

# Deliverable

**Project Acronym:** LIFE Giga Regio Factory

**Project full name:** Life Giga Regio Factory: going next stage in market uptake and factory development for more affordable Net Zero energy renovation industrialised solutions

**Proposal No.** 101077258

## D2.6 Tool functional requirements

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## Document History

<b>Date</b>	<b>Author</b>	<b>Action</b>	<b>Status</b>
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## Content

Document History .....	1
1. Introduction .....	4
2. Methodology and organization .....	5
3. Product vision .....	5
3.1. Target users .....	6
3.2. User needs .....	6
3.3. Product Form .....	6
3.4. Value proposition .....	7
4. Prototype functional description .....	8
4.1. Landing Page .....	8
4.2. Login and Authentication .....	8
4.3. Back-Office and Project Management .....	8
4.4. Home Dashboard .....	9
4.5. Workspace – Invitation and Collaboration.....	9
4.6. Workspace – Data Import.....	10
4.7. Workspace – Building Analysis .....	11
4.8. Scenario Modelling .....	13
4.9. Industrial Solutions Catalogue.....	15
4.10. Data Export and Reporting .....	15
4.11. Settings and User Profile .....	16
4.12. Help and Documentation .....	17
5. Prototype technical description .....	18
6. Estimated effort table.....	19
7. Discussion .....	22
8. Conclusions .....	23
9. Recommendations.....	23
Annexes.....	24
Annex 1:.....	24
References .....	25
Brief project summary.....	27



## List of Tables

No table of figures entries found.

## List of Figures

## List of Abbreviations



## 1. Introduction

This deliverable presents a comprehensive overview of the design, development, and preliminary evaluation of a web-based tool aimed at supporting large-scale renovation of residential buildings managed by social housing organizations. The document serves as a key milestone in the project, consolidating methodological approaches, strategic vision, and practical implementation insights to guide further development and deployment.

The report is structured into several interrelated sections. It begins with an explanation of the **methodology and organizational approach** adopted for the design and development of the tool, including user-centered design principles, iterative workflows, and collaborative practices that ensure alignment with stakeholder needs. The **product vision** section articulates the strategic objectives, target users, and expected value of the tool, providing a foundation for design and decision-making.

Following this, the **prototype functional description** details the key features and user workflows, illustrating how the tool addresses the needs of social housing actors, from data import and building analysis to scenario modelling and solution selection. Complementing this, the **prototype technical description** outlines the underlying architecture, technology stack, and integration considerations, ensuring that the functional vision is supported by robust technical implementation. An **estimated effort** is also provided, offering an initial assessment of resources required to complete and deploy the platform.

The latter sections of the report engage in **discussion, conclusions, and recommendations**, reflecting on lessons learned, potential improvements, and next steps for the project. Together, these sections provide stakeholders with a holistic understanding of the tool's purpose, capabilities, and development roadmap, forming a solid foundation for further refinement, validation, and eventual adoption.



## 2. Methodology and organization

The development of a web product requires a structured methodology that ensures the final tool meets user needs while remaining technically feasible and cost-effective. Our approach follows a **user-centered and iterative design process**, integrating both functional and technical considerations.

The first step involves **stakeholder interviews, persona development, and user story mapping**. Through interviews with target users, such as social housing operators, technical consultants, and local authorities, we gather insights into their workflows, challenges, and goals. Personas are then created to represent key user types, capturing their objectives, behaviors, and pain points. These personas are used to generate user stories, which describe the tasks users need to accomplish within the platform. Mapping these stories allows the team to prioritize features and identify core user journeys early in the process. **In this project, personas were represented by partners from the Giga Regio Factory project consortium.** This first step also relies on the development of a spreadsheet proof-of-concept tool developed for Work Package 2 which supported the case studies involving *AURA HLM* social housing organizations. This spreadsheet helped to lay the foundations for the vision of the future product, it is presented in *Annex 1: Presentation of proof-of-concept spreadsheet tool*.

Next, the team develops **wireframes** to visually structure the platform. Wireframes focus on layout, navigation, and the placement of key elements, without concern for detailed visual design. This step ensures that the overall architecture of the product supports the identified user needs and provides a coherent flow across screens. Wireframes also serve as a reference point for discussions with stakeholders, enabling early feedback and rapid iteration.

Once wireframes are validated, they are translated into **interactive prototypes**. Prototyping allows users and stakeholders to experience the functionality of the platform, test workflows, and explore different scenarios in a simulated environment. This step is crucial for identifying usability issues and refining interactions before development begins. The prototypes can range from low-fidelity click-through mockups to high-fidelity, fully interactive simulations that closely resemble the final interface.

Alongside prototyping, the team defines **functional and technical requirements**. Functional requirements specify what the system must do, including data import, analysis, scenario modelling, solution selection, and reporting features. Technical requirements outline the underlying architecture, technology stack, integration points, security measures, and performance expectations. Clear requirements ensure alignment between design, development, and stakeholder expectations and provide a basis for estimating development effort.

Finally, an **estimated effort** is established, taking into account the complexity of the platform, the required technologies, the number of users, and the anticipated development timeline. Budgeting at this stage helps balance ambition with feasibility, ensuring that the project remains realistic and sustainable while delivering maximum value to users.

By following this methodology, the web product is designed to be **user-centered, technically robust, and cost-effective**, allowing stakeholders to validate assumptions, prioritize features, and progressively refine the solution toward successful deployment.

