RESPONSE

WORKSHOP – "Climate Neutrality and Positive Energy Districts"

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SUSTAINABLE PLACES 2023

15/06/2023

INTEGRATED SOLUTIONS & REPLICATION PLANS TOWARDS POSITIVE ENERGY DISTRICTS

Eva Roldán Saso
Project Manager (Fundación CIRCE)

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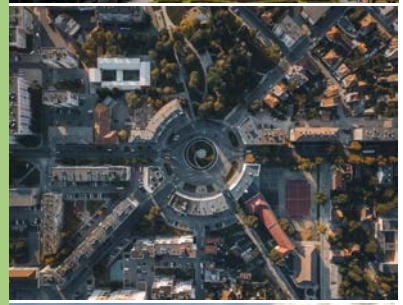

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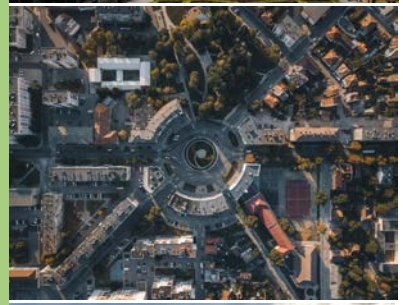
01 About RESPONSE Project
Brief project introduction

02 Lighthouse Cities & Integrated Solution Implementation
Main goals, key activities and expected results

03 Fellow Cites & Replication Roadmap by 2050
Main goals, upcoming activities, expectations for replication

04 Zaragoza FC Replication activities
Replication Roadmap and Bold City Visions

05 Q&A
Q&A Session



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01. About RESPONSE Project

2 Lighthouse Cities

6 Fellow Cities

53 Partners

54% Industries and SMEs

Lighthouse Cities:
Turku, Finland
Dijon, France

Fellow Cities:
Brussels, Belgium
Zaragoza, Spain
Botosani, Romania
Ptolemaida, Greece
Gabrovo, Bulgaria
Severodonetsk, Ukraine

RESPONSE (integ**R**at**E**d **S**olutions For **PO**sitive e**N**ergy and re**S**ilient Citi**E**s), is a **5-year project** funded by the European Horizon 2020 Programme.

It supports **2 LHCs** and **6 FCs** for the deployment of **PEB & PED** and the definition of **Smart Cities Energy Transition Strategies** to achieve **Climate-neutrality by 2050.**

RESPONSE envisions achieving this **goal** by means of **Innovative Solution implementation** and creating **novel business models** to trigger the **upscaling and replication** of these solutions in Cities across Europe and beyond.

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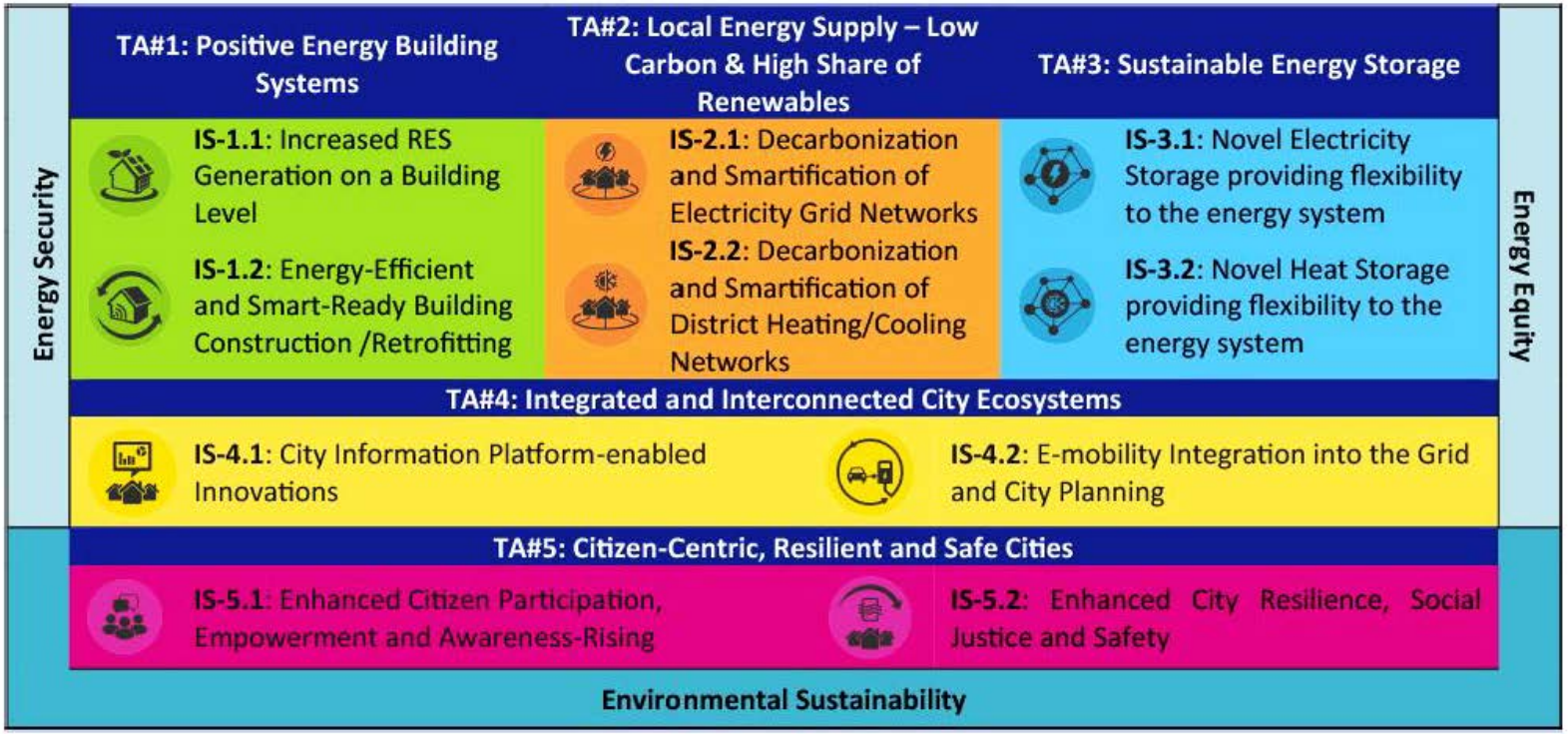
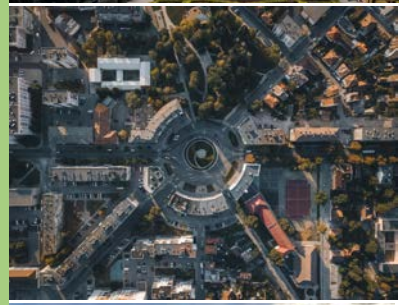
01. About RESPONSE Project

The **energy transition strategy** includes **5 Transformation Axes (TAs)** consisting of **10 Integrated Solutions (ISs)**, **composed of 93 innovative elements** (technologies, tools, methods), which are being monitored by Key Performance Indicators (**KPIs**).





