the installation of sensors in their flat or even worse; deteriorate them.

6.5.4 Progress achieved up to M24

Limited progress has been achieved so far since COFELY recently joined (May 2019) the IRIS project. However, by end of 2019, it is expected that:

- Solution 1 is implemented into the towers 13 & 14 at 100%.
- Solution 2 is implemented into the tower 13 at 50%.
- Solution 3 will be implemented into the tower 14 at 50% in2020.

6.6 Conclusion

The implementation of the technical solutions planned for this heating season is on track, hydraulic and electrical works have started in August 2019. Updates will be communicated along the way.

7 Measure 3: Commissioning process from the design to the operation

The REPERE service is 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 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 (bills are used when measurement before refurbishment, called the baseline, is not available).

The REPERE service will be tested on two high-rise buildings built in 1974 and located in Les Moulins, a social housing area densely populated characterized by a majority of low-income and multicultural households. These two buildings (towers 13 and 14) have been recently refurbished with a large panel of energy-efficient measures. **The REPERE service will be used to assess the achieved energy savings when respectively solutions 1 to 3 (defined in Measure 2) are implemented**.

7.1 Specifications

7.1.1 Hardware

The hardware used to run the REPERE service is described in Table 17.

Table 17 - Measure 3 – Hardware

Main Component	Technical Specifications	Demonstration Area
Air temperature / Humidity sensor	• Timestep: 10 min fixed or variable timestep [minimum = 5min, maximum = 1hour, variable step= 0.3°C on temperature 3% on Relative humidity] • Measure accuracy: 0.2-0.3 °C on air temperature measurement, 2-3% on relative humidity measurement • Measure resolution: 0.1 °C on air temperature measurement, 1% on relative humidity measurement • Measure range: 10°C-35°C on air temperature measurement, 0-100% on relative humidity measurement	Each apartment of Towers 13 and 14
Volumetric DHW meter	• Measure accuracy: 1L • Measure resolution: 1L • Measured variable: water volume as an index • Timestep: o Best: 1 index report per hour o Required: 1 index report per day or month	Each apartment of Towers 13 and 14

Energy consumption meter	• Index accuracy: o Bes :1kWh or better o Required: 10kWh • Timestep: o Best: 1 index report per hour o Required: 1 index report per day	Each DHS sub-station
Energy consumption meter (optional)	• Index accuracy: o Best:1kWh or better o Required: 10kWh • Timestep: o Best: 1 index report per hour o Required: 1 index report per day	Each distribution network of Towers 13 and 14
Energy DHW meter (optional)	• Index accuracy: o Best :1kWh or better o Required: 10kWh • Timestep: o Best: 1 index report per hour o Required: 1 index report per day	Each apartment of Towers 13 and 14
Data acquisition system	Wireless technology	One system per building

COFELY will deploy on site the monitoring that corresponds to these technical specifications.

7.1.2 Software

CSTB has designed and developed a method, toolkit and service – named REPERE – to qualify the actual energy performance and savings related to building energy retrofit, especially in the context of multifamily dwellings. The assessment of actual energy performance savings is put into perspective with the initial estimated/simulated ones. This service has already been implemented on different energy retrofit programs, for example with Toulouse Metropole Habitat or 3F, both are social landlords interested in evaluating the gain of theses renovation works on the energy bills for their building stock.

The REPERE service is based on monitoring and measurement data acquisition. These measurements are performed both before and after renovation and used to build an energy modelling of the building. This modelling is then exploited to compare the performance after renovation with the performance or bills before the renovation. (bills are used when measurement before renovation were not possible). For the acquisition of measurement and the modelling, the REPERE service is based on the IPMVP (International Performance Measurement and Verification Protocol) guidelines.

In the scope of the REPERE approach, measurements mainly consist in measuring the energy consumptions, from the already in place meters, related to individual and collective heating and dwelling hot water systems alongside some comfort variables such as temperature, hygrometry, luminosity. Theses variables are measured over the entire monitoring period (basically one heating season before and after retrofit operations) and usually use wireless technology and are gathered on a server to be analysed offline.

Based on these measurements, and on various meta data from the renovation project and the building and the estimated energy savings, the REPERE service consists in a complete data processing chain that allows semi-automatic energy analysis of the building renovation and comparison with the forecasted theoretical energy savings. Specifically, this data processing chain integrate a full data management process, including the diagnosis of measurement data with management of eventual missing values and errors, separation of usages of energy when measuring multi-usage energy consumption, a model identification of the building energy modelling and then the re-simulation of the consumptions, based on standard/ reference scenarios.

The REPERE service alongside the calculation of actual energy performance and savings offers various analysis of the reasons for performance gaps (analysis of initial theorical simulation, analysis of comfort and heating seasons, etc).

Some illustrations are presented below to show what elements are produced and used in the REPERE services.

Figure 27 illustrates an example of data loss detection offered by the REPERE method. This example comes from a monitoring campaign performed in the south part of France where the REPERE method has been deployed to assess the real energy gain obtained after energy saving measures were implemented on a social housing building. The scale ranges from red to green where green means all data are available. From this graph, it can be observed that some data is missing either on the spot or over longer periods of time (more than one day). The REPERE method incorporates some native routines that allow data analysis to be carried out even with incomplete datasets.

Figure 27 - Data loss detection with REPERE method

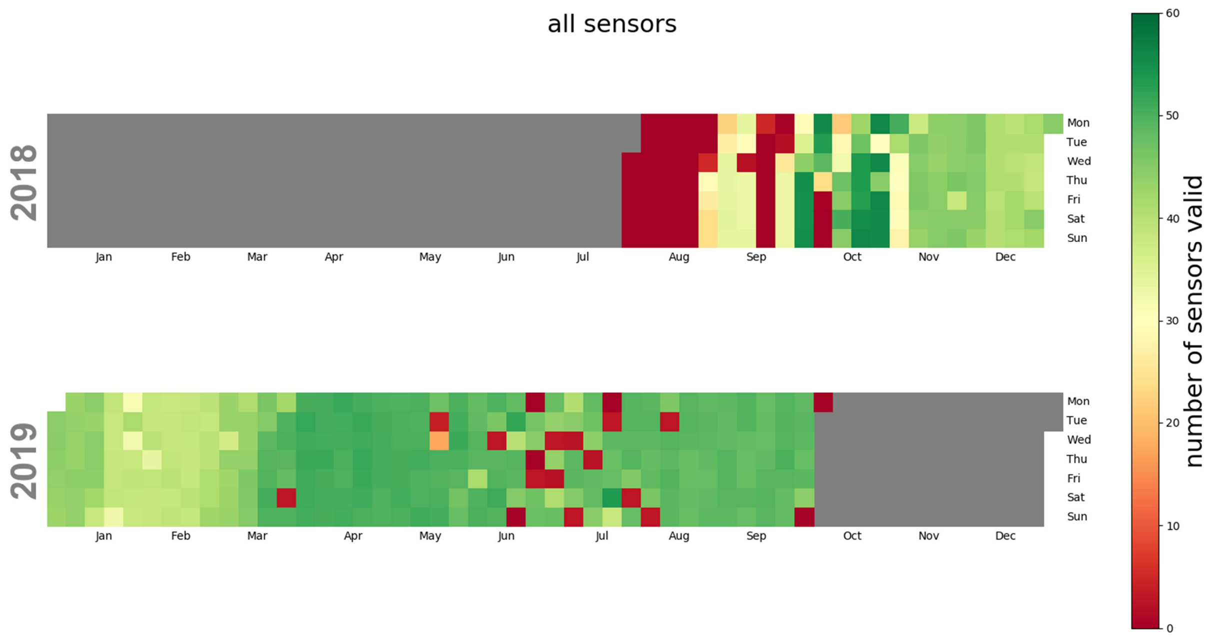


Figure 28 plots the daily energy consumption over the year calculated from the REPERE method on a multi-apartment building with individual gas heating system. A simplified dynamic energy model has been used to predict the building energy consumption and its probability to be heated based on outdoor temperature.Figure 29 shows an analysis performed on a building stock with different heating systems (central or individual heating systems, gas or electricity). This graph enables to compare the impact of these systems on the balance between energy efficiency and thermal comfort.

Figure 28 – Daily energy consumption calculated from REPERE method on a multi-apartment building with individual gas heating system

