exPEDite

"One-pager" info from Technical Partners to Workshop 1 & 2

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Implementing a Living Lab Approach for the Validation and Testing of the EXPEDITE Solution and Tools

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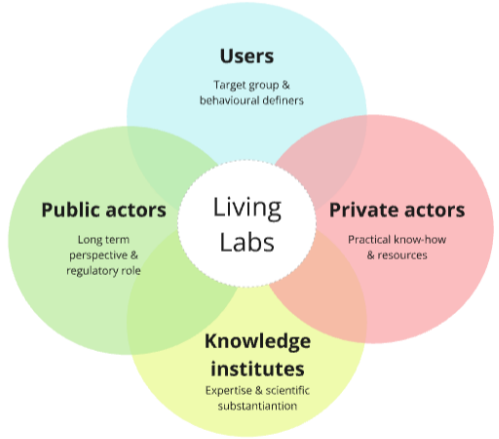
What are living labs?

European Network of Living Labs



Collaboration between PPUK
Quadruple helix approach

"Living Labs are open innovation ecosystems in real-life environments based on a systematic user co-creation approach that integrates research and innovation activities in communities and/or multi-stakeholder environments, placing citizens and/or end-users at the centre of the innovation process."

The concept 'Living Lab' is used for the organisation that innovates according to these and refers to the innovation projects that follow these guidelines and links with specific activities, methods and tools within these innovation projects. Therefore, a distinction can be made between a Living Lab organization, a Living Lab project and Living Lab activities, methods and tools (micro, meso, macro).

Living Labs as real-life test and experimentation environments, foster co-creation and open innovation among the main actors of the Quadruple Helix Model, namely:

- Citizens
- Government
- Industry
- Academia

Source: Enoll

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Emilia Risu & Francesco Molinari

What are living labs?

- A **user** uses the product or service in their daily lives and can play a different role, such as a resident, employee or tourist.
- A **utiliser** refers to a public or private actor (e.g. a company) that utilises the Living Lab in the development, research or innovation of their own product or service. A utiliser can also involve their own end users in testing an assignment, for example.
- A **developer** can be an educational or research institution, or a company that provides methods, tools and resources for development. For example, developer methods and tools can be used to collect feedback, suggestions for improvements or other data on the product or service being developed.
- An **enabler**, such as a municipality, city or other public actor, supports the operating conditions of Living Lab actors by creating practices and structures for the activities.
- The **Living Lab operator team** refers to the team that connects different actors and launches the Living Lab, such as the Lyckan – A futurehub for inspiration and rural innovations -project carried out at Lapinjärvi.[11]

Living labs are real development environments that promote creativity, diverse learning, and highlight the connections between sustainable development, technological, social, and economic phenomena.

Living labs generate practice-based innovations and support rapid experimentation of ideas and prototypes. Knowledge is created through a multi-voiced dialogue that fosters individual and organizational learning.

Living Labs can be either physical or virtual spaces where different actors can create partnerships. Living Labs combine innovation activities, research and co-creation, which enable different actors, such as towns, companies and educational institutions to develop and test ideas, solutions, products and services.

Source: Laurea & Living Lab lHandbook

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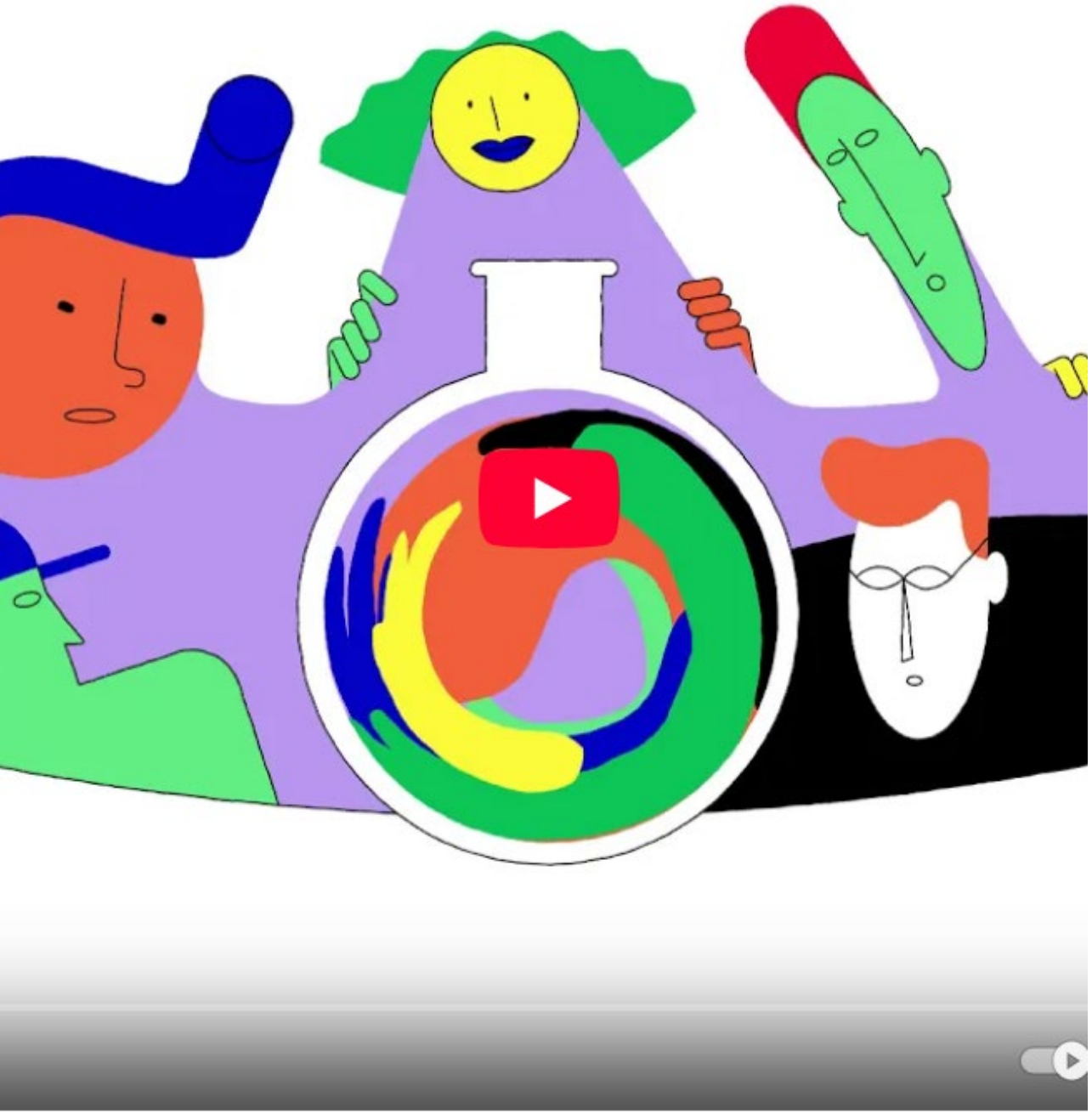