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02. Light House Cities (LHCs) & Integrated Solution Implementation

Dijon-FRANCE

Turku-FINLAND

Through the project, the 2 LHCs are expected to achieve:

- Local RES penetration (GWh/y)
- Energy savings (MWh/y)
- GHG Emission reduction (tons/y)
- Demonstrate some Smart City Solutions and promote their large-scale deployment in EU.

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Dijon LHC

What the City expects from RESPONSE?

- 1 Positive Energy District (PED) with 10 Positive Energy Buildings (PEBs) and 6 Positive Car parks
- Smart city platforms: digital technology to accelerate the energy transition
- Getting inhabitants committed with the objectives
- Achieve the goal of Carbon neutrality by 2050

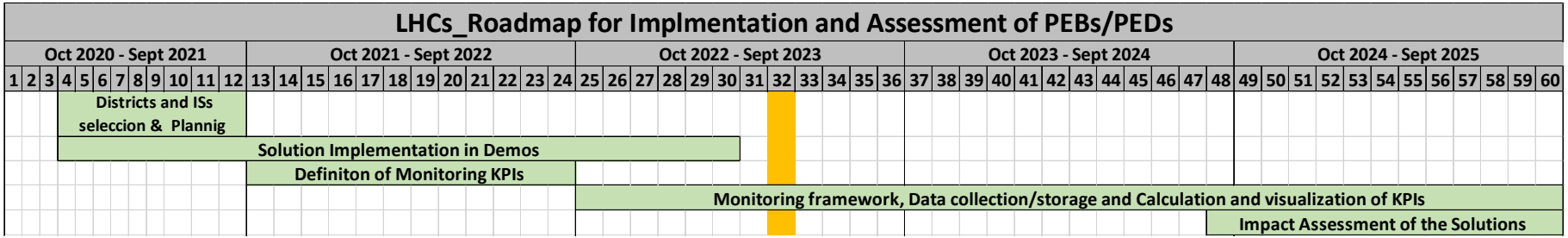
Turku LHC

What does the City of Turku expect from RESPONSE?

- 1 Positive Energy District (PED) with 5 Positive Energy Buildings (PEBs)
- Increase partnerships with local stakeholders the awareness of sustainable energy production & consumption
- Promoting local replication in other areas
- Achieve the goal of Carbon neutrality by 2050

02. Light House Cities (LHCs) & Integrated Solution Implementation

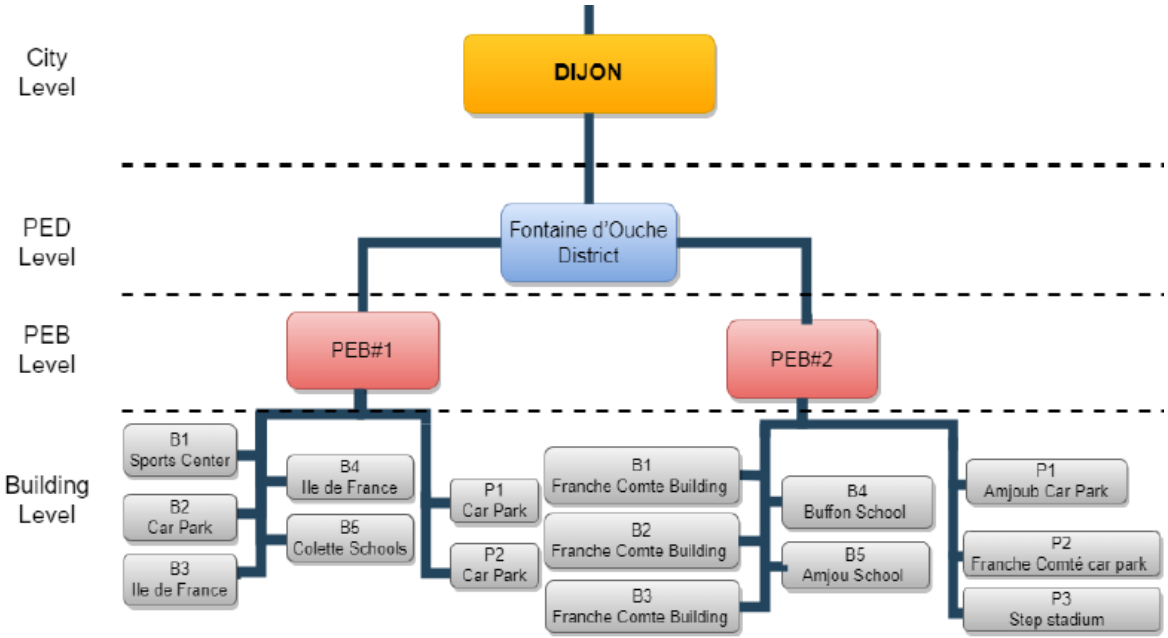
Roadmap activities for the LHCs (Dijon & Turku)

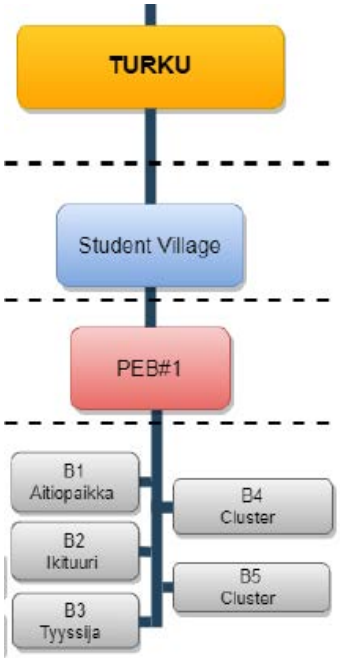


02. Light House Cities (LHCs) & Integrated Solution Implementation

1. Districts and ISs Selection & Planning Implementation:

Finished (Dec20-Dec21)