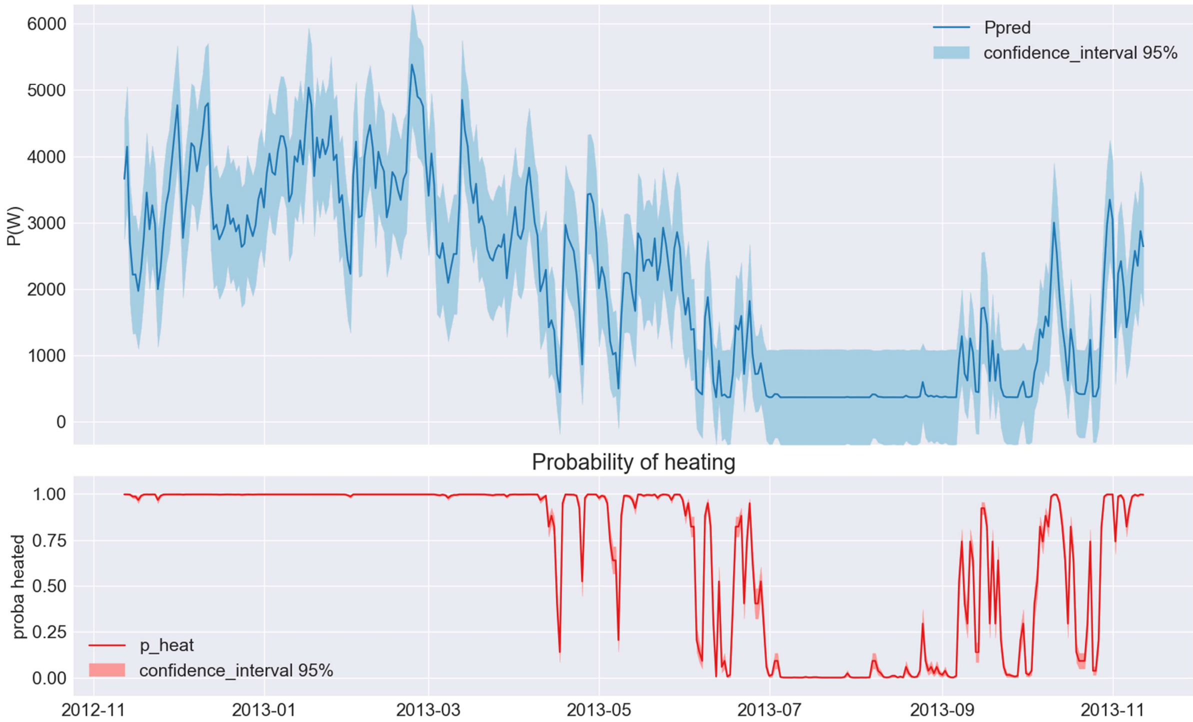
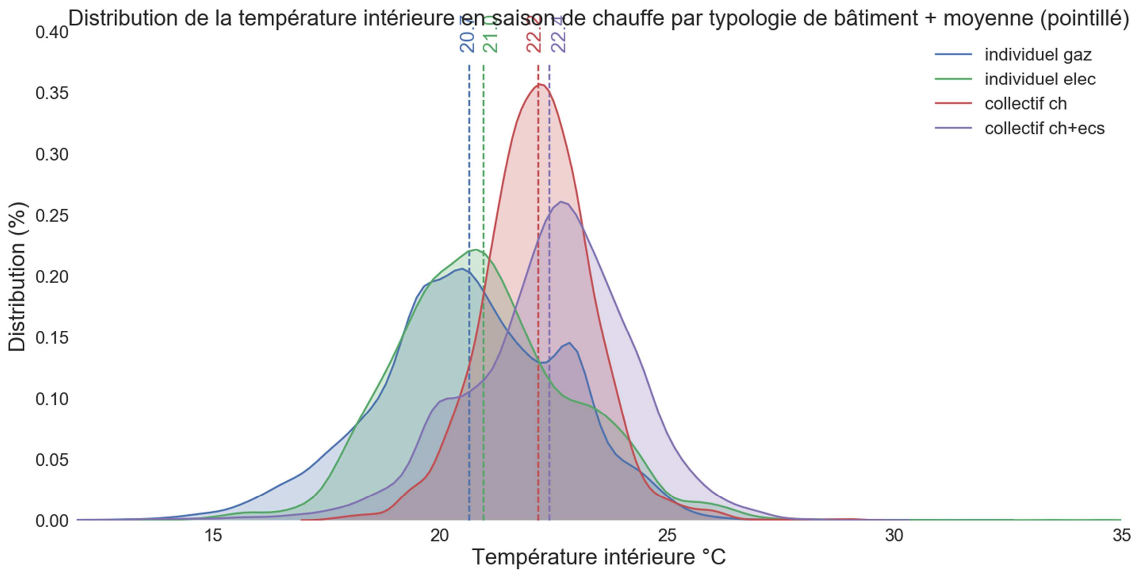


Figure 29 - Distribution plot that summarizes indoor temperature levels on multiple building grouped by their heating system type



7.1.3 Procurement of equipment and/or services

Measurement equipment is provided by COFELY that has already in place the monitoring of air temperatures inside the buildings and the monitoring of the heating substations.

7.2 Societal, user and business aspects:

7.2.1 Citizen engagement

At the end of the demonstration period, a survey, based on questionnaire, will be launched to assess the extent to which additional services have been used for increasing awareness of energy usage.

7.2.2 Business model

The business model is to provide a suite of services around the diagnosis of a building that is being renovated. This suite has been developed after noting that renovation works rarely meet their initial goal in terms of energy efficiency.

This suite of services provide diagnosis based on real measurement and not entirely on simulation to understand why the desired goal is not reached.

Then CSTB provides diagnosis on key elements that can be improved by the facility manager to get closer to the original goal.

Several ways of valorisation are investigated for the REPERE services:

- Provide a service for building owners and/or energy, facility managers to assess the actual energy performance (EP) and or savings (generated either by a high energy performance new construction, NZEB, or some deep renovation operations, respectively), identify potential explanations for the gap in between expected and actual energy performance, develop and implement a roadmap to improve EP;
- Provide a tool box to professional perform the above analysis;
- Support for public policies to assess the impact of current regulations from data on building stock observatories.

7.2.3 Governance

CSTB is responsible for the implementation and test of the REPERE method (energy analysis of the refurbished buildings and comparison with the forecasted energy savings). CAH (owner of the two refurbished high-rise buildings) is strongly associated as end-user. VEOLIA, initially in charge of the full deployment and test of the monitoring system, has been replaced by COFELY.

7.3 Impact Assessment

7.3.1 Expected impact

Measure 3 will be used to assess the achieved energy savings when respectively solutions 1 to 3 (defined in Measure 2) are implemented. Therefore, Measure 3 will not generate any energy savings nor CO_2 emissions reduction but will offer a set of smart services to better understand the potential causes of performance gaps between initial predictions (theorical simulations) and measures or bills. This will increase social acceptance of energy-saving measures, as end-users, especially building owners, will be reassured that the money spent on these measures is not wasted.

7.3.2 KPIs

The list of KPIs that will be used to quantify and qualify the performance of Measure 3 is given in Table 18.

Table 18 – Measure 3 - KPIs

KPI	Unit	Definition	Target
Data loss prevention	Percentage of lost datapoints over the monitored period	Quality of the data measured during the monitored period. Quality is related to data loss prevention but also to the detection of anomalies and defects.	< 2%
Increased awareness of energy usage.	No unit (from 1 to 5)	Capacity of Measure 3 to provide additional services increasing awareness of energy usage	4 – Good capacity

7.3.3 Monitoring plan

The monitoring is managed by COFELY and is the same as the one described in 6.3.3 for optimization of heating load curve.

7.4 Commissioning Plan

The REPERE method can be considered as a commissioning method applied to building refurbishment plans. However, the REPERE method is itself subject to a commissioning plan that consists mainly in checking that all the data needed to perform the method are provided with a high-quality standard. Ensuring good quality of data allows the calculation process behind to be more replicable because there is less manual fixing/cleaning of data necessary.

The commissioning plan for Measure 3 is described in Table 19.

Table 19 – Measure 3 – Commissioning plan

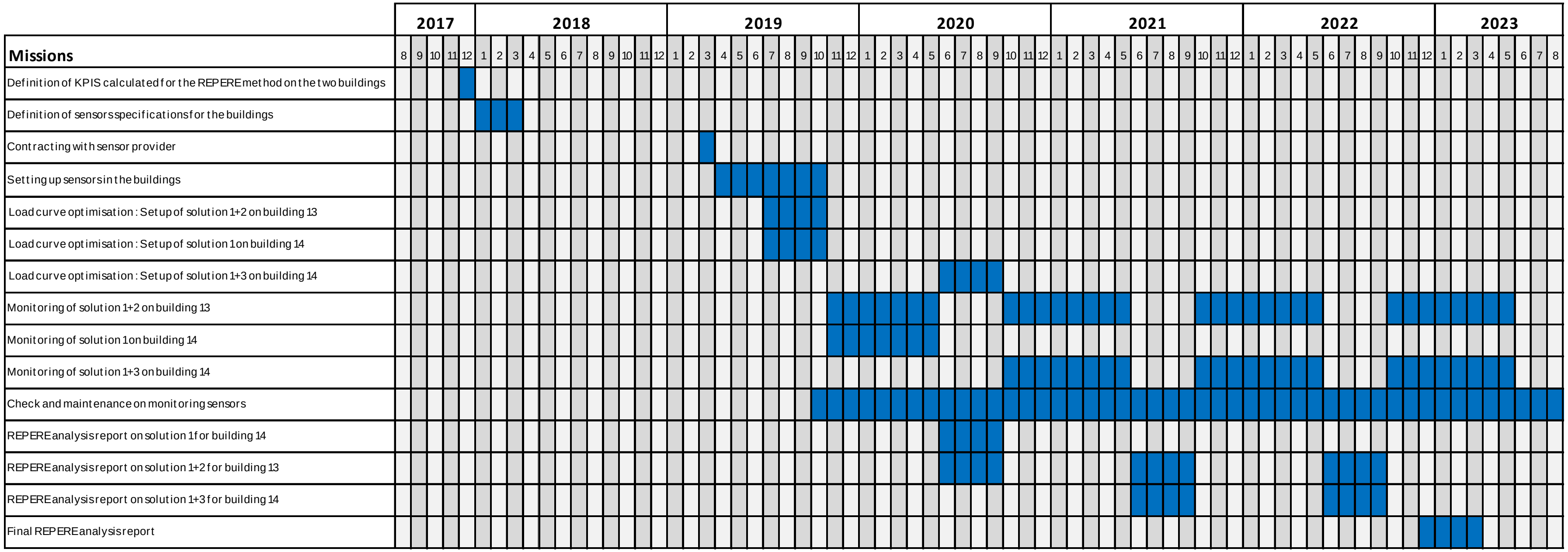
Phase		Activity	Parties involved	Responsibility
1	**Design**	Definition of KPIs	CSTB	Definition of KPIs for Measure 3 and analysis of replication potential
2	**Engineering**	Definition of monitoring sensors specifications for the buildings in terms of hardware and installation	CSTB	Provide sensor specifications for application of the REPERE method
			COFELY	Check compatibility between existing equipments and sensor specifications
			CSTB	Adapt monitoring specifications with constraints from all parties. Propose optimal trade-off
		Setup pipeline for data exchange between parties	CSTB	Define data system architecture for data exchange and needs in terms of API or manual data download
			COFELY	Provide a digitalized platform enabling to download ans store data
			CSTB	Test the data pipeline once it is setup
	Installation	Purchase sensors	COFELY	Contract with sensor provider
		Check sensors conformity	CSTB	Check sensors fulfill requirements
		Setup sensors	COFELY	Install sensors in the buildings
		Check compliance with fitting rules	COFELY	Check sensors have been correctly installed
		Check data flow	CSTB	Check data tranfer is operational and meet specifications
3	**Demonstration**	Test of Measure 2	COFELY	Test and report Measure 2
		Test of Measure 3	CSTB	Test Measure 3
		Data loss prevention	CSTB	Detect/correct data loss
		Data analysis	CSTB	Calculate KPIs and report
4	**Maintenance**	Diagnosis	CSTB	Check (every 2 weeks) sensors are correctly transmitting data complying with specifications
		Maintenance	COFELY	Change defect sensors