## 3. Product vision

The Product Vision Board was developed to capture the strategic objectives, target users, and key functionalities of the proposed web tool. Its content reflects input from **stakeholder workshops, interviews with social housing operators, and consultations with technical experts** in building renovation and industrialized construction methods. The board provides a structured overview of the product's purpose, intended users, and the value it aims to deliver, ensuring that the development of the prototype remains **aligned with user needs and policy objectives**



The tool aims to analyse, select, and group residential buildings to support **collective and rapid renovation initiatives**, using **off-site or hybrid off-site/traditional methods**. Its purpose is to accelerate large-scale, high-performance rehabilitation in order to contribute to the **EU Directive on the energy performance of buildings** objectives.

### 3.1. Target users

The following target users were identified:

- Technical consultants and engineering offices – acting as assistance for social housing organizations or design offices for renovation projects.
- Regional social housing associations or inter-bailiff networks – leading collective renovation initiatives
- Social housing organizations – including operations managers and property directors.
- Local authorities – municipalities or intermunicipal structures involved in housing and energy planning.

### 3.2. User needs

The prototype addresses a set of operational and strategic needs expressed by social housing actors and their partners:

- Assess buildings based on their suitability for off-site or hybrid renovation approaches.
- Group buildings into homogeneous clusters within a given territory.
- Connect renovation strategies with existing low-carbon and energy performance planning tools (e.g., Strategic patrimonial planning, EPC targets).
- Filter and select specific addresses or building subsets.
- Define the scope of works required for each building or cluster.
- Find the right balance between portfolio size and building similarity.
- Ensure data interoperability with existing national or regional databases.
- Build arguments to convince local authorities to support and co-finance renovation projects.
- Improve knowledge of the current building stock and its performance potential (energy and off-site feasibility).
- Import lists of addresses or analyze buildings via a administrative/tax identifier.
- Anticipate whether industrial capacities will be sufficient to meet renovation targets.

### 3.3. Product Form

The envisioned product takes the form of an **interactive, data-driven web platform** that combines cartographic and analytical functionalities. It includes several key interfaces and visual tools:

- A “Building Characterisation Dashboard”, displaying key information, performance ratings, and suitability indicators.
- A “Cluster Dashboard”, showing building groups with representative illustrations, key characteristics, and associated families of renovation solutions.
- A dynamic, exploratory interface, allowing users to navigate across analytical dimensions and visualise correlations.
- A visual scale diagram (timeline or axis) to explore the criteria that drive building association.
- Multi-scale navigation, from individual buildings to the territorial level.
- Interactive mapping of building clusters and renovation lots.
- A dual-level visualisation: both synthetic (strategic) and detailed (operational) views, depending on user needs.

### 3.4. Value proposition

The product delivers value by combining **data intelligence, automation, and shared methodology** to accelerate the collective renovation of social housing.

- Significantly reduces analysis time compared to manual, address-by-address processing.
- Identifies families of renovation solutions adapted to each cluster of buildings.
- Establishes a shared ranking and assessment methodology, with harmonized indicators across social housing operators and regions.
- Strengthens strategic asset management from a low-carbon perspective.
- Enables grouping of buildings that can be renovated using similar industrialized methods.
- Automates the clustering process, allowing experts to focus on validation rather than data cleaning.
- Facilitates comparison of investment strategies and estimation of savings generated by mutualization.
- Avoids the inclusion of unsuitable or unfeasible buildings in collective programs.
- Provides robust arguments for discussions with local authorities, funders, and construction companies.
- Ensures methodological reliability in selecting renovation targets and approaches.
- Combines performance requirements with practical feasibility on both building envelopes and systems.
- Encourages collaboration and economies of scale among housing providers.
- Promotes shared vocabulary and analytical framework, common across organizations yet adaptable to local contexts.
- Enables digitization of building stock without dependency on a single tool or database.
- Ultimately, it allows social housing actors to better understand their housing stock in order to renovate it more effectively.



## 4. Prototype functional description

The following section describes the main screens and functionalities of the prototype developed within the Giga Regio Factory project. Each screen described below corresponds to a specific stage in the user workflow, from data import to analysis, scenario modelling and export

### 4.1. Landing Page

#### **Purpose:**

The landing page serves as the introduction to the tool. It provides a brief overview of the project's objectives and the role of the application in facilitating large-scale building renovation. Users are presented with contextual information about the European LIFE Giga Regio Factory programme and the consortium partners. From this page, users can either access their existing workspace by logging in or create a new account. The page also provides a simplified visual overview of the tool's analytical process, which follows a logical sequence: *data import* → *analysis* → *scenario definition* → *solution selection* → *results export*.

#### **Key functionalities:**

- Presentation of the project and European LIFE programme logos.
- Login and registration options for users (social housing organization, consultants, administrators).
- A brief explanation of the tool's analytical workflow: import → analysis → scenarios → solutions → export.

### 4.2. Login and Authentication

#### **Purpose:**

The login interface enables secure access to the platform. It includes standard authentication fields such as email and password, as well as a password recovery function. For organisations with existing digital infrastructures, single sign-on (SSO) or institutional access may also be available. Once authenticated, users are redirected to their personal dashboard, where they can access or create projects

#### **Key functionalities:**

- Login form with email and password.
- Password reset link.
- Optional connection via a partner organisation or single sign-on (SSO).
- Redirect to the main dashboard upon authentication.

### 4.3. Back-Office and Project Management

#### **Purpose:**

The back-office is accessible to administrators and advanced users. It provides an overview of all projects, users, and datasets stored within the platform. Through this interface, administrators can manage user permissions, assign roles (e.g. viewer, editor, administrator), and oversee the creation or deletion of projects. This section ensures proper data governance and supports collaborative project management at an organizational level.



### Key functionalities:

- User and organization management.
- Project creation and deletion.
- Access rights management (e.g., read-only, editor).
- Overview of datasets imported by each user.