To gain more understanding about Living Labs , please watch a video from SmarterLabs

https://www.youtube.com/watch?v=CxhVLx2hPrQ

More info about SmarterLabs here

Example from Torino City Lab

Examples of user from Expedite

exPEDite

Citizen

View aggregated public information through graphs and visualizations.

Participate in citizen engagement missions such as quizzes, community discussions, and group projects.

Provide feedback on urban infrastructure, sustainability projects, and local initiatives.

City Planner

Ingest and manage simulation data for different urban planning scenarios.

Use District Optimization and Decision Support

Adjust parameters and request additional simulations to optimize urban policies.

DT-Runtime View with full access (?)

Building/Infrastructure Manager

View real-time and historical data about buildings' energy, occupancy, and efficiency.

Analyze short-term predictions for energy demand, maintenance needs, or sustainability metrics.

Provide feedback on building performance, data anomalies, or optimization suggestions.

External Stakeholder

Retrieve and analyze open data via the Data Spaces Integration Suite.

Access and experiment with models and simulations from the Pattern Repository.

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From this slide down you will find the technical partners presentations (3 slides/partner/solution)

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Pattern Repository

RTU/janis.kampars@rtu.lv

Dati Group/ivars.javaitis@datigroup.com

Description of the component: The Pattern Repository stores EXPEDITE models, which are part of the run-time and design-time digital twin as reusable patterns. The patterns contain usage preconditions, description, KPIs. It is also intended to store various EXPEDITE components (e.g. their source code or description) in the PR.

Pains:

Little info for city planners or building operators about the capabilities of models.

Hard to identify potentially applicable models, their performance, software architecture patterns and corresponding components.

PDFs and other traditional kinds of documentation are not machine readable, they can't be queried to locate a suitable solution.

Gains:

Collaboration environment for knowledge exchange about models, digital twin components

Benefits:

More efficient collaboration, discoverability of patterns and components

Keywords: pattern-based knowledge management, collaboration

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List of suggested target users

Model developers:

Publish their models and their corresponding KPIs, usage preconditions.

Component developers:
Publish specific components such as BMS integration component as a PED digital twin architecture patterns.

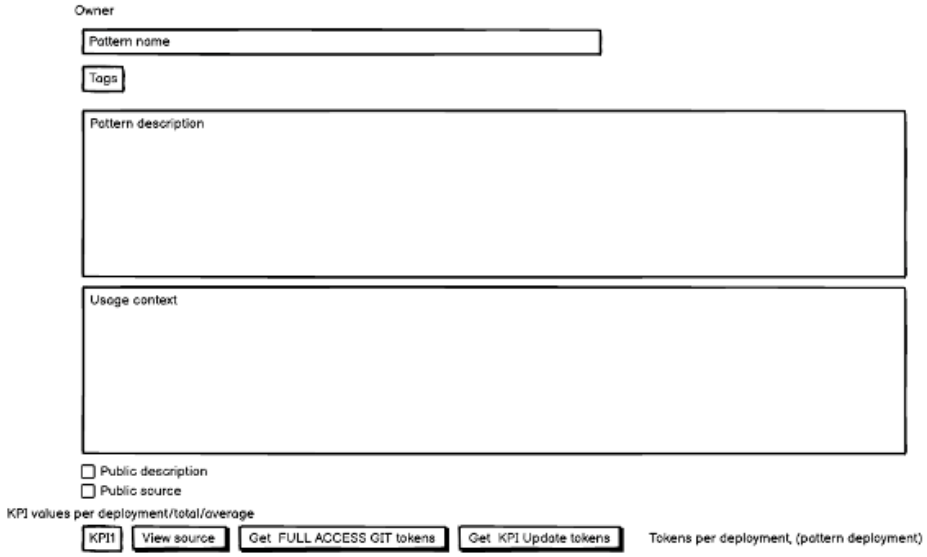
City planner:

Identify suitable models, software components.
Provide feedback about the models and components used.