7.5 Implementation plan

7.5.1 Planning of activities

The revised planning of activities is given Figure 30.

Figure 30 - Planning of activities



7.5.2 Planning of costs and (equipment) investments

No additional investment costs are expected other than those already estimated by COFELY (§ 6.5.2).

7.5.3 Risk management

The REPERE service has already been tested in many national projects dealing with refurbishment of social housing. The only risk is related to the fact that the baseline (situation before energy-efficient measures are implemented) is not well documented i.e. energy consumptions measured at sub-station and indoor air temperatures measured in a selected sample of apartments are only available over a short period of time.

7.5.4 Progress achieved up to M24

Up to M24, in collaboration with VEOLIA then COFELY, CSTB listed hardware specifications (in term of data measurement quality and quantity) necessary to apply the REPERE service and checked that the monitoring system that will be deployed on site is consistent with these specifications.

CSTB has already established the data structure that will help processing the monitored data to be used for the REPERE service.

7.6 Conclusion

The investigation phase with the definition and verification of the monitoring configuration is now completed. CSTB is ready to test the REPERE service as soon as Solution 1 (one of the three solutions COFELY is testing) is implemented in towers 13 to 14. The REPERE service will be used to compare the energy performance of buildings before and after the implementation of Solution 1, which will assess the achieved energy savings.

8 Measure 4: Dashboard

The demonstration is located in Nice France in the Grand Arenas development district.

The demonstration leans on a waste heat recovery system that is conceived as a low temperature district heating/cooling network. Nevertheless, the project is not financed by IRIS, as it is a completely private project lead by DALKIA. To be precise, the DHCN project does not rely on a public call for tender but is fully invested and deployed on initiative of the company. So the project is strongly dependent on the commercialization success in acquiring customers. Those are mostly the new real estate companies developing the new construction projects on site but also existing buildings within the network's planned catchment area. The future customer pool will thus be mostly office, commerce, hotel and educational buildings.

The DHCN will be sourcing waste heat energy at the outflow batch of the Haliotis waste water treatment plant (WWTP) (summer: 25-30°C / winter: 13-8°C) located on the west side of the airport of Nice and owned by MNCA. The water (exchanged to cleansed water at the source station) is then distributed to the buildings substations which will be equipped with reversible heat pumps to provide the needed heating, cooling and SHW to the end users (foreseen are 19 MW heating, 15 MW cooling by 2023, however the distribution perimeter might vary depending on the customer subscriptions).

What is targeted also by the DHCN project, is to take advantage of different or complementary energy profiles within certain plots among the district. This means that a heat pump will be able to take cooling energy from one building (evaporator side of heat pump) and then transfer it at higher temperature to another building (condensing side of heat pump), this is the so called "thermo-frigo pump" mode and increases the recuperation energy and efficiency of the heat pumps.

Based on such system, the demonstration of an innovative district scale "Local Energy Management Dashboard" will be put in place. This is actually the development foreseen to take place in the framework of the IRIS project. The dashboard will provide real time or near to real time information of the energy and environmental performance of the system to the community by mapping energy fluxes related to the district. Thanks to IRIS, the dashboard will be enhanced in its functionalities concerning its capabilities of monitoring the energy fluxes, potentially integrate forecasting services for optimal demand-supply balance and the information quality made accessible to the end user or provided via push notifications.

The Dashboard is under development (see Figure 31, Figure 32 and Figure 33), initiated within the ReUseHeat project (Grant Agreement 767429) lead by IVL (Swedish Research Institute). There the Dashboard is developed in order to achieve a Minimal Viable Product (MVP) to be tested under real conditions. Under ReUseHeat, such MVP will be operational by March 2020 and have undergone development from its very first ideation, passed the prototype phase and been tested under real condition, reaching an estimated TRL of 6.

Within IRIS, the work will focus on reaching higher TRL, by focusing on the customer experience and feedback and integrate the needed changes into the Dashboard, making it move higher on the ladder of the product development, away from a MVP. Thanks to the reached insight into customer expectation and user feedback, it is foreseen to produce new set of technical and functional specifications to develop different and/or additional services to be integrated in the Dashboard within IRIS.

Figure 31 : Screenshot of the home page of the prototype Dashboard. From this page, all main information and navigation links are accessible (source: EDF – ReUseHeat project)

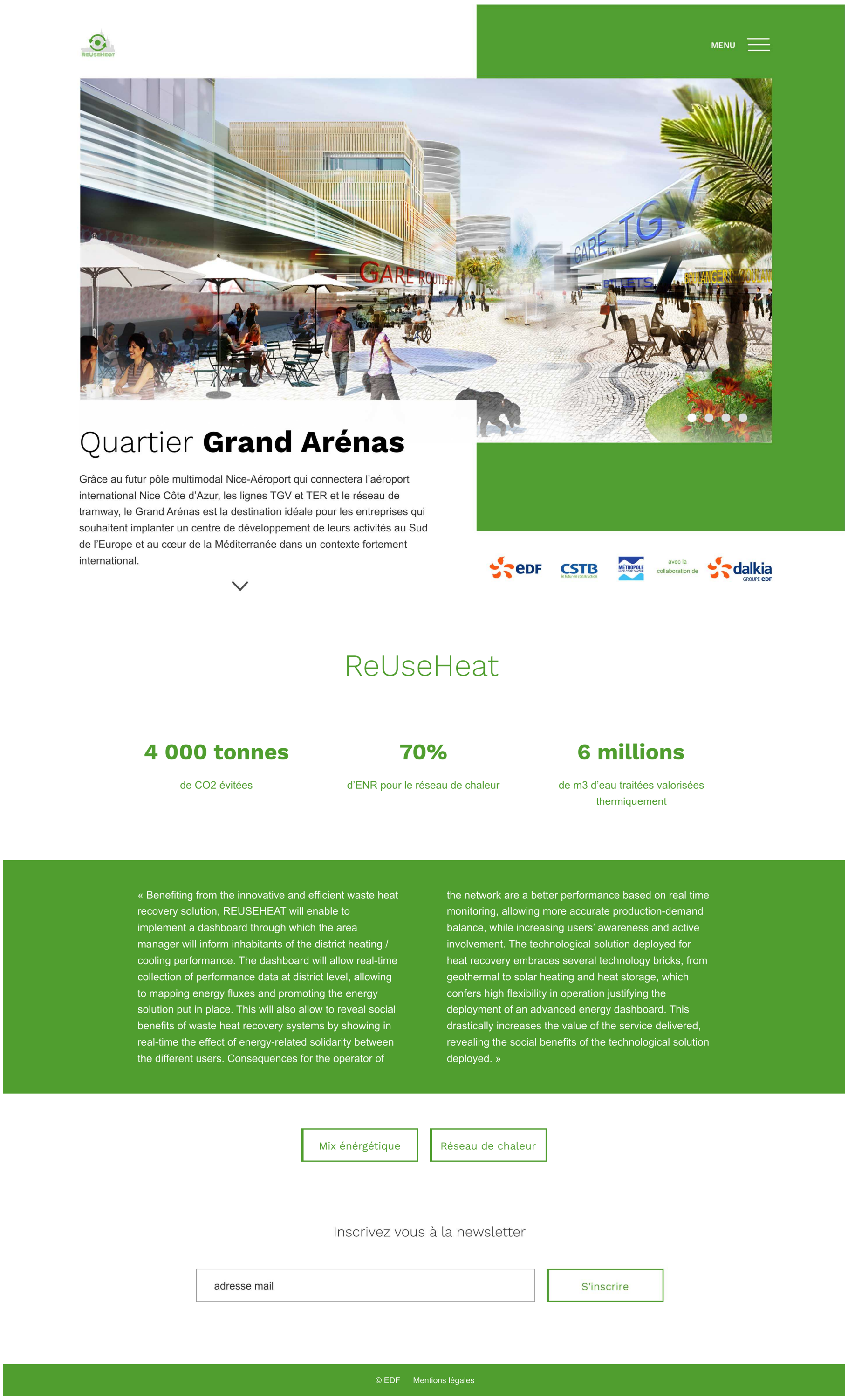


Figure 32 : Screenshot of the page concerning pedagogic section of the prototype Dashboard. With the help of a video animation and some explanatory text, an overview is given on the implemented technological solution (source: EDF – ReUseHeat project)

Figure 33: Screenshot of the page data visualisation section of the prototype Dashboard. With the help of an integrated menu, the user can scroll among different aggregation option of the metered data (time: 10/30 min, daily, weekly, monthly and yearly view; scale: district and building level view) (source: EDF – ReUseHeat project)

8.1 Specification of the measure

8.1.1 Hardware

No additional hardware is neededfor the Dashboard, as it’s run as web service.