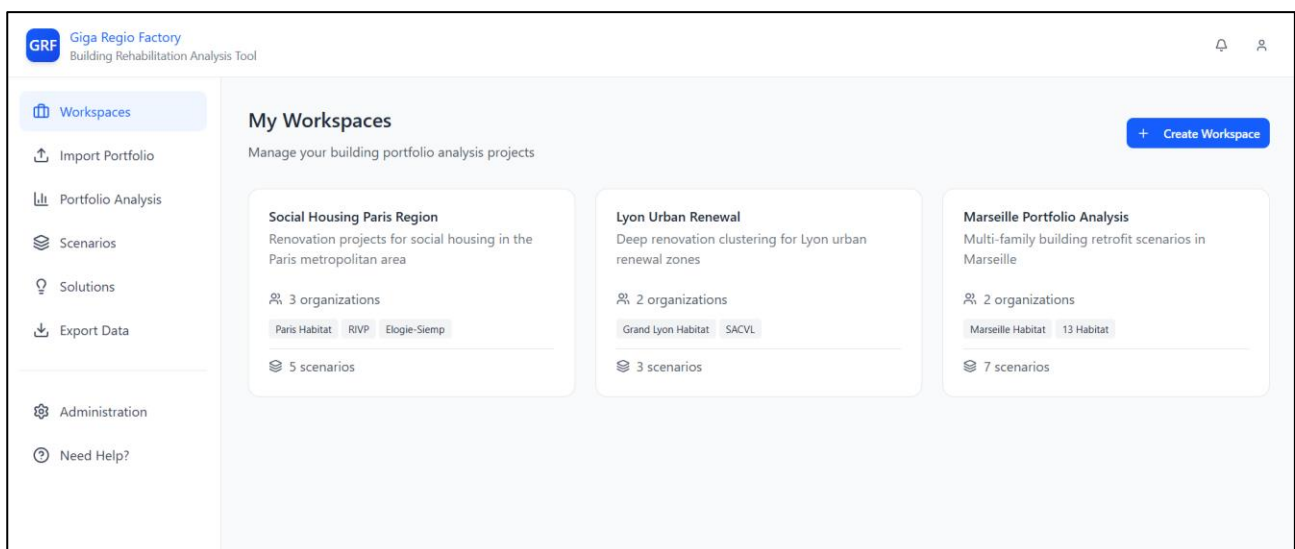
## 4.4. Home Dashboard

### Purpose:

The dashboard constitutes the main entry point after login. It displays a list of the user's active projects or "workspaces", each representing a portfolio of buildings under study. The interface also indicates how much renovation scenarios were created in each workspace, and provides quick access to core actions like opening, duplicating, sharing, or deleting a project.

### Key functionalities:

- List of projects or portfolios and essential information (users, scenarios, description).
- Project status indicators (e.g., draft, in analysis, validated).
- Quick actions: open, duplicate, delete, share.
- Access to tutorials or user guides.



## 4.5. Workspace – Invitation and Collaboration

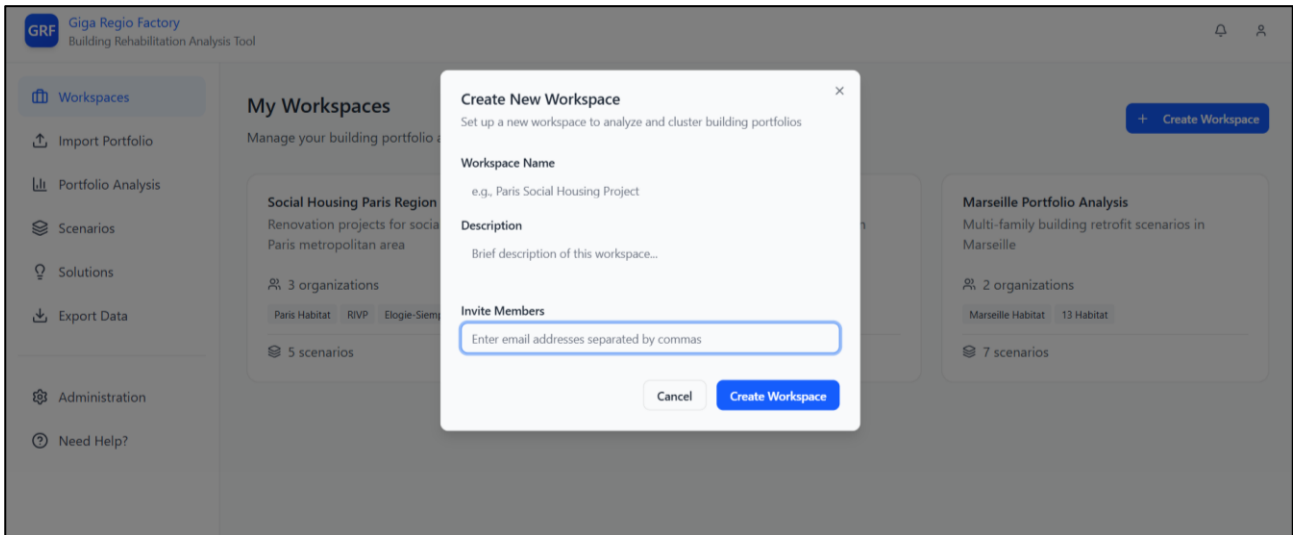
### Purpose:

Each project opens within a dedicated workspace. The workspace is designed to facilitate collaboration among several users, such as technical staff, consultants, and decision-makers within a housing organization. An invitation system allows users to add collaborators by email and assign specific roles. The interface tracks shared progress and updates in real time, ensuring that data and analyses remain synchronized among team members.



**Key functionalities:**

- Invitation system by email.
- Role assignment (viewer, analyst, administrator).