Building/Infrastrucutre manager:

Identify suitable models, software components.

Provide feedback about the models and components used.



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Experimentation

Clear requirements for sharing models, components, related metadata (e.g.Kpis).

Understand if component integrates with Core Data Services to receive live KPI updates.

Users

What information is provided for each model?

What information is provided for software components?

How do we describe the KPIs and usage context in a machine-readable format?

Wha

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DODS: District Optimization (DO) & Decision Support (DS)

EXUS – Aris Bonanos

(Mihael Maltar – EXUS; Janis Kampars – RTU)

Description of the component (in non-technical terms):
This component provides recommendations towards end users on how to optimize their district. These recommendations are provided on two distinct time horizons: **i)** for the District Optimization (DO): *immediate actions* that can improve the energy consumption of an asset (i.e. sensors indicate that a room is empty therefore turn off the lights) or alerts on the status of an asset (i.e. Sensor X is not working; HVAC is set to too high temperature); and **ii)** for the Decision Support (DS): implications of hypothetical *long-term actions* on the district's energy performance (i.e. renovating 25% of buildings by 2035 will reduce CO2 emissions by X k-ton CO2; install Y MW of PV panels by 2040) and prioritization of which actions will have the greatest impact towards achieving a PED.
Pains & Gains (Challenges it solves & What it offers):
Difficulty to directly compare multiple scenarios considering different priorities of each urban planner
Multiple stakeholders can prioritize different non-tangible outcomes (e.g. Public health benefits vs. Green jobs created)
Benefits: Helps to identify and prioritize actions that improve utilization of energy resources and transition district towards positive energy
Keywords: Decision support, district optimization, energy transition pathways

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List of suggested target users

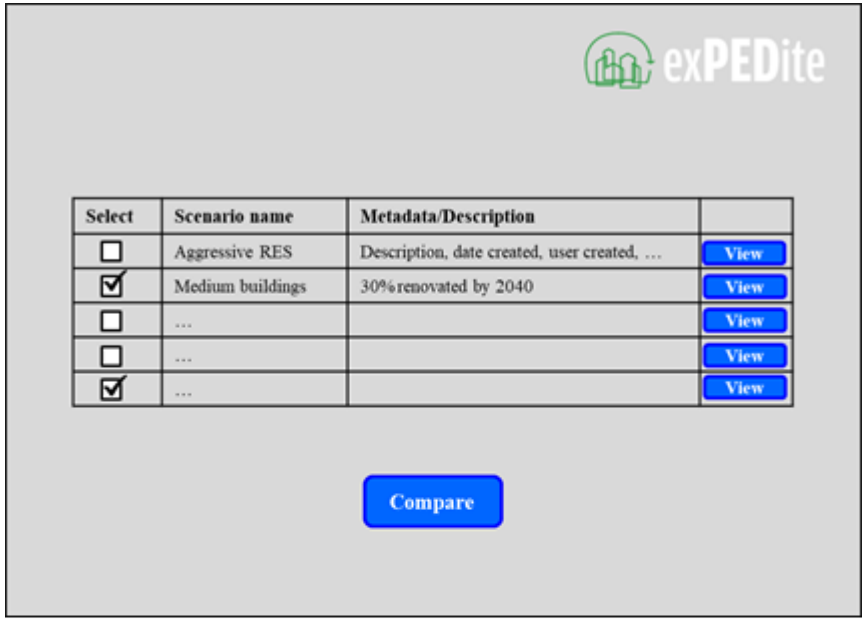
List of suggested target users for the experimentation/validation of the component (probably chosen from a predefined one)

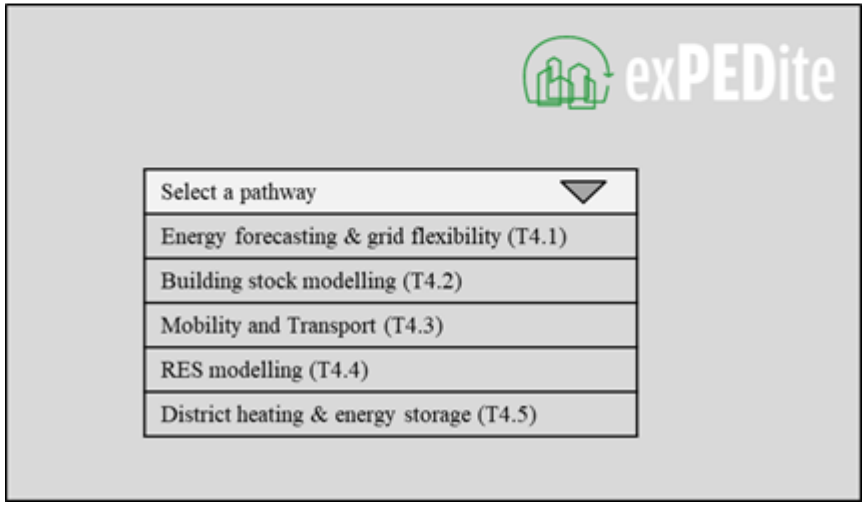
Building/Infrastructure manager (potentially Citizen)