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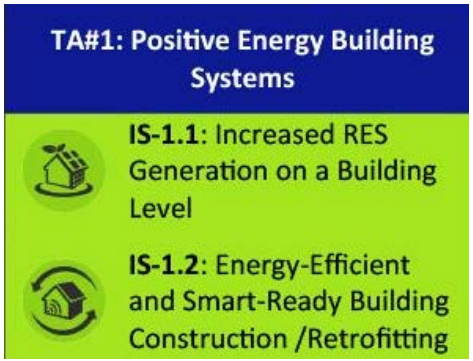
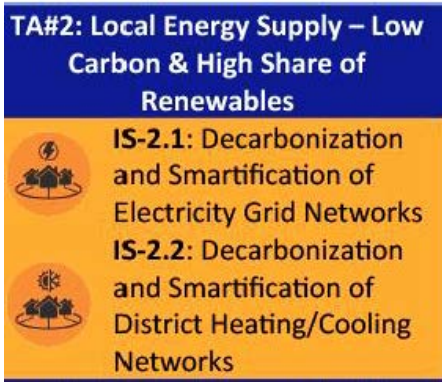


IS 1 - Positive Energy Building Systems	
IS-1.1: Increased RES Generation on a Building Level	
Innovative Elements	**LH demonstration**
1.1.1 Click&Go façade system coupled with coloured vertical PVs	Dijon
1.1.2 Pergola with bifacial PVs with albedo boost	Dijon
1.1.3 BIPV Ballustrades	Dijon
1.1.4 Urban canopies protruding from roofs	Dijon
1.1.5 DC coupled smart bifacial PV system with optimized racking system for maximum bifacial yield	Turku

IS-1.2: Energy-Efficient and Smart-Ready Building Construction/Retrofitting	
Innovative Elements	**LH demonstration**
1.2.1 Ready2Services (R2S) Digital architecture	Dijon
1.2.2 Building Operating System (BOS)	Dijon
1.2.3 Artificial Intelligence (AI) enabled dynamic management of energy (ECO-TOUCH tool)	Dijon
1.2.4 Predictive home thermostats	Dijon
1.2.5 Indoors air quality management system using smart probes	Dijon
1.2.6 Intelligent energy management system (PANGA tool)	Dijon
1.2.7 Nano coating 4-glazing panels windows	Turku
1.2.8 Novel high-performance ventilation system	Turku
1.2.9 Novel human thermal sensation control	Turku
1.2.10 Self-sufficient IoT thermostats	Turku
1.2.11 Upcycling of the near-by city district cooling energy flows	Turku
1.2.12 Conventional Retrofitting (incl. insulation, replacement of radiators, repairs, LED lighting, polyurethane sealing, sensors and tracking systems etc.) (own funding).	Dijon Turku

02. Light House Cities (LHCs) & Integrated Solution Implementation



IS 2 - Local Energy Supply - Low Carbon & High Share of Renewables	
IS-2.1:Decarbonization and Smartification of electricity Grid Networks	
Innovative Elements	**LH demonstration**
2.1.1 Collective self-consumption	Dijon
2.1.2 "Super EMS"	Dijon
2.1.3 Semi-transparent PV canopies (own funding)	Dijon
2.1.4 Parking PV shades (own funding)	Dijon
2.1.5 District smart public lighting (own funding)	Dijon
2.1.6 LVDC microgrid	Turku
2.1.7 DC coupled heat pump	Turku
2.1.8 Cloud-based Smart Energy Management System	Turku
2.1.9 Building level RES generation (see IS-1.1)	Turku
2.1.10 DC coupled Battery Storage System for demand flexibility	Turku
2.1.11 Light EV charging hub (V2G)	Turku
2.1.12 Energy meters (own funding)	

IS-1.2: Energy-Efficient and Smart-Ready Building Construction/Retrofitting	
Innovative Elements	**LH demonstration**
2.2.1 Heat exchanger substations	Dijon
2.2.2 Biomethane injection produced from sewage sludge	Dijon
2.2.3 Green Certificates Contracts	Dijon
2.2.4 Upcycling of the near-by city district cooling energy flows with high COP (>5) heat pumps	Turku
2.2.5 District heating flexibility optimizing network control and management	Turku
2.2.6 Two-way consumer/prosumer district heating connection with Green Certificates Contracts	Turku
2.2.7 District heating network control and management with dynamic district heating tariffs	Turku
2.2.8 Smart district heating substation for end user heat demand flexibility	Turku
2.2.9 PCM-heat storage for district heating flexibility	Turku

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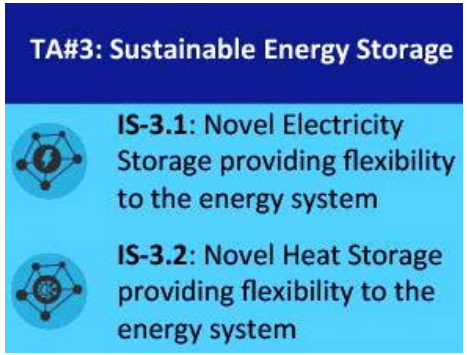
02. Light House Cities (LHCs) & Integrated Solution Implementation



IS 3 - Sustainable Energy Storage	
IS-3.1: Novel electricity Storage providing flexibility to the energy	
Innovative Elements	**LH**
3.1.1 Zn-Air battery	Dijon
3.1.2 2nd life Battery Storage System (BESS)	Dijon
	Turku
3.1.3 V2G	Dijon
	Turku
3.1.4 DC coupled Battery Storage System (BESS)	Turku

IS-3.2: Novel Heat Storage providing flexibility to the energy system	
Innovative Elements	**LH**
3.2.1 PCM tanks	Dijon
3.2.2 Industrial hot water buffer tanks	Dijon
3.2.3 Collective hot water tank with dedicated BEMS	Dijon
3.2.4 Novel PCM Heat storage for DHW	Turku
3.2.5 District heating PCM heat storage-as-a-service	Turku
3.2.6 Low enthalpy geothermal boreholes	

02. Light House Cities (LHCs) & Integrated Solution Implementation

TA#4: Integrated and Interconnected City Ecosystems

IS-4.1: City Information Platform-enabled Innovations

IS-4.2: E-mobility Integration into the Grid and City Planning

IS 4 - Integrated and Interconnected City Ecosystems	
IS-4.1: City Information Platform-enabled innovations	
Innovative Elements	**LH demonstration**
4.1.1 Control/command connections and security layer (GENESYS)	Dijon
4.1.2 Shared data-lake	Dijon
4.1.3 PEB Multi-Energy Dashboard	Dijon
4.1.4 Automatic online energy and climate indicators computation	Dijon
4.1.5 Energy-Climate Dashboard	Dijon
4.1.6 Heat Islands Dashboard (environmental quality)	
4.1.7 Smart City Knowledge Graph AI	Turku
4.1.8 Journey planner (app) for cyclists and pedestrians	Turku
4.1.9 District heating, cooling and flexibility control situational awareness and anomaly detection	Turku
4.1.10 Automated driving	Turku
4.1.11 Vehicle-to-vehicle communication of robot cars via 5G	
4.1.12 5G smart city lighting poles	Turku