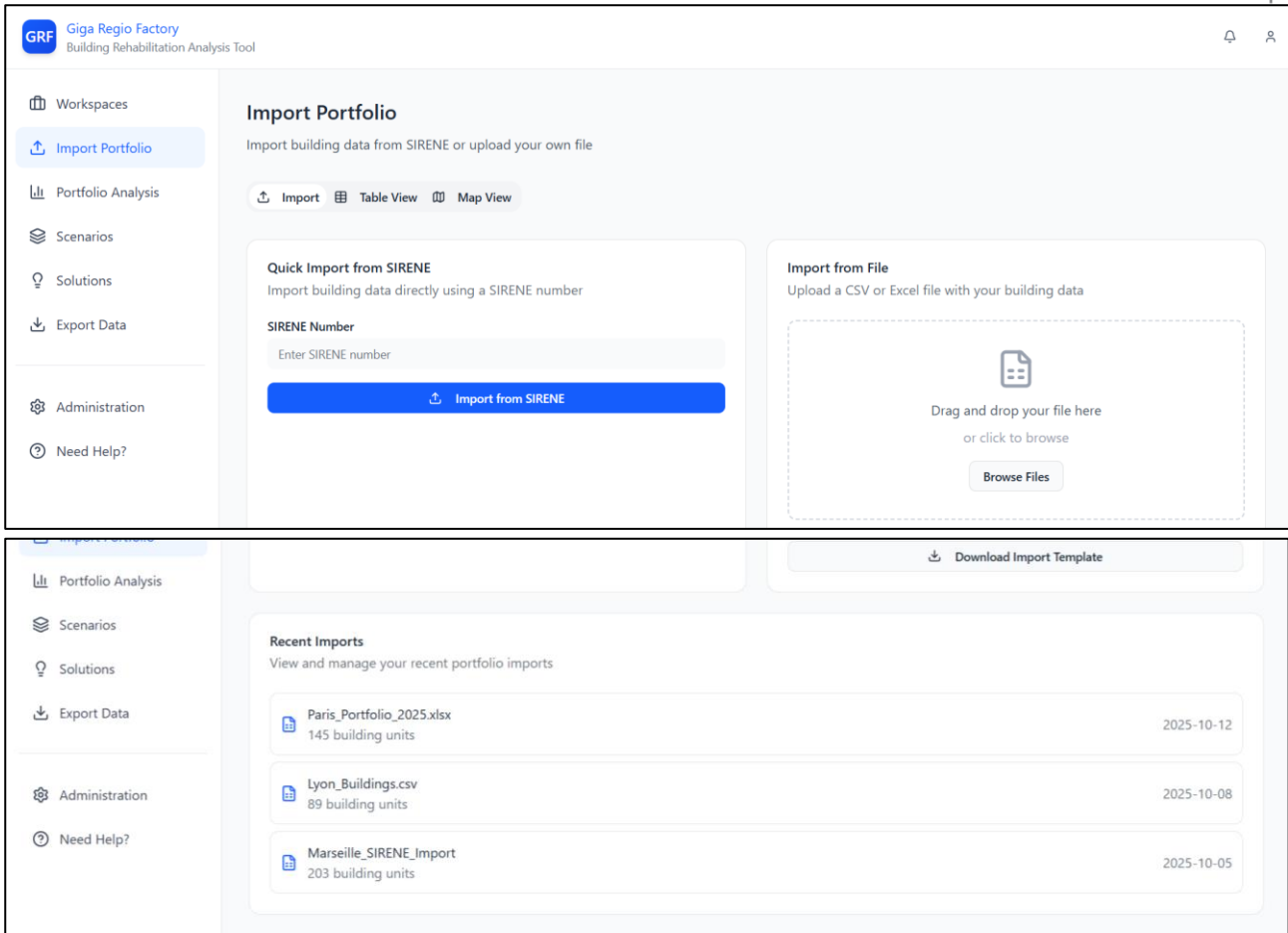
**4.6. Workspace – Data Import**

**Purpose:**

The data import screen enables users to upload datasets describing their building stock. The tool accepts common formats such as CSV or Excel files containing information on building addresses, areas, construction years, energy performance, and occupancy. During the upload process, the system performs automated data validation and geocoding to ensure consistency and completeness. Users receive feedback on missing or incorrect fields and can link their data with public sources such as SIRENE or national building databases. This step forms the foundation for subsequent analyses.

**Key functionalities:**

- Upload of CSV or Excel files containing building metadata (address, area, year, energy performance, etc.).
- Automated geocoding and data validation.
- Feedback messages highlighting missing or incorrect fields.
- Option to merge with public datasets (e.g., SIRENE in France).
- Interactive map displaying building locations and characteristics.



## 4.7. Workspace – Building Analysis

### Purpose:

Once the data is uploaded, the analysis interface provides a comprehensive view of the building stock. The screen combines various visualizations in an analytical dashboard. Graphical representations—such as bar charts, heatmaps, and histograms—support intuitive exploration and comparison between subgroups or geographical areas

Users can customize parameters for indicators computation in order to adjust the weight of different criteria in the results.

An interactive results table displays all buildings, enabling filtering and selection by typology, construction period, energy class, or ownership. Aggregated indicators summarize the overall characteristics of the portfolio, such as total floor area, average energy performance, and estimated renovation potential.

### Key functionalities:

- Filtering by typology, construction period, energy class, or ownership.
- Parameters customization form for indicators computation
- Aggregated indicators (e.g., total floor area, average energy performance, renovation potential).
- Comparison between subsets (e.g., by city, by typology).
- Data visualizations (charts, heatmaps, histograms).