8.1.2 Software

The Dashboard is split in 3 distinct parts:

- The first one, is made of HTML/CSS files used to display the static parts (text, images, video or animations) of the site. These files are built with a static website generator named Hugo;
- The second one is a server application, located in a data center, whose responsibility is to serve HTML files for the web site and raw data for the data visualisation component of the Dashboard. This sever is coded in JavaScript using Node.js;
- The third part lies in the browser on the client computer: it is the JavaScript component that actually displays data to the user. This component will be an off the shelf one (not yet chosen) parameterized for our needs.

Data will be gathered by the server part of the dashboard on the FTP server (DALKIA’s regional control centre), fed by the DHCN’s SCADA. This data consists of .csv files issued more of less regularly (up to 8 times a day). This raw data is transformed by the dashboard server to be more usable for its purposes, specifically by aggregation (i.e. arithmetical means over different periods of time) or by derived indicator computing (CO2 avoided for instance).

The server does not maintain this enhanced data with a database of some sort: data volume is quite low and there is no need of complex queries to retrieve it. This data is simply saved as text file (standard JSON format), read at initial server start-up, and updated (including aggregated data) each time a new raw data file is detected on the SCADA’s FTP server. In order to back-up from a Dashboard server failure or, a bug in aggregation calculations, all the raw data .csv files are saved by the server. JSON files can then be recomputed anytime with the full historical data. This has to be ensured, as the data on the servers of DALKIA are removed in a regular manner.

No specific software requirements are needed: the dashboard is built on a web editor to display the Dashboard content. The data streams are managed via existing protocol (i.e. ftp), ensuring periodic inquiry towards the centralized servers for the Regional Control Centre of DALKIA, to update the locally stored database hosted by EDF. Specific algorithms for data management, aggregation and indicators calculations are developed locally.

8.1.3 Procurement of equipment and/or services

No specific external procurement of services is foreseen at the current state of knowledge.

8.2 Societal, user and business aspects:

8.2.1 Citizen engagement

It is expected that the Dashboard implementation will enable to raise awareness within the local community, so also for end users, about the deployed energy solutions, showcase its role and impact within the local energy mix and raise the active involvement in energy usage and also achieve, thanks to the monitoring, a positive feedback on the overall operation of the system.

Within IRIS, the Dashboard will be enhanced towards more user cantered needs and hopefully raise acceptance and enhance user experience of the Dashboard. It is expected that more advanced forecast services and more detailed visualization capabilities might be needed however, this will have to be validated by the customer feedback.

8.2.2 Business model

Since the Dashboard is a first of a kind development, the exact business model is not clearly defined yet. The Dashboard might at the current stage be mostly focused on a B2B2C model, so the DHCN operators itself and/or the public local authority might be the very first adopters of this solutions. This is due to the fact that it’s in their very interest to showcase to the wider public, customers or citizens alike, the positive environmental and social impact. Nevertheless, the value proposition is not the same in the two cases: for a public local authority, the value proposition is the awareness raising on the development of the local environmental or energy transition plan to its citizens and voters; for the DHCN operator, the value proposition is mostly to enlarge its potential customer pool and lower the acceptance barriers. Nevertheless, it is not clear yet if this is viable and without demonstration and replication activities, it will be difficult to assess the bankability of this solution.

Another potential channel for the adoption of such solution, might potentially lie in the hand of the public authority: with the ever-growing digitalization of infrastructures and data accessibility, such type of reporting tool might become part of Public Call for Tenders and become a requirement for any bidding DHCN operator. The first mover advantage might thus be an important aspect for the overall business case of this solutions.

8.2.3 Governance

The Dashboard will be solely developed by EDF. It will further take charge of coordinating the interfaces with MNCA and the DHCN operator DALKIA (100% subsidiary of EDF) and other possible third-party entities. The relation between DALKIA and EDF for the ReUseHeat and IRIS projects, has been formalized via an agreement protocol. This should ensure a transparent process among the parties.

8.3 Impact Assessment

8.3.1 Expected impact

As detailed in the DoA and GA, the following are the main targeted impacts to be achieved by IRIS (the significant impacts for Measure 4 have been underlined):

- <u>IMPACT 1</u>: Put in practice a bankable solution for a challenge identified by the city.
- <u>IMPACT 2:</u> Increase the energy efficiency on district scale.
- <u>IMPACT 3:</u> Increase significantly the share of renewable energies, their integration into the energy system, stimulate self-consumption, reduce curtailment to the minimum.
- <u>IMPACT 4:</u> Increase local air quality.
- <u>IMPACT 5:</u> Reduce the technical and financial risks in order to give confidence to investors for investing in large scale replication.
- <u>IMPACT 6:</u> Make the local energy system more secure, more stable and cheaper for the citizens and public authorities.
- IMPACT 7: Reduce transport based CO_2 emissions, on the basis of CO_2 intensity of the European electricity grid of 443 CO_2/kWh (coherent with TEST format - available on the Participant Portal).
- IMPACT 8: Create stronger links and active cooperation between cities in a large number of Member States with a large coverage of cities with different size, geography, climatic zones and economical situations.

The first impact for Measure 4 is achieved via its value as for being a “pilot” for the industry and public authority alike, within the Mediterranean context, which should serve as model for further developments and replication. They should provide confidence to related stakeholder and decision makers and promote the further development for promoting the adoption of such RES based systems. This relates directly to impact 1 and 5 via the demonstration of Measure 4.

Measure 4 is indirectly contributing to impact 2 and 3, as part of their scope and objectives is the assessment of the performances of a more advanced management system can achieve via a DHCN operation and other client-side connected assets. This will contribute directly also to the achievement of impact 5 and 6, as the demonstration will provide financial and exploitation related results.

Indirectly, the DHCN solution proposed, displaces in principle single or building sized gas boilers for heating and SHW provision. This implies a significant reduction of local emissions from such fuel-based energy production means and consequent amelioration of the air quality. This is related to impact 4.

8.3.2 KPIs

The list of KPIs that will be used to quantify and qualify the performance of Measure 4 is given in Table 20.

Table 20 – Measure 4 - KPIs

KPI	Unit	Definition	Target
Energy savings	MWh/year	The reduction of the energy consumption to reach the same services (e.g. comfort levels) after the interventions, taking into consideration the energy consumption from the reference period.	N/A
Carbon dioxide Emission Reduction	tCO_2eq/year	Total reduction of emissions of carbon dioxide.	N/A
Increased environmental awareness	LIKERT	• Acknowledgment of the existence of the implemented energy solution among the district. • Acknowledgment and understanding of the pedagogic material provided by the Dashboard. • Interest in the provided indicators and displayed information. • Likelihood of users to share the knowledge with other people. • Likelihood to consult the Dashboard in a regular manner.	
Ease of use for end users of the solution		• Ease of understanding of provided pedagogic material. • Ease to relate/understand the chosen indicators. • Ease to navigate the different Dashboard sections. • Ease to understand the technical solution. • Identification of more appropriate indicators and forms of communication to explain the implemented technological solution.	
User engagement		• Number of visitors. • Ratio of new/returning visitors (based on IPs). • Session duration. • Bounce rate. • Behaviour (use of subpages).	

8.3.3 Monitoring plan

For the monitoring of the DHCN performances (not financed by IRIS, neither owned by any of the consortium partners): the Dashboard will display and monitor the global energy and environmental performances of the connected DHCN in a continuous manner. Thus, monitoring of the DHCN will be an integral part of the Dashboard.

Concerning the survey: based on the Dashboard of ReUseHeat, a first reference survey should be available from this project. This will create a baseline by first semester 2021. For the new additional developments of the Dashboard within IRIS, the improvement will be measured by mid-2022.

8.4 Commissioning Plan

No commissioning plan applies to the Dashboard as explained before, the software components are developed “in-house”, so by EDF, and are not managed under a commissioning process.

8.5 Implementation plan

Under ReUseHeat, the Dashboard should be implemented by March 2020. The Dashboard will be running under its current form of a Minimal Viable Product configuration.

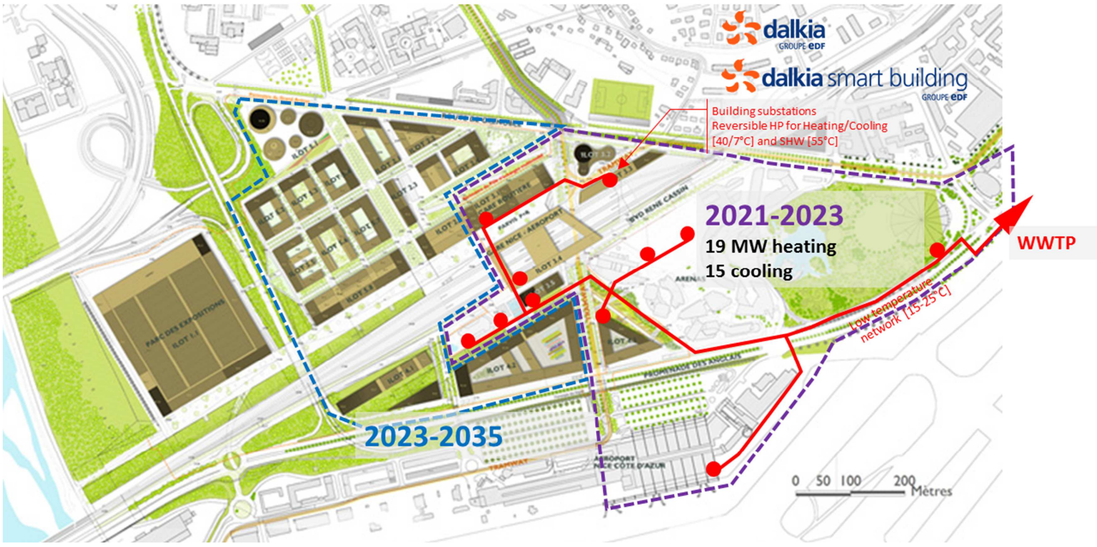
The amelioration from the user feedback, will be started from beginning of 2021 to provide an updated Dashboard by mid-2021.