- Comprehensive view of current asset situation
- Direct feedback from user preferences
- Alert on anomalous readings from sensors
- Recommendations on energy optimization actions

Urban planner & Policy Maker

- Crafting and analysis of pathways
- Direct comparison of pathways





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Experimentation

Purpose: To validate the usability and effectiveness of the DODS tool in helping users manage energy (DO) and select appropriate energy transition pathways (DS), ultimately contributing towards converting the district into positive energy.

Scope:

Test pathway creation: can user effectively navigate through the precomputed simulations?

Test optimization: are the recommendations provided relevant and actionable? Is information about the status presented in a timely fashion?

Involve **15** users from diverse roles (urban planners, facility managers, citizens). ***KPI2.2***

[DO] Run the experiment for 4 weeks, collecting feedback through surveys and analytics.

[DS] Run a 2-hour session covering all pathway options (as a user training). ***KPI3.2***

Measure success based on user satisfaction.

Users

Main: Does DODS help in choosing an action that can reduce the energy use of the district?

Sub-questions:

Functionality: Does the component perform its core tasks as expected? Are there any bugs, errors, or limitations that hinder its functionality?

Usability: Is the component intuitive and easy to use? How quickly can users learn to navigate and use the tool effectively?

User Experience (UX): Do you find the component enjoyable and satisfying to use? Are there any pain points or frustrations during interaction?

Relevance: Does the component address the specific needs and challenges of its target users? Are there any missing features or functionalities that you might have expected?

Efficiency: Does the component save users time or effort compared to their current methods or tools? How does it impact their productivity or workflow?

Integration: Does the component work well with other tools or systems users rely on? Are there any compatibility issues?

Scalability: Can the component handle different levels of usage or complexity? Does it perform well under stress or high demand?

Value Proposition: Do you perceive the component as valuable and worth adopting? What benefits do you experience, and do these align with the intended goals?

Improvement Opportunities: What changes or enhancements would you suggest to make the component better? Are there any unexpected use cases or needs that the component could address?

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Mobile app

UpcoMinds/Kostas flokos

Description of the component (in non-technical terms):
A citizen engagement mobile application with the goal to help cities/institutions incentivise citizens to reduce their energy consumption and their CO2 footprint.

Pains & Gains (Challenges it solves & What it offers):
The application makes the energy reduction goal a social problem and not just a management or political issue.

Benefits: Engaged citizens, knowledgeable to the energy related problems

Keywords: mobile app, citizen engagement, energy reduction, energy consumption

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List of suggested target users

List of suggested target users for the experimentation/validation of the component (probably chosen from a predefined one)

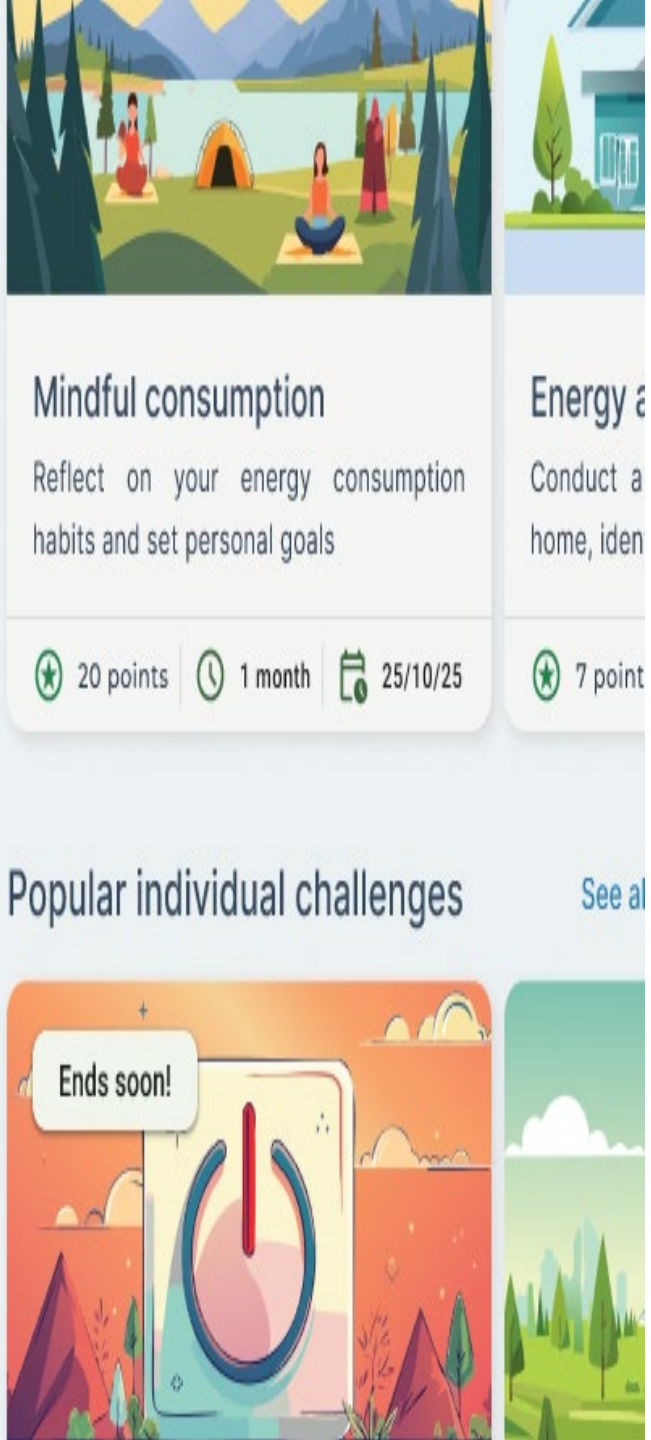
- Everybody working in the University of Riga
- School masters, responsible for energy consumption, in the City of Riga
- Members of project partners wishing to help the project outcomes