**GRF** Giga Regio Factory  
Building Rehabilitation Analysis Tool

**Portfolio Analysis**  
Analyze building morphology, performance, and industrialization potential

Overview Parameters Results Table

Building Units: 122

Housing Units: 1,847

Housing Providers: 8

Energy Performance (DPE) Distribution

DPE Category	Percentage
D	28%
C	12%
B	5%
A	2%
E	35%

Construction Year Distribution

Construction Year Range	Count
Before 1950	0
1950-1970	45
1970-1990	30
1990-2000	0
After 2000	0

**GRF** Giga Regio Factory  
Building Rehabilitation Analysis Tool

**Portfolio Analysis**  
Analyze building morphology, performance, and industrialization potential

Overview Parameters Results Table

Building Morphology Types

Morphology Type	Percentage
Individual House	35%
Large Collective	15%
Medium Collective	20%
Small Collective	30%

Analysis Summary

Total Surface Area	248,500 m <sup>2</sup>
Average Building Age	52 years
Avg. Off-site Potential	6.8/10
Last Calculation	Today, 10:34 AM

Recalculate

**GRF** Giga Regio Factory  
Building Rehabilitation Analysis Tool

**Portfolio Analysis**  
Analyze building morphology, performance, and industrialization potential

Overview Parameters Results Table

Calculation Parameters

Configure the parameters used to calculate morphology, performance, and industrialization indices

Morphology Parameters

Minimum Surface (m<sup>2</sup>): 50

Maximum Surface (m<sup>2</sup>): 5000

Building Compactness Weight: 50%

Consider Roof Type:

Address	Surface (m <sup>2</sup> )	Morphotype	DPE	Off-site Score
15 Rue de la République	2 400	Medium Collective	E	7.8/10
42 Avenue des Champs	3 200	Large Collective	D	6.5/10
8 Boulevard Voltaire	1 800	Small Collective	F	8.2/10
23 Rue de Belleville	2 100	Medium Collective	E	7.1/10
67 Avenue de la Liberté	2 800	Large Collective	D	6.8/10

## 4.8. Workspace – Scenario Modelling

### Purpose:

This screen allows users to define and compare renovation scenarios. Each scenario can be configured by selecting clustering criteria such as building morphology, energy performance, or off-site potential. The tool gives an overview of the resulting clusters of buildings with synthetic information about each cluster. Results are displayed both numerically and graphically, enabling a direct comparison between alternative strategies and helping decision-makers prioritize interventions.

### Key functionalities:

- Creation of multiple scenarios per project.
- Selection of clustering criteria (building morphology, energy performance, off-site potential, etc.).
- Detailed view of each cluster (aggregated buildings, attributes distributions, etc.)
- Visual comparison between scenarios (graphs, tables, maps).

Scenario Name	Creator	Date Created	Last Modified	Clusters
High-Performance Retrofit - Phase 1	Marie Dubois	Sep 15, 2025	Oct 10, 2025	5
Off-site Pilot Buildings	Jean Martin	Sep 20, 2025	Oct 12, 2025	3
Traditional Renovation Approach	Sophie Laurent	Oct 1, 2025	Oct 14, 2025	4

**High-Performance Retrofit - Phase 1**

Portfolio Selection Clustering Criteria Results

**Select Buildings for Scenario**

Filter and select the buildings you want to include in this clustering scenario

<input type="checkbox"/>	Address	Surface (m <sup>2</sup> )	DPE	Off-site Score
<input checked="" type="checkbox"/>	Building 1	2 100	E	7,2/10
<input checked="" type="checkbox"/>	Building 2	2 200	E	7,4/10
<input checked="" type="checkbox"/>	Building 3	2 300	E	7,6/10
<input checked="" type="checkbox"/>	Building 4	2 400	E	7,8/10
<input checked="" type="checkbox"/>	Building 5	2 500	E	8,0/10

**High-Performance Retrofit - Phase 1**

Portfolio Selection Clustering Criteria Results

**Clustering Criteria Selection**

Choose the dimensions to consider when grouping buildings into clusters

Select Clustering Dimensions

- Building Morphology
- Surface Area
- Building Height
- Energy Performance (DPE)
- Construction Year
- Off-site Potential Score
- Geographic Proximity

Target Number of Clusters: 5

**Run Clustering Algorithm**

**High-Performance Retrofit - Phase 1**

Portfolio Selection Clustering Criteria Results

**Clustering Results**

5 clusters identified based on selected criteria

Cluster	Housing Units	Surface (m <sup>2</sup> )
Cluster 1 - High Standardization	245	18 500
Cluster 2 - Medium Rise Buildings	312	24 000
Cluster 3 - Low Rise Collective	156	12 800
Cluster 4 - Large Buildings	428	35 200

Thumbnail: Morphology Distribution 70% Medium Collective, Average Surface: 1233 m<sup>2</sup>

## 4.9. Workspace – Industrial Solutions Catalogue

### Purpose:

The industrial solutions module connects the analytical results for buildings and clusters with a library of prefabricated or standardized renovation options proposed by industrial partners identified in the Giga Regio Factory project. Users can browse or filter family of solutions according to building typology, construction system, or renovation component (e.g., facade, roof, heating system). Each family of solutions is presented with a compatibility score, indicative costs, and example references. Compatible solutions can be linked to specific scenarios, enabling users to visualize their application potential. Selected solutions can be bookmarked or marked as “favorites” for further analysis.

### Key functionalities:

- Search and filter by building clusters of buildings or components (facade, roof, heating system, etc.).
- Description of each solution (technical data, cost, reference projects).
- Link to compatible scenarios.
- Option to mark solutions as “favorite” or “selected for simulation.”