8.5.1 Planning of activities

As said the DHCN is not financed by IRIS or owned by any of the consortium’s partners. However, the Dashboard implementation will be based on such project (see Figure 34). The actual official commissioning plan of the network is as follows: delivery of the recovery system, first network section with potentially 7 substations by 1st semester 2021. By end 2021, the second network section and 6 further substations should be delivered.

The Dashboard should as said be operational by obligation of ReUseHeat, the first trimester 2020. The Dashboard will thus be most probably connected to another DHCN. EDF is evaluating the different options at hand to ensure the demonstration of the Dashboard, although it is clear that this won’t happen within the Metropolitan area of Nice, where no such low temperature network based on waste heat recovery is yet operational. The enhancements of the Dashboard will be delivered mid-2021.

Figure 34 - Provisory concept scheme of the DHCN of the Grand Arenas (Source: EPA Plan du Var and modifications added by EDF)



8.5.2 Planning of costs and (equipment) investments

No other costs than those entailed in the GA are foreseen.

8.5.3 Risk management

1. The Dashboard's underlying case study DHCN will be delayed:
    - This seems to be the current major risk to be treated. EDF is looking for the possibility to connect to the Dashboard another DHCN with the same characteristics (low temperature loop based on heat recovery from a WWTP or sewage system) to provide a temporary solution for the time of the delay.

2. Data are not accessible on the building level - this is a risk in case the DHCN clients do not agree to publish their consumption data:
    - For this an agreement form will have to be delivered by EDF to DALKIA to be signed by the customers.

8.5.4 Progress achieved up to M24

No action has been taken so far under the IRIS project. Progress report can be found under the ReUseHeat related reporting activity.

8.6 Conclusion

The Dashboard seems a first of a kind development within the French context, with a potential to raise awareness of citizens of new and innovative sustainable energy solutions as that proposed for the Grand Arenas low temperature DHCN project. Nevertheless, the acceptance and added value creation of such a solution has yet to undergo the demonstration process to provide validation of its underlying assumptions and further collect user feedback to ameliorate its impact in local communities.

9 Summary on monitoring of KPIs

9.1 Expected impact

Expected impacts must be estimated in the short term (at the end of the IRIS project, i.e. in 2022) and in the medium term (beyond the end of the project, i.e. in 2030). These estimates have been calculated on the demonstration area for TT#1 i.e. Grand Arenas, Nice Meridia and Les Moulins (see Figure 2).

In 2030, constructed floor areas (projection) are as follows:

- Grand Arenas: 140 000 m²
- Nice Meridia: 540 000 m²
- Les Moulins: unchanged (but all buildings have been refurbished)

Table 21 and Table 22 show the expected impacts for Measures 1 to 4 and for TT#1 in the short term and the medium term.

Table 21 – Expected impacts – Short term (2022)

	KPIs		
	Increase renewables (kWp)	Energy savings (MWh/year)	CO_2 reduction (ton CO_2/year)
Measure 1	360	340	24
Measure 2	0	900	252
Measure 3	0	0	0
Measure 4	0	0	0
TT#1	360	1240	276

Table 22 – Expected impacts – Medium term (2030)

	KPIs		
	Increase renewables (kWp)	Energy savings (MWh/year)	CO_2 reduction (ton CO_2/year)
Measure 1	4030	5300	371
Measure 2	0	1300	364
Measure 3	0	700	196
Measure 4	0	500	50
TT#1	4030	7800	981

9.2 Aggregation of KPIs for each LH city

Each LH city has its own set of KPIs that can be related to the IRIS KPI house; the top level of the house containing the IRIS level KPIs (IL) is however the same for all cities. On solution level (STT1-5), the KPIs may vary between the cities since different solutions are implemented in each city and the cities have different objectives, but in many cases the same KPIs can be found in all cities, thus allowing comparison between the Transition Tracks of the cities. For some Transition Tracks the evaluation of integrated solutions cannot be separated and the KPIs are hence calculated at Transition Track level (TT1-5). The KPIs for each transition track and possibilities to aggregate them are presented in Figure 35.

Figure 35 - IRIS KPI-house.

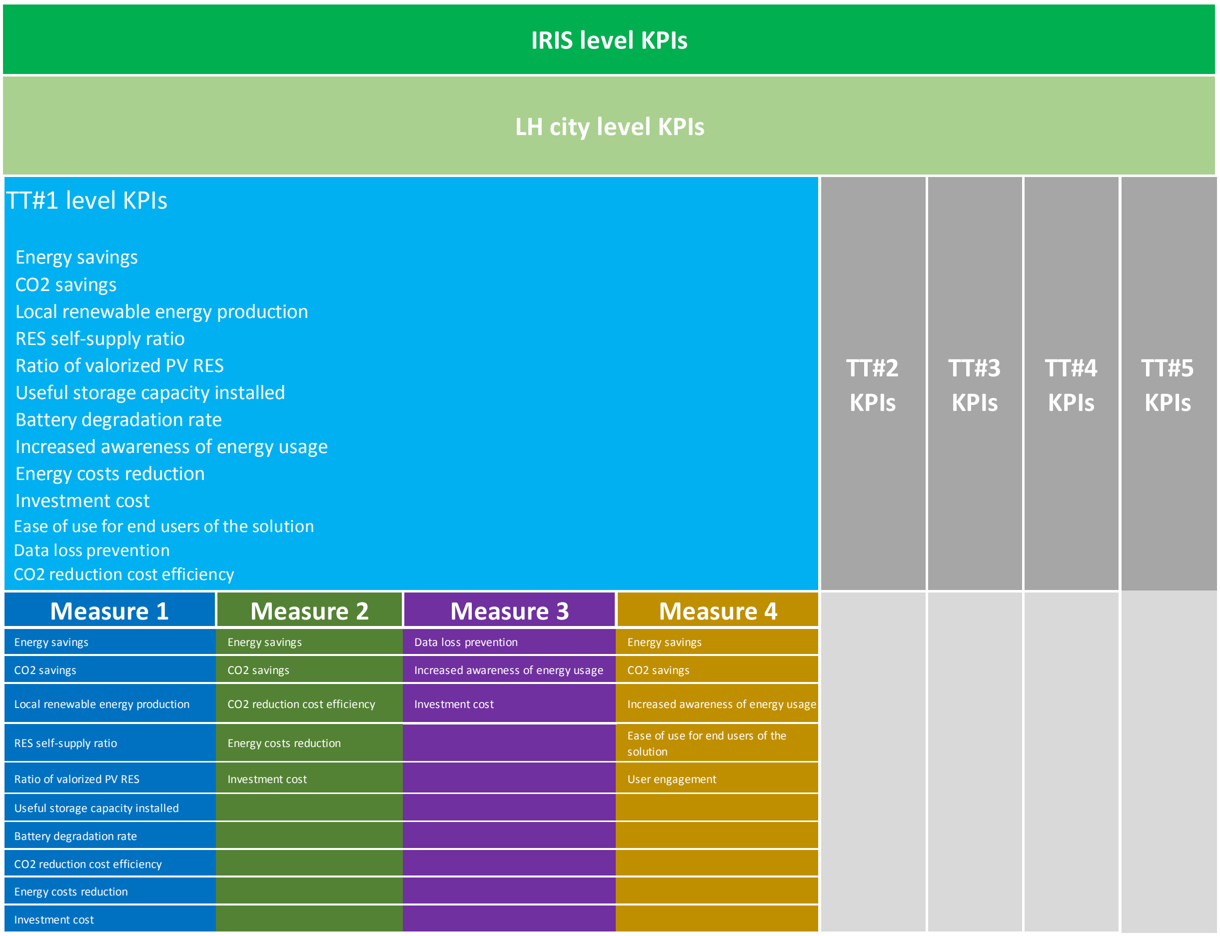


Table 36 - Relation and possible aggregation of KPIs to solutions and the IRIS KPI-house in Figure 35.

KPIs	Solution	Proposed position in IRIS KPI-house
Energy savings	Measure 1 Measure 2 Measure 4	All levels
CO2 savings	Measure 1 Measure 2 Measure 4	All levels
Useful storage capacity installed	Measure 1	All levels
RES self-supply ratio	Measure 1	All levels
Local renewable energy production	Measure 1	All levels
Energy costs reduction	Measure 1 Measure 2	All levels
CO2 reduction cost efficiency	Measure 1 Measure 2	All levels
Data loss prevention	Measure 3	All levels
Increased awareness of energy usage	Measure 3 Measure 4	All levels
User engagement	Measure 4	All levels
Ease of use for end users of the solution	Measure 4	All levels
Investment cost	Measure 1 Measure 2 Measure 3 Measure 4	All levels

10 Ethics requirements

No specific ethical requirements are identified for TT#1.

10.1 Overall lighthouse approach

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

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

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

10.2 GDPR compliance

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

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

The following table shows the GDPR related elements per measure of TT#1.