Why These Users?

They represent a mix of technical and non-technical backgrounds.

They cover a variety of industries and use cases, ensuring diverse feedback.

They can validate the component's usability, scalability, and effectiveness in real-world scenarios.



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Experimentation

Validate the core concepts of the solution:

- communities
- challenges
- knowledge quizzes
- forum

Check the user experience of the proposed designs and suggest corrections

Allow for more ideas to flow, answering the core question to the right

Users

What are the concepts that would engage citizens the most, in their desire to help reduce the energy consumption and carbon footprint in their district.

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BSEM

Tecnalia\ Nekane Hermoso

Description of the component (in non-technical terms):
This component is a methodological framework and modeling tool designed to help municipalities and decision-makers analyze the energy demand and environmental impact of building stocks. Think of it as a digital roadmap that provides clear insights into how buildings consume energy today and how they might evolve in the future. It enables urban planners to make informed decisions about sustainable development, helping them design and expand Positive Energy Districts (PEDs) more effectively.

Pains:
•Lack of accurate, georeferenced data to analyze current and future energy demand.
•Difficulty in integrating energy and environmental data into broader urban planning efforts.
•Limited resources to identify and replicate potential PEDs in other parts of the city.

Gains:
•Provides a structured and comprehensive methodology for analyzing building stock energy performance.
•Delivers geo-referenced models that facilitate informed decision-making at district and city levels.
•Supports the analysis of the impact of the implementation of strategies.
•Supports the identification of new potential PEDs and the replication of successful models in other areas.

Benefits:
•**Improved Decision-Making:** Offers municipalities/urban planners the possibility to assess energy consumption and environmental impacts.
•**Enhanced Sustainability Planning:** Helps cities design more energy-efficient districts by leveraging data-driven insights.
•**Scalability and Replication:** Can be expanded beyond pilot projects, making it useful for broader city planning initiatives.
•**Integration with Digital Twins:** Ensures compatibility with digital twin models, enhancing data visualization and analysis.

Keywords: Building Stock Modeling, Energy Demand, Environmental Impact, Digital Twins, Positive Energy Districts, Urban Planning, Geo-Referenced Data, Sustainability

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BSEM

Target users

- **Municipalities and Energy Planners:**
  - Need tools for selecting and optimizing renewable energy solutions.
- **Renewable Energy Developers:**
  - Use modeling frameworks for designing efficient energy systems.
- **Utility Companies:**
  - Require insights into integrating PEDs into broader energy networks.
- **Research Institutions:**
  - Study renewable energy potential and efficiency in urban settings.
- **Technology Providers:**
  - Develop AI-based and geospatial tools for renewable energy modeling.

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BSEM

Experimentation

Purpose:
To validate the usability and effectiveness of the Building Stock Modeling (BSM) methodology in assisting municipalities and decision-makers in analyzing current and future energy demand, environmental impacts, and identifying potential Energy Positive Districts (PEDs).

Scope:

•**Evaluate the methodology and it's** accuracy and relevance for energy and environmental modeling of building stocks at district and city levels to support urban planning and decision-making related to energy planning actions

•**Test the applicability** of the methodology in identifying new PEDs based on energy consumption and environmental impact.

•**Test the replicability of** the methodology and models for scaling PEDs at the city level.

•**Feedback from municipalities** on the practical use of the framework for identifying new PEDs and improving urban energy planning.

Users

Main question:

Does this methodology effectively help municipalities and decision-makers analyzing current and future energy demand, environmental impacts, and identifying potential Energy Positive Districts (PEDs)?

Subquestions:

Functionality: Does the component perform its core tasks as expected? Are there any bugs, errors, or limitations that hinder its functionality?