The screenshot displays the 'Giga Regio Factory Building Rehabilitation Analysis Tool' interface. The left sidebar contains navigation options: Workspaces, Import Portfolio, Portfolio Analysis, Scenarios, Solutions (highlighted), Export Data, Administration, and Need Help?. The main content area is titled 'Solution Families' and includes a sub-section for 'Cluster 1 - High Standardization' (15 buildings • 3 compatible solution families). Three solution cards are shown:

Solution Family	Location	Compatibility	Estimated Cost	Timeline
Prefabricated Facade Panels	Off-site	95%	Medium	6 months
Modular Insulation System	Off-site	90%	Medium-High	5 months
Traditional External Insulation	On-site	85%	Low-Medium	8 months

Each card includes a 'View Details' button. A 'View Cluster Details' button is also present in the top right of the cluster section.

## 4.10. Workspace – Data Export and Reporting

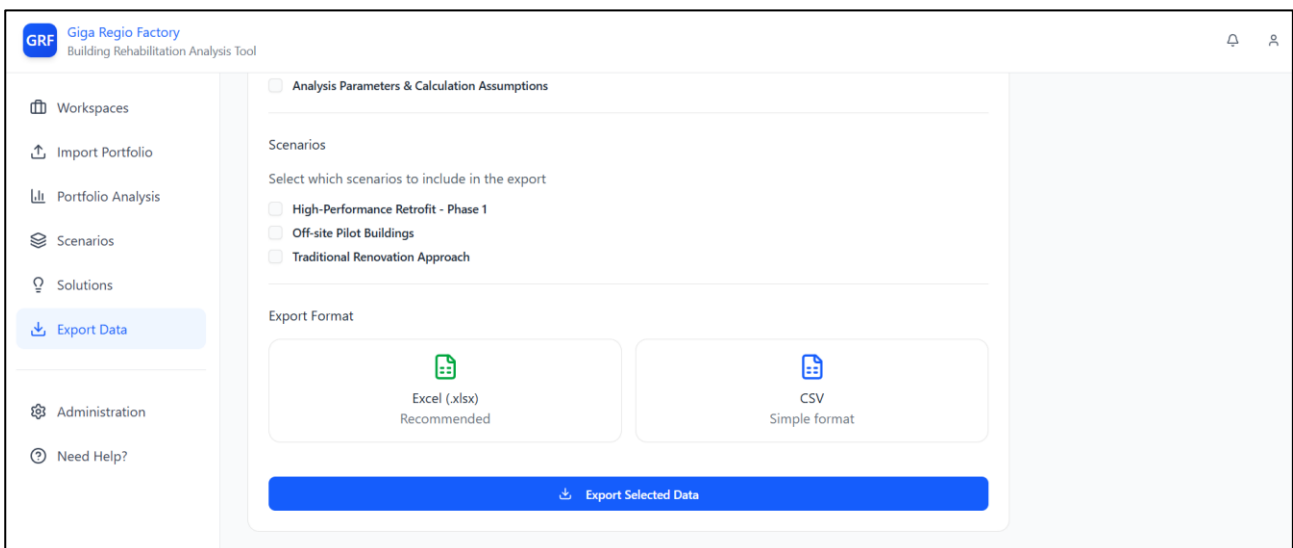
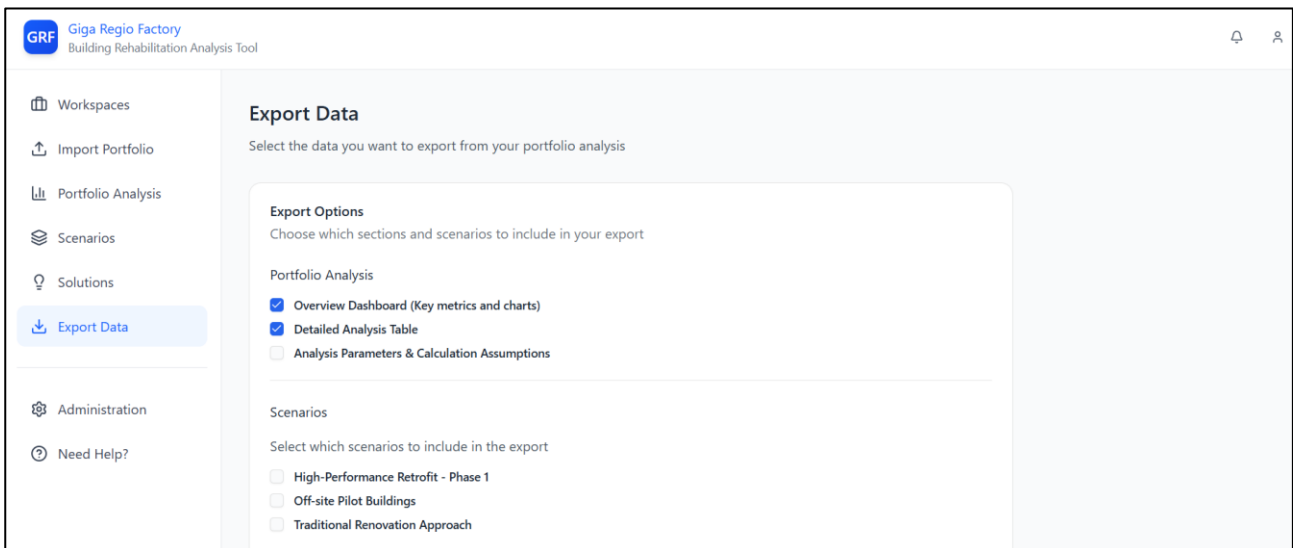
### Purpose:

After completing the analysis and scenario definition, users can export their results. The export module allows data extraction in multiple formats, including Excel or CSV. The exported report typically contains summary indicators, detailed indicators, parameters and assumptions, scenario results (etc.) and enables users to make further graphical representations of results in a spreadsheet tool for example. This functionality ensures that insights generated within the tool can easily be shared with external stakeholders or funding bodies.

### Key functionalities:

- Export to Excel or CSV.
- Portfolio analysis indicators.