Demonstrator	Element and description	
Measure 1: Collective self-consumption at building scale	Data controller:	PALAZZO: Nexity (until 2020); property agent (from 2021) IMREDD2: UCA (from 2020)
	Personal Data:	No personal data: multi-tenant aggregated data only
	High risk involved:	No restricted use of collected collective data
	DPIA:	No DPIA is required
	Informed Consent Procedure	Energy performance contract signed between the property agent or building owner and the DSO (Enedis)

Demonstrator	Element and description	
Measure 2: Optimization of heating load curve	Data controller:	Côte d'Azur Habitat (CAH)
	Personal Data:	Yes: flat number, apartment indoor temperature
	High risk involved:	No: collected data are either collective (building-level metering) or, when personal (apartment indoor temperature), unrelated to the tenant's behaviour. Additionally, personal data are not communicated to other tenants.
	DPIA:	No DPIA is required
	Informed Consent Procedure	Personal data collection is based on an optional addendum information sheet to the existing apartment rental agreement to be signed between the tenant and the social housing company (CAH).
Measure 3: Commissioning process from the design to the operation	Data controller:	CSTB
	Personal Data:	Yes: flat number, apartment indoor temperature
	High risk involved:	No: collected data are either collective (building-level metering) or, when personal (apartment indoor temperature), unrelated to the tenant's behaviour. Additionally, personal data are not communicated to other tenants.
	DPIA:	No DPIA is required
	Informed Consent Procedure	Same than measure 2
Measure 4: Dashboard providing real-time energy balance	Data controller:	EDF
	Personal Data:	No: collected data are collective at DHCN or building-level.
	High risk involved:	No restricted use of collected collective data
	DPIA:	No DPIA is required
	Informed Consent Procedure	An information article is part of the business contract signed between each building owner and the DHCN operator to get access to the building-level data and an informed consent is included in the business contract signed between the DHCN operator and EDF to process these data.

Table 23 table of GDPR topics per measure

10.3 Ethical aspects

A privacy impact assessment (PIA) form will be filled for each personal data processed within the frame of a measure which fulfils at least 2 criteria of a DPIA questionnaire produced by NCA public administration including ethics risks and individuals' profiles involved. This PIA form is inferred from the capture of all data profile and processing information thanks to the eponym PIA software tool provided by the CNIL French national agency in accordance to the GDPR rules.
All PIA forms are periodically reviewed by an ad hoc DPIA ethic committee of NCA which is coordinated by the DPO. The committee can validate, restrict or invalidate the use conditions of the related personal data for the targeted activity.

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

11 Links to other work packages

Despite delays in the implementation of integrated solutions, the monitoring campaign, which is expected to cover a two-year period in each demo site, will begin as planned, i.e. by March 2020 for the various measures, except for measure 4.

Measured data will be collected and stored in the CIP (WP4) at a regular frequency. Through continuous analysis and evaluation of the results along with the impact analysis, WP9 will ensure high quality data and results. Impact assessment will represent the basis for the evaluation of the results of the project and of the effective potential of each integrated solution and technology, providing elements for their scalability and replicability as well as their profitability and potential to develop business models (WP3).

12 Conclusions and next steps

24 months after the project was launched, much progress has been made but not all objectives have been achieved.

The two new positive energy buildings are almost built. They are expected to be delivered before the end of the year and the experimental campaign, to test the concept of collective self-consumption at building scale, can begin in due course, i.e. by March 2020 at the latest.

On November 2018, VEOLIA indicated to the Nice LH manager and to the Project Coordinator that they had the intention to withdraw from the IRIS consortium. COFELY had been consulted and was willing to take over the tasks from VEOLIA related to TT#1. On May 2019, the CPB agreed with the decision to replace VEOLIA by COFELY. This change of partner resulted in a significant delay in the implementation of IS#2 and IS#3. To catch up, COFELY proposed a new action plan to test a smart control system enabling to adjust the heat supply to the individual demand in each apartment. This action plan, made of 3 different solutions, is going to be implemented step by step over the next 2 years (the first step corresponding to the first solution is already operational), tested and assessed using the commissioning method developed by the CSTB.

Implementation and testing of the dashboard (measure 4) were delayed. This is due to the fact that the low-temperature urban heating/cooling network is still a project and will not be realized until commercial success is guaranteed, i.e. as long as various buildings commit to connect to this network. The actual official development plan of the network is as follows: delivery of the recovery system, first network section with potentially 7 substations by 1st semester 2021. By end 2021, the second network section and 6 further substations should be delivered. In the meantime, a backup proposition is to apply the Dashboard to the “La Seyne sur Mer” (LSSM) LT DHCN, located in the homonymic municipality, within the Metropolitan Area of Toulon, located roughly half way on the coast between Nice and Marseille. The implemented solution is the most resembling one to that planned in the Grand Arenas: it’s a LT distribution loop, sourcing the energy from the sea.

13 References

[1] SMARTER TOGETHER - Report on collective self-consumption of Photovoltaic - D3.3.1 – 2016.

[2] PVFINANCING - Business Model Report – France - D2.6 – 2016.

[3] RENEWABLE SELF-CONSUMPTION: Cheap and clean power at your doorstep - SolarPower Europe – 2016.

[4] SELF CONSUMPTION OF PV ELECTRICITY – Position Paper – EPIA – 2013.

[5] Rasmus Luthander, Joakim Widén, Daniel Nilsson and Jenny Palm - Photovoltaicself-consumption in buildings: A review - Applied Energy, (142), 80-94 – 2015.

[6] IPMVP APPLICATION GUIDES FAMILY - Core Concepts EVO 10000–1:2016 – 2016.

[7] AFNOR. FD X 30-148. Techniques de détermination des économies d'énergie et incertitudes associées. 2016.

14 Annex 1 - KPIs – detailed listing

Measure 1 – IMREDD Building

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Locally produced electrical energy (electricity generated by the PV panels)
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M1- Collective self-consumption at building scale
4	KPI *KPI('s) that are related to the data*	Local renewable energy production
5	Units of measurement *i.e. KWh, Euro, etc.*	kWh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	No baseline (new building)
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Digital smart electricity meter
8	Location of measurement *Where the measurements take place*	Measurements are done by PV inverters and are located on the 2nd floor of the building in a technical room.
9	Data accuracy How accurate is the measurement	±5% with output power below 20% ±3% with output power above 20% ±4% for all statistical data
10	Collection interval *How often the data is recorded*	1 min
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	2-3-2020
12	End of measurements *i.e. 31-12-2020, 24:00CET*	2-3-2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Public
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	JSON standard FIWARE
16	Data owner *i.e. the name of the company that will give access to data*	IMREDD
17	Comments *Further info*	Data will be available on the CIP

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Electrical energy consumption (electricity demand only for building common areas)
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M1- Collective self-consumption at building scale
4	KPI *KPI('s) that are related to the data*	Degree of energy self-supply Carbon dioxide emission reduction Energy savings CO2 reduction cost efficiency
5	Units of measurement *i.e. KWh, Euro, etc.*	kWh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	No baseline (new building)
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Digital smart electricity meter
8	Location of measurement *Where the measurements take place*	Distributed measurement
9	Data accuracy *How accurate is the measurement*	
10	Collection interval *How often the data is recorded*	
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	2-3-2020
12	End of measurements *i.e. 31-12-2020, 24:00CET*	2-3-2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Public
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	JSON standard FIWARE
16	Data owner *i.e. the name of the company that will give access to data*	IMREDD
17	Comments *Further info*	Data will be available on the CIP

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Electrical energy consumption (total building electricity demand)
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M1- Collective self-consumption at building scale
4	KPI *KPI('s) that are related to the data*	Degree of energy self-supply Carbon dioxide emission reduction Energy savings CO2 reduction cost efficiency
5	Units of measurement *i.e. KWh, Euro, etc.*	kWh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	No baseline (new building)
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Digital smart electricity meter
8	Location of measurement *Where the measurements take place*	Electrical room
9	Data accuracy *How accurate is the measurement*	
10	Collection interval *How often the data is recorded*	Once a year (maximum precision every 10 min)
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	2-3-2020
12	End of measurements *i.e. 31-12-2020, 24:00CET*	2-3-2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Public
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	JSON standard FIWARE
16	Data owner *i.e. the name of the company that will give access to data*	IMREDD
17	Comments *Further info*	Data will be available on the CIP and provided by ENEDIS

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Electrical energy consumption (electricity imported from the grid)
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M1- Collective self-consumption at building scale
4	KPI *KPI('s) that are related to the data*	Degree of energy self-supply Carbon dioxide emission reduction Energy savings CO2 reduction cost efficiency
5	Units of measurement *i.e. KWh, Euro, etc.*	kWh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	No baseline (new building)
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Digital smart electricity meter
8	Location of measurement *Where the measurements take place*	Electrical room
9	Data accuracy *How accurate is the measurement*	
10	Collection interval *How often the data is recorded*	Once a year (maximum precision every 10 min)
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	2-3-2020
12	End of measurements *i.e. 31-12-2020, 24:00CET*	2-3-2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Public
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	JSON standard FIWARE
16	Data owner *i.e. the name of the company that will give access to data*	IMREDD
17	Comments *Further info*	Data will be available on the CIP and provided by ENEDIS

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Electrical energy consumption (electricity exported to the grid)
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M1- Collective self-consumption at building scale
4	KPI *KPI('s) that are related to the data*	Degree of energy self-supply Carbon dioxide emission reduction Energy savings CO2 reduction cost efficiency
5	Units of measurement *i.e. KWh, Euro, etc.*	kWh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	No baseline (new building)
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Digital smart electricity meter
8	Location of measurement *Where the measurements take place*	Electrical room
9	Data accuracy *How accurate is the measurement*	
10	Collection interval *How often the data is recorded*	Once a year (maximum precision every 10 min)
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	2-3-2020
12	End of measurements *i.e. 31-12-2020, 24:00CET*	2-3-2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Public
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	JSON standard FIWARE
16	Data owner *i.e. the name of the company that will give access to data*	IMREDD
17	Comments *Further info*	Data will be available on the CIP and provided by ENEDIS