IS-4.2: e-mobility Grid Integration and City Planning	
Innovative Elements	**LH demonstration**
4.2.1 Smart charging	Dijon
4.2.2 V2G	Turku
4.2.3 Smartcharging infrastructure deployment planning tool	Dijon
4.2.4 3D visualization of enhanced decision-making	Dijon
4.2.5 LEV Hubs	Turku
4.2.6 EV sharing scheme	Turku

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TA#5: Citizen-Centric, Resilient and Safe Cities

IS-5.1: Enhanced Citizen Participation, Empowerment and Awareness-Rising

IS-5.2: Enhanced City Resilience, Social Justice and Safety

IS 5 - Citizen-Centric, Resilient and Safe Cities	
IS-5.1: Enhanced Citizen Participation, Empowerment and Awareness-Rising	
Innovative Elements	**LH demonstration**
5.1.1 Local events/meetings/workshops	Dijon
	Turku
5.1.2 Children energy and environment days	
5.1.3 Kids Labs	
5.1.4 Replication methodology	
5.1.5 Living Fab Lab	Dijon
5.1.6 Collaborative workshops	Dijon
4.1.7 Hackathons	Dijon
	Turku
4.1.8 Ideathons	Dijon
4.1.9 Mobility Ones-Stop-Shop	Dijon
4.1.10 Training modules	Dijon
4.1.11 Cascade funding	Dijon
	Turku
4.1.12 Digital participation platform	Dijon
4.1.13 Serious gaming	
4.1.14 VR application	Dijon
4.1.15 Informative touch screens	Dijon
4.1.16 Capacity building events	Turku
4.1.17 Training of peer mentors	Turku
4.1.18 Environmental quizzes	Turku
4.1.19 Activities implemented by mentors	Turku
4.1.20 Training sessions of digital tools	Turku
4.1.21 Avatar creation events	Turku
4.1.22 Open dialogues with policy level actors	Turku

IS-5.2: Enhanced City Resilience, Air Quality monitoring, Social Justice and Safety	
Innovative Elements	**LH demonstration**
5.2.1 Bike as a Sensor platform (inc. mobile air quality and noise gateway and dedicated app)	Dijon
5.2.2 Replicability of mitigation solutions assessment (modelling)	Dijon
5.2.3 Climate scenarios and resilience assessment (modelling)	Dijon
5.2.4 LES based PALM meteorological flow modeling system utilizing the 4-meter pre-calculated PALM wind fields	Turku
5.2.5 5G sensor network for PM monitoring	Turku

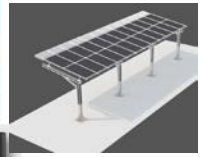
02. Light House Cities (LHCs) & Integrated Solution Implementation

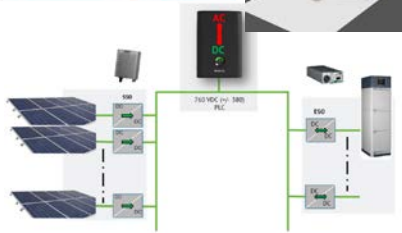
2. Implementation of Solutions in Demos: Almost Finished (Dec20-May23)

PV pannels installation in roof & parking lots, 5G Smart City Lighting Poles





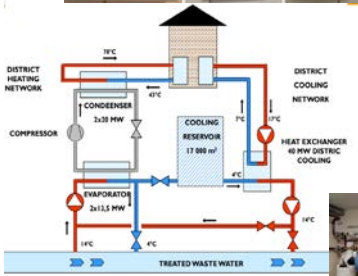



Microgrids, novel storage systems (DC-batteries, PCMs tanks) for optimizing energy flows and maximize self-consumption.

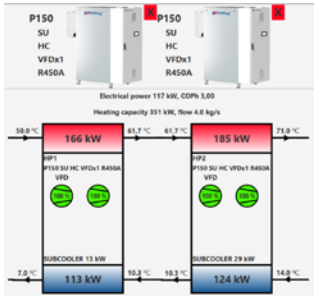
Building Retrofitting: windows, thermal insulation









High performance ventilation & thermal systems, human comfort control thermosts

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02. Light House Cities (LHCs) & Integrated Solution Implementation

2. Implementation of Solutions in Demos: Almost Finished (Dec20-May23)

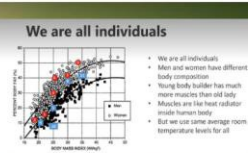
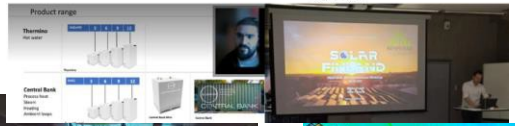
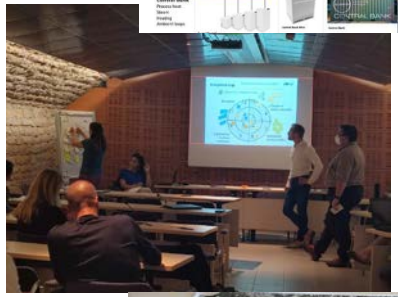
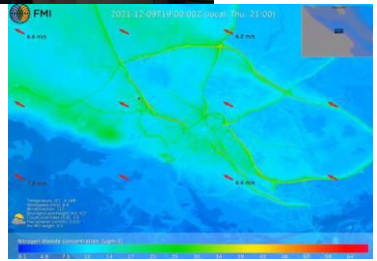
Engagements activities with citizens & Participatory events (workshops, mentors, hackatons)







Digital solutions for increased citizen empowerment (Smart City Knowledge Graph platform, Air Quality journey planner)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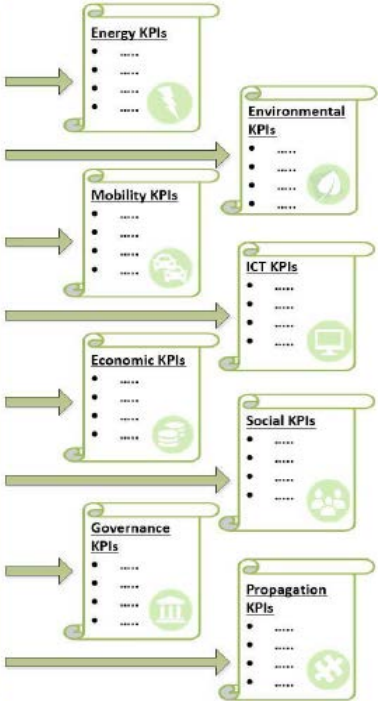
02. Light House Cities (LHCs) & Integrated Solution Implementation