- Export of selected scenario tables.



## 4.11. Settings and User Profile

### Purpose:

This section allows each user to manage their personal information and preferences. Options include editing profile details, changing passwords, selecting the interface language, and configuring privacy or data-sharing settings. This ensures both compliance with data protection requirements and adaptability to different organisational contexts.

### Key functionalities:

- User profile information (name, organisation, role).
- Language selection and interface preferences.
- Data sharing and privacy settings.



## 4.12. Help and Documentation

### **Purpose:**

Finally, the prototype integrates a help and documentation section. It provides an overview of the main functionalities, illustrated step-by-step tutorials, and access to frequently asked questions. A contact form enables users to reach technical support or submit feedback on the prototype. This component supports user autonomy and contributes to the overall accessibility of the tool.

### **Key functionalities:**

- Embedded help center or FAQ.
- Tutorials and sample datasets.
- Contact form for technical support.



## 5. Prototype technical description

In order to estimate a budget, we drafted technical architecture for this tool. This architecture proposal could be changed, as long as it allows to meet the functional requirements described in the previous section. Change of architecture and technical framework may then vary the estimated budget.

The tool is designed as a **web-based platform**, requiring a **frontend**, **backend**, and **database** to ensure a seamless, interactive, and scalable user experience.

The **frontend** constitutes the user-facing interface and is responsible for displaying data, dashboards, maps, and interactive components. To deliver a responsive and maintainable interface, the recommended technologies include the **Angular framework** for component-based development, **RxJS** for reactive data handling, and **Angular Material** for consistent UI design. Interactive maps, which are central to the platform's visualization capabilities, will be implemented using **Leaflet**, enabling dynamic geospatial display and interaction with building clusters and renovation lots.

The **backend** serves as the computational engine and data management layer. It is responsible for processing user requests, performing calculations, formatting data for presentation, and enforcing business logic. Recommended technologies include **NestJS** for structured, modular backend development, **TypeORM** for object-relational mapping and database interaction, and **PassportJS** to implement secure user authentication and role-based access control.

The **database** manages user permissions and stores all operational data, including building information, scenario configurations, and solution selections. A **PostgreSQL relational database** is recommended due to its robustness, scalability, and support for complex queries and spatial data. This architecture ensures data integrity, security, and the ability to efficiently support multiple concurrent users and projects.

Overall, this technical stack is selected to provide a **scalable, secure, and maintainable platform** that can evolve over time, integrate additional data sources, and support advanced analytical and visualization features essential for large-scale building renovation planning.



## 6. Estimated effort table

The following table presents an **estimation of the development effort** required to deliver the web platform, expressed in **person-days** rather than monetary values. It breaks down the work by topic, task, and detailed description, and indicates the expected allocation of effort across key roles, including **data engineers**, **web developers**, and the **product owner**. This structured overview provides stakeholders with a clear understanding of resource requirements and supports planning and prioritisation throughout the project lifecycle. This table takes into account the development efforts already invested during the LIFE Giga Regio Factory project. The **total estimated amount is 144 person-days**.

TOPIC	TASK	DETAILS	Data engineer	Web dev	Product Owner
<b>User stories refinement</b>	Workshop	1 or 2 workshops to re-challenge the initial requirement	0,5	0,5	2
<b>Prototype</b>	Design	Transform updated wireframes into final mockups	0	1	5
<b>API backend</b>	Initialization of backend web project	- Create GIT project BACK/FRONT/DB - Set up a staging & production instance via Gitlab CI/CD - Link with the main project	25	10	6
	Import portfolio	- 1 API call to process a SIRENE number and return a list of buildings - 1 API call to process a list of buildings from a CSV with adresses en geocode			
	Portfolio analysis and indicators	1 API call to compute indicators to analyze buildings portfolio with customized user parameters			
	Scenarios	1 API call to cluster buildings and send scenarios results			
	Solutions	1 API call and implementation of solutions database			
<b>Landing Page</b>	Landing Page	1 three-page WordPress site	0	1	5

<b>Initialization of frontend web project</b>	Hosting	- Create GIT project Back/Front/database/Minio - Set up staging & production instance via Gitlab CI/CD - Domain name registration	0	7	2,8
	Components	- Create database entities - Create UI components: Header, sidebar, buttons, Inputs, indicators, maps, charts			
<b>Login</b>	Login	- Login page - "Forgot password" page	0	2	0,8
<b>Back-Office</b>	Back-Office / admin page	- Create/update/delete an organization - Create/update/delete a user	0	3	1,2
<b>Home</b>	Homepage	- View my workspaces (Back & Front) - 1 creation modal	0	4	1,6
<b>Workspace - Invite</b>	Invite users to workspace	Ability to invite other users to view the project, or to create an organization and its first user to invite	0	4	1,6
<b>Workspace - Import portfolio</b>	Import - SIRENE	- Import via SIRENE - An API call to backend API returns the results	0	15	6
	Import - Custom file	- Import via custom user file (.csv) - An API call to backend API returns the results			
	Import - Table view	1 table of retrieved buildings with dynamic column management			
	Import - Map view	A map of buildings Buildings are polygons. Zooming out, they become clusterPoints			
<b>Workspace - Portfolio analysis</b>	Compute indicators	Interface with backend API to run calculations and save results in the database	0	12	4,8
	Parameters	Tabs with forms			
	Overview	Some KPIs and charts			



	Results Table	4 tabs with simple tables without dynamic column management to display summary, morphology, performance and off-site potentials			
<b>Workspace - Scenarios</b>	Scenarios list	- Display scenarios - Scenario creation modal	0	9	3,6
	Buildings selection	Table of selectable buildings with dynamic column management			
	Clustering criteria selection	Simple form			
	Results table	Display clusters (and call the backend API to fetch clusters)			
<b>Workspace - Solutions</b>	Solutions display	- Select Scenario and Display solutions returned by backend API - Display clusters and associated solutions	0	4	1,6
<b>Results export</b>	Export data	- 1 simple page - 1 Export Park Analysis in CSV - 1 Export Scenario Analysis (1 tab for park selection, 1 tab for criteria selection, 1 tab for cluster summary, 1 tab per cluster (buildings with info+))	0	3	1,2
<b>Total</b>			<b>26</b>	<b>75</b>	<b>43</b>



## 7. Discussion

The development of the prototype has demonstrated the potential of a web-based decision-support tool to accelerate the large-scale renovation of social housing through industrialized solutions. However, several points deserve discussion regarding the **scope, technological choices, business model, and future evolution** of the product.