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Electrical energy consumption (electricity provided by the battery to the building)
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M1- Collective self-consumption at building scale
4	KPI *KPI('s) that are related to the data*	Degree of energy self-supply Carbon dioxide emission reduction Energy savings CO2 reduction cost efficiency
5	Units of measurement *i.e. KWh, Euro, etc.*	kWh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	No baseline (new building)
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Digital smart electricity meter
8	Location of measurement *Where the measurements take place*	
9	Data accuracy *How accurate is the measurement*	
10	Collection interval *How often the data is recorded*	
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	2-3-2020
12	End of measurements *i.e. 31-12-2020, 24:00CET*	2-3-2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Public
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	JSON standard FIWARE
16	Data owner *i.e. the name of the company that will give access to data*	IMREDD
17	Comments *Further info*	Data will be available on the CIP provided by the EMS

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Electrical energy consumption (electricity demand of auxiliary equipments of storage room - ventilation, micro controllers from EMS)
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M1- Collective self-consumption at building scale
4	KPI *KPI('s) that are related to the data*	Degree of energy self-supply Carbon dioxide emission reduction Energy savings CO2 reduction cost efficiency
5	Units of measurement *i.e. KWh, Euro, etc.*	kWh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	No baseline (new building)
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Digital smart electricity meter
8	Location of measurement *Where the measurements take place*	2nd floor, EMS technical room
9	Data accuracy *How accurate is the measurement*	
10	Collection interval *How often the data is recorded*	
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	2-3-2020
12	End of measurements *i.e. 31-12-2020, 24:00CET*	2-3-2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Public
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	JSON standard FIWARE
16	Data owner *i.e. the name of the company that will give access to data*	IMREDD
17	Comments *Further info*	Data will be available on the CIP

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Electrical energy consumption (electricity demand of auxiliary equipments of storage room - ventilation, micro controllers from BMS etc)
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M1- Collective self-consumption at building scale
4	KPI *KPI('s) that are related to the data*	Degree of energy self-supply Carbon dioxide emission reduction Energy savings CO2 reduction cost efficiency
5	Units of measurement *i.e. KWh, Euro, etc.*	kWh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	No baseline (new building)
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Digital smart electricity meter
8	Location of measurement *Where the measurements take place*	Underground parking area, battery technical room
9	Data accuracy *How accurate is the measurement*	
10	Collection interval *How often the data is recorded*	
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	2-3-2020
12	End of measurements *i.e. 31-12-2020, 24:00CET*	2-3-2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Public
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	JSON standard FIWARE
16	Data owner *i.e. the name of the company that will give access to data*	IMREDD
17	Comments *Further info*	Data will be available on the CIP

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Thermal energy consumption (total building **heat** demand)
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M1- Collective self-consumption at building scale
4	KPI *KPI('s) that are related to the data*	Carbon dioxide emission reduction Energy savings CO2 reduction cost efficiency
5	Units of measurement *i.e. KWh, Euro, etc.*	kWh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	No baseline (new building)
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Digital smart thermal meter
8	Location of measurement *Where the measurements take place*	Heating Substation
9	Data accuracy *How accurate is the measurement*	±2% between Qmin et Qmax
10	Collection interval *How often the data is recorded*	4 seconds
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	2-3-2020
12	End of measurements *i.e. 31-12-2020, 24:00CET*	2-3-2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Public
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	JSON standard FIWARE
16	Data owner *i.e. the name of the company that will give access to data*	IMREDD
17	Comments *Further info*	Data will be available on the CIP Pollutherm WFD FS DN100 70m3/h + Carte MOD-Bus RTU V3 pollutherm/pollustat E- 24VAC + Bloc Alim 24V Pour Pollutherm/Stat FW2 E

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Thermal energy consumption (total building **cool** demand)
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M1- Collective self-consumption at building scale
4	KPI *KPI('s) that are related to the data*	Carbon dioxide emission reduction Energy savings CO2 reduction cost efficiency
5	Units of measurement *i.e. KWh, Euro, etc.*	kWh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	No baseline (new building)
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Digital smart thermal meter
8	Location of measurement *Where the measurements take place*	Cooling Substation
9	Data accuracy *How accurate is the measurement*	±2% between Qmin et Qmax
10	Collection interval *How often the data is recorded*	4 seconds
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	2-3-2020
12	End of measurements *i.e. 31-12-2020, 24:00CET*	2-3-2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Public
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	JSON standard FIWARE
16	Data owner *i.e. the name of the company that will give access to data*	IMREDD
17	Comments Further info	Data will be available on the CIP Pollutherm WFD FS DN125 100m3/h + Carte MOD-Bus RTU V3 pollutherm/pollustat E- 24VAC + Bloc Alim 24V Pour Pollutherm/Stat FW2 E

Measure 1 – PALAZZO MERIDIA Building

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Locally produced electrical energy (electricity generated by the PV panels)
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M1- Collective self-consumption at building scale
4	KPI *KPI('s) that are related to the data*	Local renewable energy production
5	Units of measurement *i.e. KWh, Euro, etc.*	kWh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	No baseline (new building)
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Digital smart electricity meter
8	Location of measurement *Where the measurements take place*	
9	Data accuracy *How accurate is the measurement*	
10	Collection interval *How often the data is recorded*	
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	20/01/2019
12	End of measurements *i.e. 31-12-2020, 24:00CET*	30/09/2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Public
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	
16	Data owner *i.e. the name of the company that will give access to data*	NEXITY
17	Comments *Further info*	

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Electrical energy consumption (electricity demand only for building common areas)
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M1- Collective self-consumption at building scale
4	KPI *KPI('s) that are related to the data*	Degree of energy self-supply Carbon dioxide emission reduction Energy savings CO2 reduction cost efficiency
5	Units of measurement *i.e. KWh, Euro, etc.*	kWh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	No baseline (new building)
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Digital smart electricity meter
8	Location of measurement *Where the measurements take place*	
9	Data accuracy *How accurate is the measurement*	
10	Collection interval *How often the data is recorded*	
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	20/01/2019
12	End of measurements *i.e. 31-12-2020, 24:00CET*	30/09/2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Public
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	
16	Data owner *i.e. the name of the company that will give access to data*	NEXITY
17	Comments *Further info*	

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Electrical energy consumption (total building electricity demand)
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M1- Collective self-consumption at building scale
4	KPI *KPI('s) that are related to the data*	Degree of energy self-supply Carbon dioxide emission reduction Energy savings CO2 reduction cost efficiency
5	Units of measurement *i.e. KWh, Euro, etc.*	kWh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	No baseline (new building)
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Digital smart electricity meter
8	Location of measurement *Where the measurements take place*	
9	Data accuracy *How accurate is the measurement*	
10	Collection interval *How often the data is recorded*	
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	20/01/2019
12	End of measurements *i.e. 31-12-2020, 24:00CET*	30/09/2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Public
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	
16	Data owner *i.e. the name of the company that will give access to data*	NEXITY
17	Comments *Further info*	

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Electrical energy consumption (electricity imported from the grid)
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M1- Collective self-consumption at building scale
4	KPI *KPI('s) that are related to the data*	Degree of energy self-supply Carbon dioxide emission reduction Energy savings CO2 reduction cost efficiency
5	Units of measurement *i.e. KWh, Euro, etc.*	kWh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	No baseline (new building)
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Digital smart electricity meter
8	Location of measurement *Where the measurements take place*	
9	Data accuracy *How accurate is the measurement*	
10	Collection interval *How often the data is recorded*	
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	20/01/2019
12	End of measurements *i.e. 31-12-2020, 24:00CET*	30/09/2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Public
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	
16	Data owner *i.e. the name of the company that will give access to data*	NEXITY
17	Comments *Further info*	

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Electrical energy consumption (electricity exported to the grid)
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M1- Collective self-consumption at building scale
4	KPI *KPI('s) that are related to the data*	Degree of energy self-supply Carbon dioxide emission reduction Energy savings CO2 reduction cost efficiency
5	Units of measurement *i.e. KWh, Euro, etc.*	kWh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	No baseline (new building)
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Digital smart electricity meter
8	Location of measurement *Where the measurements take place*	
9	Data accuracy *How accurate is the measurement*	
10	Collection interval *How often the data is recorded*	
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	20/01/2019
12	End of measurements *i.e. 31-12-2020, 24:00CET*	30/09/2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Public
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	
16	Data owner *i.e. the name of the company that will give access to data*	NEXITY
17	Comments *Further info*	

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Electrical energy consumption (electricity provided by the battery to the building)
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M1- Collective self-consumption at building scale
4	KPI *KPI('s) that are related to the data*	Degree of energy self-supply Carbon dioxide emission reduction Energy savings CO2 reduction cost efficiency
5	Units of measurement *i.e. KWh, Euro, etc.*	kWh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	No baseline (new building)
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Digital smart electricity meter
8	Location of measurement *Where the measurements take place*	
9	Data accuracy *How accurate is the measurement*	
10	Collection interval *How often the data is recorded*	
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	20/01/2019
12	End of measurements *i.e. 31-12-2020, 24:00CET*	30/09/2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Public
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	
16	Data owner *i.e. the name of the company that will give access to data*	NEXITY
17	Comments *Further info*	