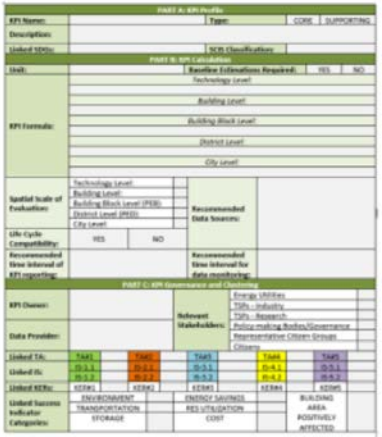
3. Definition of Monitoring KPIs: Finished (jan21-Dec22)

Monitoring objectives & Data tipology available

KPIs definition



KPIs Factsheets Repository



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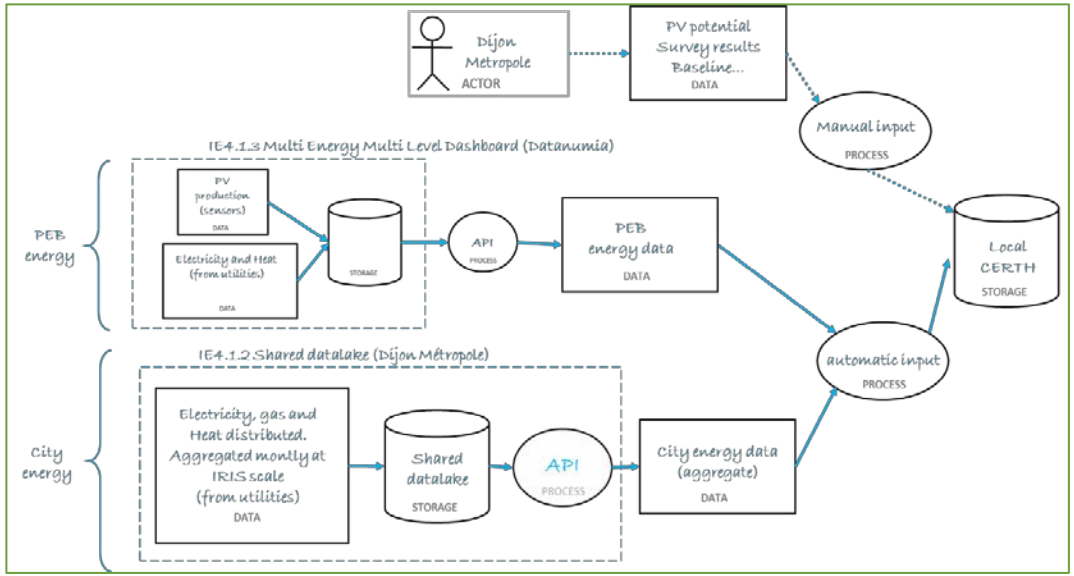
02. Light House Cities (LHCs) & Integrated Solution Implementation

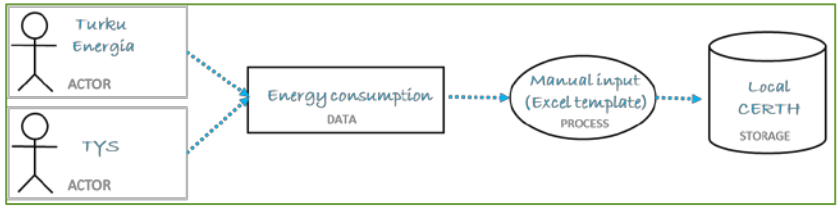
4. Monitoring framework, Data collection/storage and Calculation and visualization of KPIs

Still in progress (Oct22-Sept25)

Dijon LHC



Turku LHC



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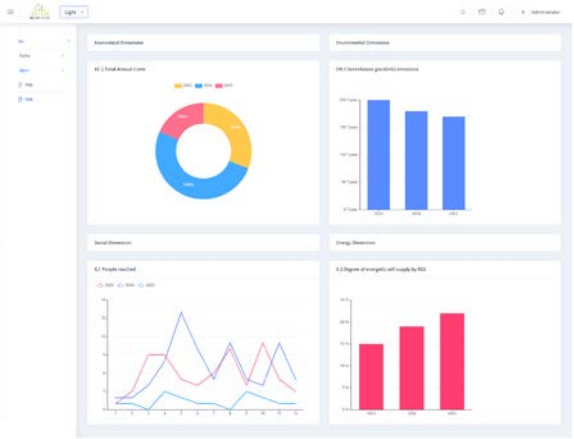
4. Monitoring framework, Data collection/storage and Calculation and visualization of KPIs:

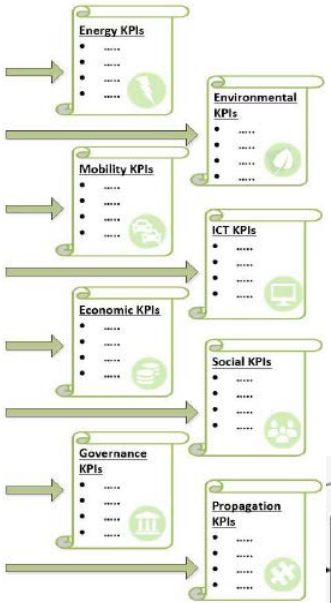
Still in progress (Oct22-Sept25)

Visualization and Interactive Dashboad for KPI results

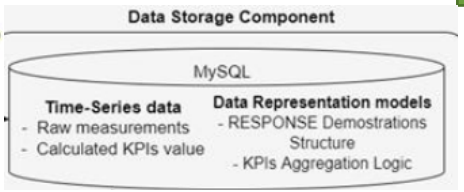


5. Impact Assessment of the Solutions

Not started yet (Sep24-sept25)



Data & KPIs results repository



Methodology framework to evaluate the impacts of the Project under 4 dimensions:

Impact Evaluation of the implemented ISs/IEs:

- Technical Efficiency
- Environmental impact
- Cost-effectiveness
- Users 'acceptance