Usability: Is the component intuitive and easy to use? How quickly can users learn to navigate and use the tool effectively?

User Experience (UX): Do you find the component enjoyable and satisfying to use? Are there any pain points or frustrations during interaction?

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Improvement Opportunities: What changes or enhancements would you suggest to make the component better? Are there any unexpected use cases or needs that the component could address?

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RES

Tecnalia\ Nekane Hermoso

1/3

Description of the component (in non-technical terms):
This component focuses on modeling and optimizing renewable energy systems to help municipalities and decision-makers design sustainable and efficient Positive Energy Districts (PEDs). Think of it as a smart planning tool that finds the best mix of renewable energy sources—like solar, wind, and hydrogen—to maximize efficiency and sustainability. It ensures that PEDs can be expanded at the city level while maintaining an optimal balance between energy production and demand.

Pains:
•Complexity in selecting the right mix of renewable energy technologies for PEDs.
•Lack of integration between energy modeling and urban planning strategies.
•Limited guidance on linking renewable energy models with geospatial and digital twin tools.

Gains:
•Provides a comprehensive methodology for optimizing renewable energy system design at district and city levels.
•Enables decision-makers to integrate energy forecasting, district heating, and storage solutions.

Benefits:
•**Optimized Energy Planning:** Ensures PEDs have the most efficient and sustainable energy mix.
•**Advanced Technology Integration:** Geospatial modeling to enhance decision-making.
•**Scalability and Expansion:** Supports the replication of optimized energy models in other urban areas.
•**Seamless Digital Twin Integration:** Links with urban digital twin tools for real-time analysis and improved planning.

Keywords: Renewable Energy, Energy System Optimization, Digital Twins, Positive Energy Districts, Sustainability.

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RES (Same as BSEM)

Target users

- **Municipalities and Energy Planners:**
  - Need tools for selecting and optimizing renewable energy solutions.
- **Renewable Energy Developers:**
  - Use modeling frameworks for designing efficient energy systems.
- **Utility Companies:**
  - Require insights into integrating PEDs into broader energy networks.
- **Research Institutions:**
  - Study renewable energy potential and efficiency in urban settings.
- **Technology Providers:**
  - Develop AI-based and geospatial tools for renewable energy modeling.

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RES

Experimentation

Purpose: To validate the usability and effectiveness of the Renewable Energy System (RES) modeling framework in helping municipalities and decision-makers optimize energy solutions for PEDs.

Scope:

•**Test the accuracy** and usability of the methodology in selecting optimal renewable energy mixes.

•**Evaluate the integration** of RES modeling with digital twins and urban planning tools.

•**Test the replicability of** the methodology and models for scaling PEDs at the city level.

•**Feedback from municipalities** on the practical use of the framework for identifying the optimal mix of renewable energy technologies for PEDs

Users

3/3

Main question:

Does this methodology effectively help municipalities and decision-makers design sustainable and efficient Positive Energy Districts (PEDs)?

Subquestions:

Functionality: Does the component perform its core tasks as expected? Are there any bugs, errors, or limitations that hinder its functionality?

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Data Spaces Integration Suite (DSIS)

EVIDEN/Sergio Palacios

Description of the component (in non-technical terms):
DSIS will allow EXPEDITE project to be prepared to connect to collaborative Data Spaces based in the IDSA standards enabling different stakeholders (e.g., businesses, departments, or even different organizations) to share and collaborate on data without exposing all of their underlying systems or proprietary data.

Pains:
IDSA compliance: The requirement of a full connector and a common DAPS (Dynamic Attributes Provissioning Service) for data exchage could be chalenging.
Lack of general knowlegde about what a Data Space is and standard UCs.

Gains:
Share and exchange data maintaining the data ownership and sovereignty
Define access policies to assure the data control
Have a data assets catalogue
Have previous information about a Data Asset based on its metadata

Benefits:
Increase the possibility to integrate external data into the project and/or give more value to the project data giving visibility for other projects/participants.
Be alligned with the EU strategy and regulations about data sharing

Keywords: Data Spaces, data sovereignty, access control, data catalogue, access policies

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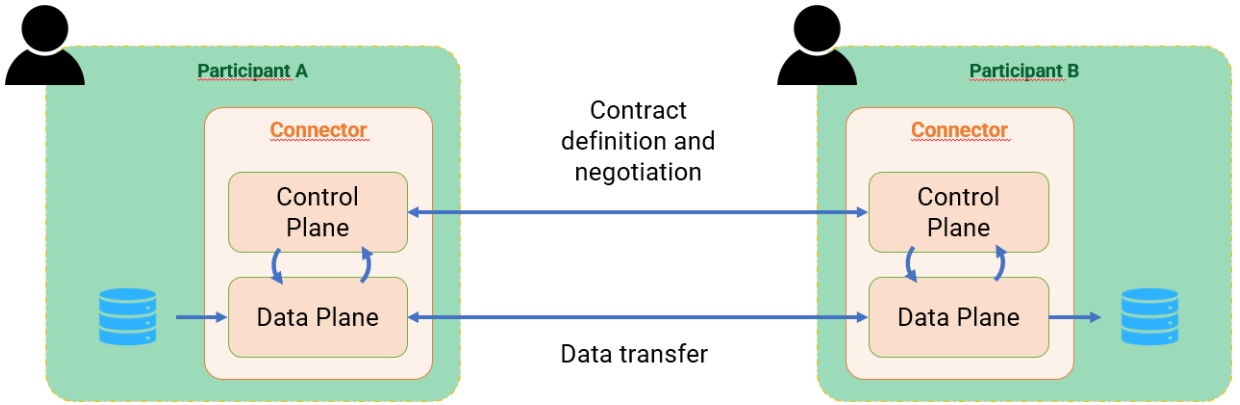
List of suggested target users