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Electrical energy consumption (electricity demand of auxiliary equipments of storage room - ventilation, micro controllers from EMS and BMS etc)
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M1- Collective self-consumption at building scale
4	KPI *KPI('s) that are related to the data*	Degree of energy self-supply Carbon dioxide emission reduction Energy savings CO2 reduction cost efficiency
5	Units of measurement *i.e. KWh, Euro, etc.*	kWh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	No baseline (new building)
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Digital smart electricity meter
8	Location of measurement *Where the measurements take place*	
9	Data accuracy *How accurate is the measurement*	
10	Collection interval *How often the data is recorded*	
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	20/01/2019
12	End of measurements *i.e. 31-12-2020, 24:00CET*	30/09/2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Public
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	
16	Data owner *i.e. the name of the company that will give access to data*	NEXITY
17	Comments *Further info*	

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Thermal energy consumption (total building heat and cool demand)
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M1- Collective self-consumption at building scale
4	KPI *KPI('s) that are related to the data*	Carbon dioxide emission reduction Energy savings CO2 reduction cost efficiency
5	Units of measurement *i.e. KWh, Euro, etc.*	kWh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	No baseline (new building)
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Digital smart thermal meter
8	Location of measurement *Where the measurements take place*	
9	Data accuracy *How accurate is the measurement*	
10	Collection interval *How often the data is recorded*	
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	20/01/2019
12	End of measurements *i.e. 31-12-2020, 24:00CET*	30/09/2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Public
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	
16	Data owner *i.e. the name of the company that will give access to data*	NEXITY
17	Comments *Further info*	

Measure 2

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Energy Savings
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M2 - Optimization of heating load curve
4	KPI *KPI('s) that are related to the data*	Energy Savings
5	Units of measurement *i.e. KWh, Euro, etc.*	Kwh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	Heating energy for previous year(s) (e.g. 2018) times CO2 factor for natural gas
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Existing smart meter
8	Location of measurement *Where the measurements take place*	Substation
9	Data accuracy *How accurate is the measurement*	Margin of error : 1%
10	Collection interval *How often the data is recorded*	Monthly
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	June 2019
12	End of measurements *i.e. 31-12-2020, 24:00CET*	September 2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Confidential
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication,
15	Data format *i.e. csv file, json…*	CSV
16	Data owner *i.e. the name of the company that will give access to data*	CAH
17	Comments *Further info*	

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	C02 Reduction Cost Efficiency
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M2 - Optimization of heating load curve
4	KPI *KPI('s) that are related to the data*	C02 Reduction Cost Efficiency
5	Units of measurement *i.e. KWh, Euro, etc.*	MWH, €
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	*PGO = 39,62€/MWh* *PH0 = 61,8€/MWh*; PH includes the heating losses between the boiler room and the substation Invoices of January 2019 for energy price
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Smart Meter, Energy Bill
8	Location of measurement *Where the measurements take place*	Substation
9	Data accuracy *How accurate is the measurement*	Margin of error : 1%
10	Collection interval *How often the data is recorded*	Monthly
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	June 2019
12	End of measurements *i.e. 31-12-2020, 24:00CET*	September 2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Confidential
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online but requires authentication
15	Data format *i.e. csv file, json…*	CSV
16	Data owner *i.e. the name of the company that will give access to data*	CAH
17	Comments *Further info*	

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Carbon Dioxide Emission Reduction
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M2 - Optimization of heating load curve
4	KPI *KPI('s) that are related to the data*	Carbon dioxide emission reduction
5	Units of measurement *i.e. KWh, Euro, etc.*	Kwh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	Heating energy for previous year(s) (e.g. 2018) times CO2 factor for natural gas
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Existing smart meter
8	Location of measurement *Where the measurements take place*	Substation
9	Data accuracy *How accurate is the measurement*	Margin of error : 1%
10	Collection interval *How often the data is recorded*	Monthly
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	June 2019
12	End of measurements *i.e. 31-12-2020, 24:00CET*	September 2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Confidential
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication,
15	Data format *i.e. csv file, json…*	CSV
16	Data owner *i.e. the name of the company that will give access to data*	CAH
17	Comments *Further info*	

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Carbon Dioxide Emission Reduction
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M2 - Optimization of heating load curve
4	KPI *KPI('s) that are related to the data*	Carbon dioxide emission reduction
5	Units of measurement *i.e. KWh, Euro, etc.*	Kwh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	Heating energy for previous year(s) (e.g. 2018) times CO2 factor for natural gas
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Existing smart meter
8	Location of measurement *Where the measurements take place*	Substation
9	Data accuracy *How accurate is the measurement*	Margin of error : 1%
10	Collection interval *How often the data is recorded*	Monthly
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	June 2019
12	End of measurements *i.e. 31-12-2020, 24:00CET*	September 2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Confidential
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication,
15	Data format *i.e. csv file, json…*	CSV
16	Data owner *i.e. the name of the company that will give access to data*	CAH
17	Comments *Further info*	

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Return on Investment
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M2 - Optimization of heating load curve
4	KPI *KPI('s) that are related to the data*	Return on Investment
5	Units of measurement *i.e. KWh, Euro, etc.*	MWH, €
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	*PGO = 39,62€/MWh* *PH0 = 61,8€/MWh*; PH includes the heating losses between the boiler room and the substation Invoices of January 2019 for energy price
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Smart Meter, Energy Bill
8	Location of measurement *Where the measurements take place*	Substation
9	Data accuracy *How accurate is the measurement*	Margin of error : 1%
10	Collection interval *How often the data is recorded*	Monthly
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	June 2019
12	End of measurements *i.e. 31-12-2020, 24:00CET*	September 2022
13	Expected availability *i.e. open data, public, confidential, no data available*	Confidential
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online but requires authentication
15	Data format *i.e. csv file, json…*	CSV
16	Data owner *i.e. the name of the company that will give access to data*	CAH
17	Comments *Further info*	

Measure 3

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Thermal energy consumption (building heat demand per distribution system)
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M3 - Commissioning process from the design to the operation
4	KPI *KPI('s) that are related to the data*	Data loss prevention Energy savings
5	Units of measurement *i.e. KWh, Euro, etc.*	Kwh
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	Monitoring periods before IS2 is implemented
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Digital smart thermal meter
8	Location of measurement *Where the measurements take place*	District heating substation room
9	Data accuracy *How accurate is the measurement*	
10	Collection interval *How often the data is recorded*	
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	
12	End of measurements *i.e. 31-12-2020, 24:00CET*	
13	Expected availability *i.e. open data, public, confidential, no data available*	Open data
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	
16	Data owner *i.e. the name of the company that will give access to data*	COFELY
17	Comments *Further info*	

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Indoor Air Temperature
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M3 - Commissioning process from the design to the operation
4	KPI *KPI('s) that are related to the data*	Data loss prevention Energy savings
5	Units of measurement *i.e. KWh, Euro, etc.*	°C
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	Monitoring periods before IS2 is implemented
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Air temperature sensor
8	Location of measurement *Where the measurements take place*	In each housing living room.
9	Data accuracy *How accurate is the measurement*	0.3-0.5 °C
10	Collection interval *How often the data is recorded*	
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	
12	End of measurements *i.e. 31-12-2020, 24:00CET*	
13	Expected availability *i.e. open data, public, confidential, no data available*	Open data
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Online, but requires authentication
15	Data format *i.e. csv file, json…*	
16	Data owner *i.e. the name of the company that will give access to data*	COFELY
17	Comments *Further info*	50% of apartments must be equipped with air temperature sensors at least

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Outdoor Air Temperature
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M3 - Commissioning process from the design to the operation
4	KPI *KPI('s) that are related to the data*	Data loss prevention Energy savings
5	Units of measurement *i.e. KWh, Euro, etc.*	°C
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	Monitoring periods before IS2 is implemented
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Air temperature sensor
8	Location of measurement *Where the measurements take place*	In nearby NICE airport station
9	Data accuracy *How accurate is the measurement*	0.1 °C
10	Collection interval *How often the data is recorded*	1 hour
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	01/01/1990
12	End of measurements *i.e. 31-12-2020, 24:00CET*	01/01/2100
13	Expected availability *i.e. open data, public, confidential, no data available*	Open data
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Open data
15	Data format *i.e. csv file, json…*	csv
16	Data owner *i.e. the name of the company that will give access to data*	Meteo France
17	Comments *Further info*	

No	Parameter	Value
1	Data Variable Name *i.e. Thermal energy consumption, locally produced electrical energy, etc.*	Solar Radiation
2	Transition Track Number	TT1
3	Measure Number *As it is stated in the measure tracker*	M3 - Commissioning process from the design to the operation
4	KPI *KPI(‘s) that are related to the data*	Data loss prevention Energy savings
5	Units of measurement *i.e. KWh, Euro, etc.*	W/m²
6	Baseline (of data variable) *e.g. relating to BaU or previous performance data*	Monitoring periods before IS2 is implemented
7	Meter *i.e. smart meter, survey, energy bill, etc.*	Air temperature sensor
8	Location of measurement *Where the measurements take place*	In nearby NICE airport station
9	Data accuracy *How accurate is the measurement*	Estimation of accuracy of the data is provided in this publication : https://hal-mines-paristech.archives-ouvertes.fr/hal-01074107/document
10	Collection interval *How often the data is recorded*	1 hour
11	Start of measurements *i.e. 1-1-2019, 0:00CET*	01/01/2005
12	End of measurements *i.e. 31-12-2020, 24:00CET*	01/01/2100
13	Expected availability *i.e. open data, public, confidential, no data available*	Open data
14	Expected accessibility *i.e. 1) online without access constraints, 2) online, but requires authentication, and, 3) offline*	Open data
15	Data format *i.e. csv file, json…*	csv
16	Data owner *i.e. the name of the company that will give access to data*	CAMS radiation Service (COPERNICUS)
17	Comments *Further info*	