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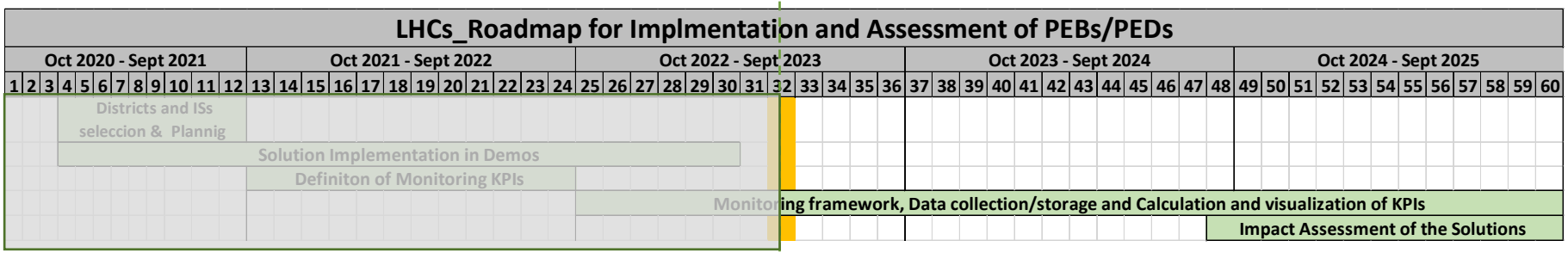
02. Light House Cities (LHCs) & Integrated Solution Implementation

Next steps for the FCs:

Present time



- Continue with the **monitoring & demonstration phase**, consolidate the **experience** gained and **lessons learnt**.
- **Evaluate** the **performance** and achievements of the demos under all IS/IEs implemented.
- **Feasibility studies** to investigate the replicability level in other local areas
- **Replication Plan (short (2030) and long-term (2050):** a realistic implementation roadmap for deploying the solutions implemented according to the ambitious **City neutrality goal by 2050**

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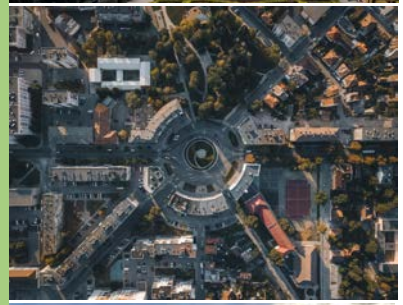

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03. Fellow Cities (FCs) & Replication Roadmap by 2050

Brussels-NETHERLANDS

Zaragosa-SPAIN

Botosani-ROMANIA

Gabrovo-BULGARIA

Severodonetsk-UKRAINE

Ptolemaida-GREECE

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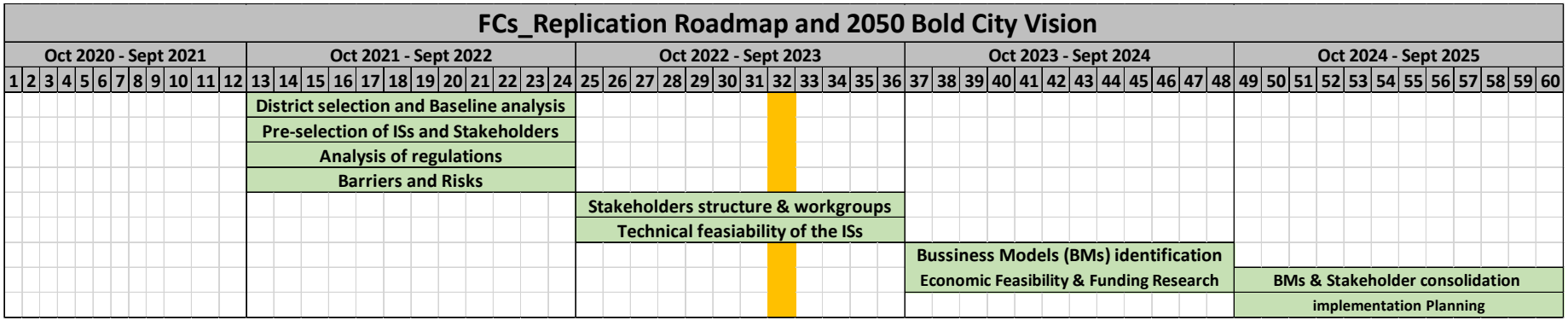
03. Fellow Cities (FCs) & Replication Roadmap by 2050

Through the project the 6 FCs are expected to achieve:

- **Feasibility studies** from technical, economic, social and regulatory perspectives to identify the most suitable Iss for each local ecosystem according to the specific needs of the city.
- Identification of **potential districts** for replication**.**
- Identification of **stakeholders, citizen participation tools** and **business models.**
- **Replication plans and Roadmaps for City neutrality by 2050:** trigger replication and deployment of the selected ISs from the district level to the whole city.

03. Fellow Cities (FCs) & Replication Roadmap by 2050

Replication Roadmap activities for the Fellow Cities



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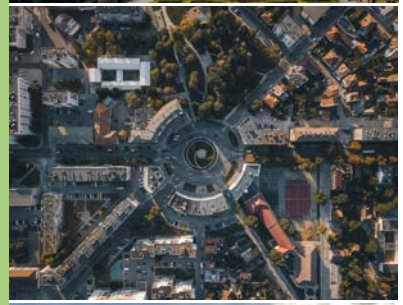

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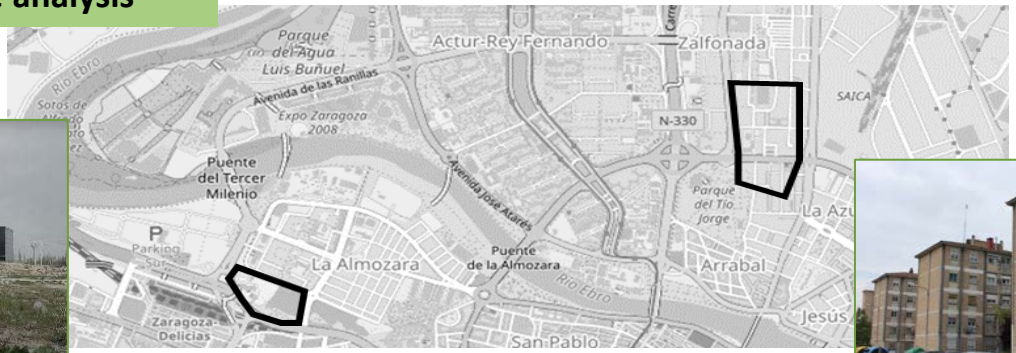
04. Zaragoza FC Replication activities

District selection and Baseline analysis

Finished (Oct21-Sep22)



PED2: Equipped park - Etopia

Baseline:

- *Underused area and in the way of transit for hundreds of citizens*

Expectations:

- *Plannig desing considering the requests of local neighbours.*
- *Digital space interconnected with different parts of the city for citizen awareness and interaction.*

PED1: Balsas de Ebro Viejo

Baseline:

- *Neighbourhood built in the 1960s with 30.000 inhabitants with little social integration and economic resources.*

Expectations :

- *first positive energy retroffinting demo with potential for replication from neighbourhood to city level.*