Project participants (City planner)

- Could act as Data Owner or Data consumer:
  - Project Data owner
  - Will deploy and operate his own connector to create data offers an publish it in the catalogue
  - Project Data consumer
  - Will deploy and operate his own connector to be able to retrieve data from other connectors in the same data space

External stakeholders

- Will have a valid connector in the same Data Space (using the same DAPS) and will offer owned data or consume data from the project participants.



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Experimentation

What is the purpose of experimentation

Design and implement a full Use Case in which 2 participants (EXPEDITE Project member could act as Participant A) exchange data.

The actions that should be taken are:

- Both participants should have a IDSA compliant connector validated in the same DAPS.
- Participant A will create a Data Offer to publish it in the Data Assets catalogue
- Participant B will browse over the Participant A connector catalogue to choose the data asset to be retrieved.
- Data Asset will be transferred between Participant's connectors

Users

Main question:

Could I exchange data with other participants in the same Data Space?

Sub questions:

Could I publish a Data Offer?

Could I see the catalogue for other connector in the same data space?

Could I select a Data Offer and check the metadata?

Could I retrieve the data after sign a contract for a Data Offer?

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Energy forecasting and grid flexibility

PLEGMA LABS – S. Chadoulos & S. Kalogridis

Description of the component (in non-technical terms):
This component is a short-term energy forecasting module, focusing on predicting the energy consumption of specific district assets (devices/buildings) based on historical energy consumption data, as well as the energy generation of renewable energy sources. Based on the energy demand and generation, the module provides flexibility schedules for district assets.

Pains:
Variability in renewable energy sources and consumer behavior makes accurate forecasting challenging.
Traditional energy models struggle to adapt to dynamic grid conditions, leading to inefficiencies.

Gains:
AI-driven models enhance energy demand and generation forecasting at multiple levels, hence facilitating better scheduling of assets and resources, reducing costs and improving grid stability.

Benefits:
Better forecasting allows for higher integration of RES into the energy mix.
Proactive energy management may reduce peak demand costs and optimize flexibility resources.
Can be applied across different urban energy infrastructures, from buildings to entire districts and different energy markets.

Keywords: Energy Demand Forecasting, Renewable Energy Generation Prediction, Flexibility & Demand Response, AI & Machine Learning in Energy, Smart Grid Optimization.

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List of suggested target users

- **Building Managers**
  - They need insights into energy consumption trends to optimize efficiency and reduce operational costs.
  - Our AI-driven forecasting enables smarter energy management, reducing waste and enhancing sustainability.
- **City planners**
  - Cities need data-driven solutions to manage energy resources efficiently and promote sustainability.
  - Our tool provides data-driven short-term forecasting through the DT-Runtime view helping city planners with district optimization and decision support for specific PED assets.

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Experimentation

Purpose: To validate the usability and effectiveness of the “Energy forecasting and grid flexibility” tool.

Scope:

Assess for which level the module outputs are more useful (device, building, district).

Evaluate the integration of the forecasting and flexibility scheduling module with other tools and modules.

Gather feedback from stakeholders on the practical use of the module for enhancing demand-side flexibility and renewable energy integration.

Users

Main question:

Does this module assist the stakeholders that aim for Positive Energy Districts in terms of short-term district asset insights and decision making?

Subquestions:

Functionality: Does the component perform its core tasks as expected? Are there any bugs, errors, or limitations that hinder its functionality?

Usability: Is the component intuitive and easy to use? How quickly can users learn to use the tool effectively?

Relevance: Does the component address the specific needs and challenges of its target users? Are there any missing features or functionalities that you might have expected?

Integration: Does the component work well with other tools or systems users rely on? Are there any compatibility issues?

Scalability: Can the component handle different levels of usage or complexity? Does it perform well under stress or high demand?

Value Proposition: Do you perceive the component as valuable and worth adopting? What benefits do you experience, and do these align with the intended goals?

Improvement Opportunities: What changes or enhancements would you suggest to make the component better? Are there any unexpected use cases or needs that the component could address?

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Transport and Mobility

NTUA\ Marios Giouroukelis

Description of the component (in non-technical terms):
This component is designed to simulate and optimize transportation energy use and greenhouse gas emissions. It helps decision-makers a) understand how energy consumption and emissions develop over both the short and long term, and b) prepare for future changes in traffic energy demands by estimating the model shift created by strategies like parking pricing can boost public transit usage and identifying optimal locations for new EV chargers as the number of electric vehicles grows.