RESPONSE

04. Zaragoza FC Replication activities

Analysis of local regulations for Solution implementation

Finished (Oct21-Sep22)

Regulatory readiness level for the ISs

Regulatory topics		IS 1.1	IS 1.2	IS 2.1	IS 2.2	IS 3.1	IS 3.2	IS 4.1	IS 4.2	IS 5.2	ZGZ´s Regulatory preparedness level per Topic
1. Electricity retail tariff design		●	●	●	□	●	□	□	●	□	2
2. Smart metering for electricity			●	●	□	●	□	□	●	□	2
3. Electricity grid access and connection	3.1	●	□	●	□	●	□	□	●		2
	3.2		□	●	□	●	□	□	●		0
4. Local flexibility services to electricity DSOs			□	●	□	●	□	□	●	□	1
5. Ownership and operation of electrical storage assets		□	□	●	□	●	□	□	●	□	0
6. Provision of ancillary services to electricity TSOs			□	●	□	●	□	□	●	□	1
7. Self-generation		●	□	●	□	□	□	□	□	□	2
8. Energy Communities		□	□	●	□	□	□	□	□	□	1
9. Renewable certificates and support schemes		●	□	●	●	●	●	□		□	2
10. Energy Efficiency obligations and services			●	□	●		●	□		□	2
11. Building energy requirements		●	●	●			●	□	●	□	2
12. Electric mobility		□	□	●	□	●	□	□	●	□	1
13. Local air quality regulations		□	□	□	□	□	□	●	●	●	2
14. Automated Driving		□	□	□	□	□	□	●	□		1
15. District heating network regulation and tariff design		□	□	□	●		●	□	□	□	0
16. Data protection		□	●	□	□	□	□	●	□	●	2
ZGZ´s Regulatory preparedness level per ISs:		**H**	**H**	**MH**	**M**	**M**	**MH**	**H**	**M**	**H**	

The most suitable Solutions for the Replication

High prepared (H) in :

- *IS-1.1. Increased RES Generation on a Building Level*
- *IS-1.2. Energy-Efficient and Smart-Ready Building Construction/Retrofitting*
- *IS-4.1. City Information Platform-enabled Innovations*
- *IS-5.1. Enhanced City Participation and empowerment .*

Medium prepared (M) in:

- *IS-2.1. Decarbonization and Smartification of Electricity Grid Networks*
- *IS-3.2. Novel Heat Storage providing flexibility to the energy system.*

Low prepared (L) in:

- *IS-2.2. Decarbonization and Smartification of District Heating/Cooling Networks*
- *IS-3.1. Novel Electricity Storage providing Flexibility to the energy system*
- *IS-4.2. E-mobility Grid Integration and City Planning.*

RESPONSE

04. Zaragoza FC Replication activities

Preselection of most promising Solutions for the Replication

Finished (Oct21-Sep22)

PED1: Balsas de Ebro Viejo

IS 1.1: Conventional PVs for roofs and public spaces

IS 1.2: Building envelope retrofitting & Novel high-performance systems (heating/cooling/lighting)

IS 2.1: Collective energy self-consumption

PED2: Equipped park - Etopia

IS 4.1.: 5G Smart City lighting poles

IS 5.1: Ideathons and Co-creation events

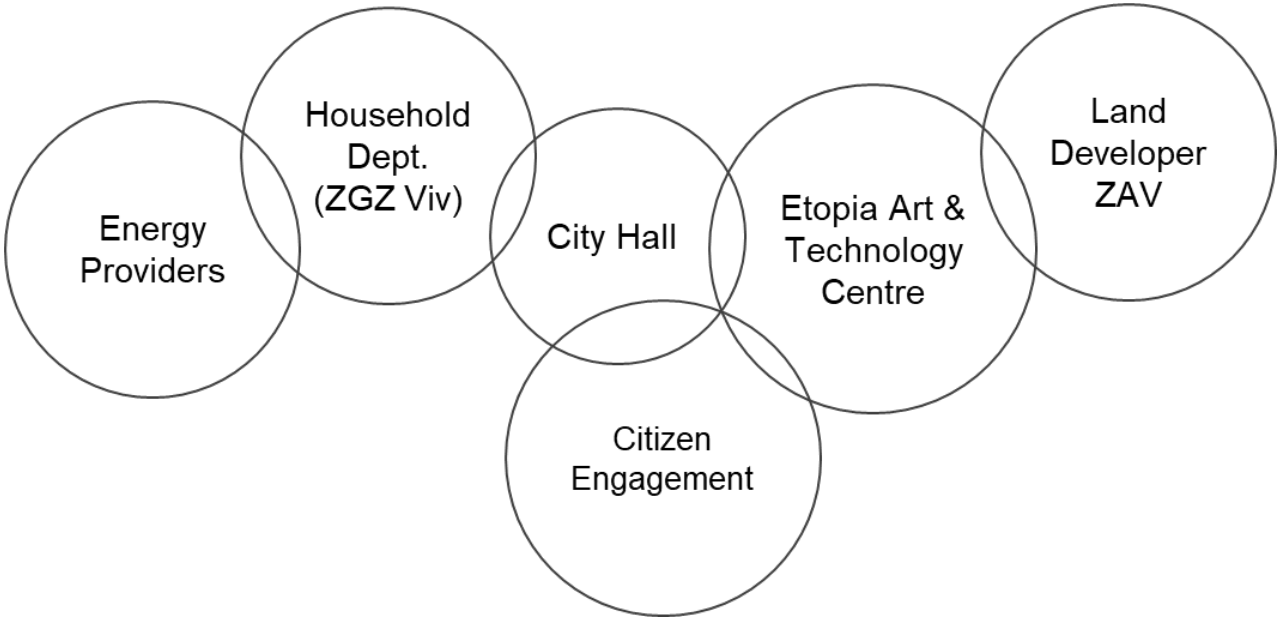
RESPONSE

04. Zaragoza FC Replication activities

Stakeholders identification and Consolidation

In progress (Oct21-Sep25)

The main stakeholders involved in the Replication process and the interconnection between them:



04. Zaragoza FC Replication activities

Barrier/Risk identification

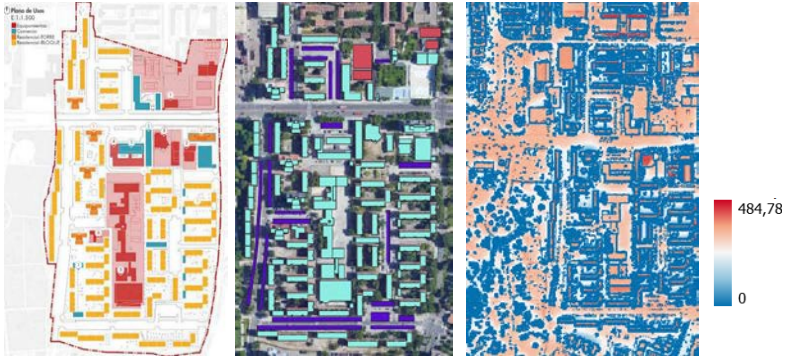
In progress (Oct21-Sep23)