Pains:
•Difficulty in choosing and simulating the optimal combination of demand management strategies.
•Challenges in integrating data from IoT sensors into the simulation platform.
•Reliance on external tools that are not fully compatible with the digital twin platform and require expert handling.

Gains:
•Offers a comprehensive method for monitoring and understanding traffic flows, focusing on energy use and GHG emissions at the district level.
•Empowers decision-makers to tackle transport-related energy consumption, a factor often neglected in PED analyses.

Benefits:
•Provides an intuitive view of how traffic flows, energy consumption, and emissions evolve over time and across space, especially when demand management strategies are applied.

Keywords: Transport-related energy consumption, greenhouse gas emissions, travel demand management strategies, EV vehicles, EV chargers

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Transport and Mobility

Target users

- **Model developers:**
- Creation and calibration of transport simulation models, identification of KPIs, scenarios and demand management strategies and usage preconditions, integration of data sources.
- Respond to requests for additional scenarios
- **City planner:**
- Selection of demand management strategies, adjust their paraments and read of the associated energy, cost and emissions KPIs. Request additional simulations.
- **Infrastructure manager:**
- Analyze short-term predictions for energy demand of EV chargers installed within the district.
- **Citizen:**
- View aggregated public information on transport through graphs and visualizations.

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Experimentation

Purpose: To validate the usability and effectiveness of the Transport & Mobliity (RES) modeling framework in helping decision-makers understand and optimize transport-related energy consumption and GHG emissions

Scope:

•Can users navigate the precomputed simulations with ease?

•Are the preconfigured scenarios sufficient; do users need more relevant alternatives?

•Do the demand management strategies fit the RTU campus context, and can they be replicated on a city scale?

•With each scenario associated with particular KPIs, do these metrics fully capture performance? Is there a need for additional KPIs?

- Involve **10** users from diverse roles (urban planners, facility managers, citizens)

- Run the experiment for 4 weeks, collecting feedback through surveys and analytics.

- Measure success based on user satisfaction.

Users

Main question:

Does this methodology effectively help municipalities and decision-makers understand and manage transport-related energy demand and emissions?

Subquestions:

Functionality: Does the component perform its core tasks as expected? Are there any bugs, errors, or limitations that hinder its functionality?

Usability: Is the component intuitive and easy to use? How quickly can users learn to use the tool effectively?

Relevance: Does the component address the specific needs and challenges of its target users? Are there any missing features or functionalities that you might have expected?

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District heating and energy storage

RIGA TECHNICAL UNIVERSITY

RTU/Jelena Pubule

Description of the component (in non-technical terms):
This component involves creating a system dynamics model for district heating and thermal storage. The model will be designed to help decision-makers test and compare different heating solutions for both existing and newly developed Positive Energy Districts (PEDs).

Pains & Gains (Challenges it solves & What it offers):

- Provides a dynamic model for decision-makers to test different heating solutions.
- Ensures compatibility with renewable energy sources (RES) and waste heat recovery systems.

Benefits:

- Helps predict future heating needs and optimize system performance.
- Users can test "what-if" scenarios for various heating solutions.
- Supports sustainability goals by demonstrating emission reduction potential.
- Encourages knowledge sharing and innovation in energy management.
- Helps reduce operational and maintenance expenses in district heating.

Keywords: District Heating; Thermal Storage; System Dynamics Modeling; Renewable Energy Integration; Carbon Emission Reduction; Decision Support Tool; Interactive Simulation

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List of suggested target users

- **Energy Planners:**
  - Need tools for selecting and optimizing energy solutions.
- **Renewable Energy Developers:**
  - Use modeling frameworks for designing efficient energy systems.
- **Utility Companies:**
  - Require insights into integrating PEDs into broader energy networks.
- **Research Institutions:**
  - Study renewable energy potential and efficiency in urban settings.
- **Citizens:**
  - Study impact of different district heating options on level of GHG.

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Experimentation

Purpose:
To validate the usability and effectiveness of the Districh Heating and storage (DHS) modeling framework in helping decision-makers optimize energy consumption, use or RES and related GHG emissions

Scope:

- **Engage stakeholders in discussions** about the possibilities of modifying key technical parameters of PEDs and exploring various “what-if” scenarios for building heating solutions, heat distribution, and energy storage.
- **Test the replicability of** the methodology and models.
- **Feedback from stakeholders** on emission reduction, potential investments, and operation & maintenance (O&M) costs under different conditions.

Users

What is the core question users might help to answer

How can the DHS modeling framework be optimized to support decision-makers in improving energy efficiency, integrating renewable energy sources, and reducing GHG emissions while ensuring cost-effectiveness and scalability?

- **Usability & Effectiveness:** Does the model provide accurate and practical insights for optimizing district heating and energy storage?
- **Replicability:** Can this methodology and model be successfully applied in other PEDs or regions?
- **Investment & Costs:** What are the financial implications, including operational and maintenance (O&M) costs, for different heating strategies?
- **Stakeholder Insights:** What improvements or adjustments can be made based on stakeholder feedback?

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If you have any question, please contact

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