List of the barriers identified	
Technical barriers:	• Lack of technical competency of the existing staff: lack in expertise in specific fields or areas not currently covered in the administration • Lack of available staff resources (in both time and numbers). • Data privacy • Data availability, sharing and interoperability • Low ability to present solutions in a simple way to citizens/stakeholders
Social barriers	• High investment costs and payback times that can lead to a lack of interest • Lack of awareness of financing opportunities and of information in general (technical for example) • Organizing collective agreement and action • Lack of motivation – consumer priorities, attitude, and behaviour
Regulatory/ administrative barriers	• Lack of inter-departmental coordination and communication • Incompatibility with public procurement policies • Regulations limiting implementation • Legislative or political instability • Insufficient political will or commitment • Administrative conflicts and cultural differences • Difficulties in the coordination of a large number of actors
Financial barriers	• High initial costs & questionable profitability • Perception of innovative solutions as too risky • Lack of incentives or the existence of disincentives • Difficulty in finding sources of fundings

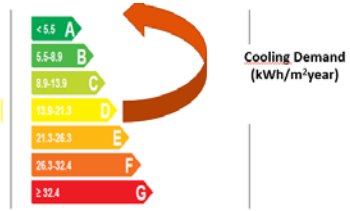
04. Zaragoza FC Replication activities

Technical feasibility studies

PED1: Balsas de Ebro Viejo



PV electric production (kWh/m²year)



In progress (Oct21-Sep24)

BASELINE	
TOTAL	
Total Primary Energy [MWh/year]	36.237
Total emissions [TCO_2/year]	5.268

ACTIONS	SCENARIO 2050	
• Installation of PV panels on building roofs	Reduction Total Primary Energy	-22,70%
	Reduction Total emissions	-20,70%
• Installation of PV panels on public areas	Reduction Total Primary Energy	-19,80%
	Reduction Total emissions	-18,10%
• Retrofitting of building envelopes & High-performance systems & LED lighting	Reduction Total Primary Energy	-58,40%
	Reduction Total emissions	-62,10%

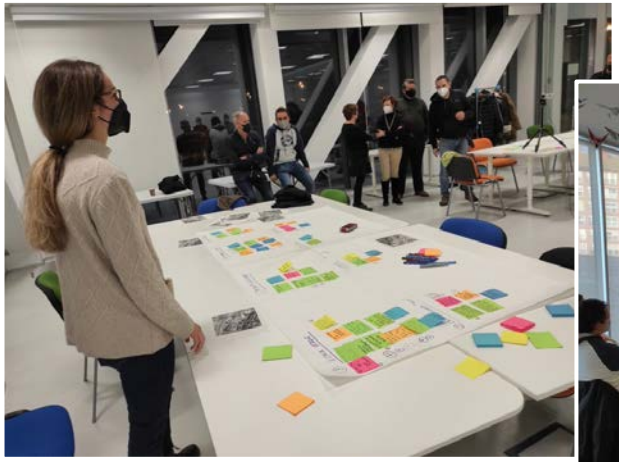
RESPONSE

04. Zaragoza FC Replication activities

Stakeholder working groups

PED2: Equipped park - Etopia

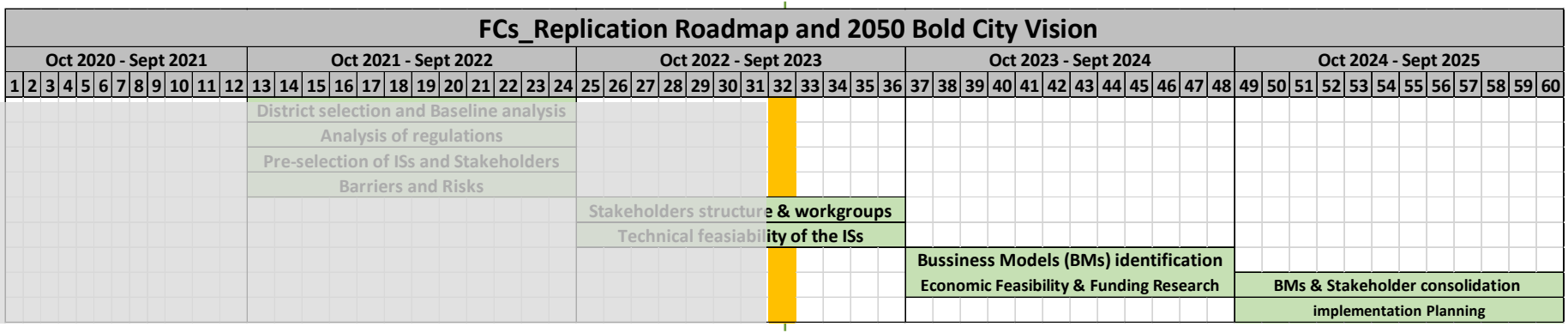
In progress (Oct21-Sep24)



RESPONSE

04. Zaragoza FC Replication activities

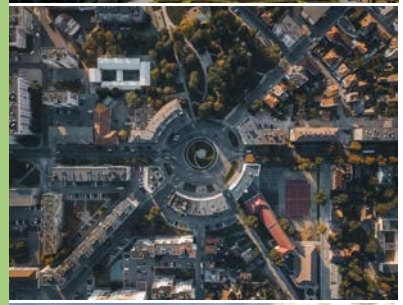
Next steps



To be done..

- Carry out more **feasibility studies** for all ISs selected for each PEDs
- Define the **stakeholders structure** and roles and consolidate their relations.
- Conduct **workshops** and **Ideathon/Hackathon/Datathon** on climate and energy issues
- Start working on the **definition of the BMs** (integrating technical, economic and social approaches).
- Exploring **new funding opportunities** for Replication
- Defining the **Replication Plan (short (2030) and long-term (2050)** in line with the **City neutrality goal by 2050**

RESPONSE



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This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement nº 957751. The document represents the view of the author only and is his/her sole responsibility: it cannot be considered to reflect the views of the European Commission and/or the European Climate, Infrastructure and Environment Executive Agency (CINEA). The European Commission and the Agency do not accept responsibility for the use that may be made of the information it contains.