First, the tool can be **implemented in a modular way**, allowing the development team to focus on specific functional blocks depending on available **budget, user priorities, or expected value creation**. For instance, some users may find greater value in the data visualization and filtering features for portfolio analysis, while others might prioritize the comparison of renovation scenarios or the integration of external datasets. This modularity provides flexibility in the roadmap and opens opportunities for progressive implementation and iterative improvement.

Second, while the prototype suggests a technical stack based on **Angular** and **NestJS**, other technologies could also be considered depending on the development context and available expertise. Frameworks such as **React** or **Vue.js** could be suitable alternatives for the frontend, while **Django, Flask** (Python), or **FastAPI** might serve as efficient backends, particularly if the data science components grow in importance. Similarly, a **cloud-native architecture** (e.g., AWS, Azure, or GCP) could enhance scalability and facilitate integration with external data services and APIs. Alternatively, simpler proprietary solutions as **PowerBI and Excel** (Microsoft) could be explored, with possible technical limitations but probably lowering initial development costs.

Third, the **business model** of the tool has not yet been defined, which raises several strategic questions. Should the platform be made freely accessible as an open-source tool to encourage broad adoption and data sharing among public stakeholders? Or should it be developed as a **commercial service**, allowing for continuous improvement, hosting, and support financed through subscriptions or project-based licensing? Hybrid approaches could also be considered, such as an open-core model or a freemium version offering basic features for free and advanced analytics as premium options. Clarifying the model will be key to ensuring long-term sustainability and alignment with the objectives of the LIFE project and its partners.

Finally, one promising avenue for future development would be to **integrate automated estimation modules** for investment costs, energy savings, and financial performance (e.g., payback time, net present value). Coupled with technical and environmental indicators, such functionalities would allow the tool to evolve from a visualization and planning platform into a **comprehensive decision-making assistant**, supporting both strategic and operational stages of renovation programs. This could ultimately lead to the development of a **business plan or investment simulator**, enhancing the value proposition for both social housing operators and industrial partners.



## 8. Conclusions

This deliverable has presented the design, functional and technical specifications, and development strategy of a prototype web tool aimed at facilitating large-scale renovation of social housing through industrialized approaches. The report detailed the **methodology** adopted, from user interviews and prototyping to technical specification and budget estimation, providing a comprehensive overview of both the conceptual and practical dimensions of the project.

Through the **product vision** and **functional description**, the prototype demonstrates the potential of digital tools to streamline the analysis of housing portfolios, identify renovation opportunities, and support decision-making across stakeholders. The **technical specifications** outline a robust yet flexible architecture capable of accommodating evolving needs and data structures, while the **budget estimation** offers a clear framework for planning and prioritization.

The **discussion** highlighted the strengths of a modular and scalable design, the openness to alternative technologies, and the importance of defining a sustainable business model to ensure the tool's longevity and impact. It also pointed toward future extensions, including cost and performance estimation features, that could significantly enhance the platform's value for housing operators and policymakers alike.

In conclusion, this work lays the foundation for a **scalable, data-driven platform** that bridges strategic planning and operational execution in the energy renovation of social housing. Beyond the prototype, it provides a clear roadmap for further development, collaboration, and experimentation, in line with the LIFE project's objectives to accelerate the ecological and energy transition in the housing sector.

## 9. Recommendations

Building on the insights gained throughout this work, several key recommendations can guide the next steps:

1. **Prioritize development scope**  
Focus initial efforts on the most valuable and feasible modules of the prototype to ensure early results and user engagement.
2. **Adopt a modular architecture**  
Design the tool so that new functionalities, data sources, and analytical models can be integrated progressively.
3. **Explore alternative technologies**  
Evaluate modern frameworks (e.g., React, Vue.js, or Django) and cloud-based infrastructures to optimize performance and scalability.
4. **Define a sustainable business model**  
Clarify the tool's ownership, licensing, and funding strategy to ensure long-term viability beyond the project.
5. **Expand functional capabilities**  
Integrate estimation modules for investment costs, energy savings, and carbon impacts to strengthen decision support.
6. **Engage end-users early**  
Maintain close collaboration with social housing stakeholders to validate assumptions and refine usability throughout development.

These recommendations aim to turn the prototype into a robust, operational solution that maximizes its impact on accelerating large-scale, low-carbon renovation strategies.



## Annexes

### Annex 1: Presentation of proof-of-concept spreadsheet tool



## References



## LIFE Giga Regio Factory

LIFE GIGA REGIO FACTORY : GOING NEXT STAGE IN MARKET UPTAKE AND FACTORY DEVELOPMENT FOR MORE AFFORDABLE NET ZERO ENERGY RENOVATION INDUSTRIALISED SOLUTIONS

### PROJECT COORDINATOR

GreenFlex (France)

### CONSORTIUM

Edera (Italy)

Green Invest Berlin (Germany)

Buildwise (Belgium)

Ressorts (France)

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Pouget Consultants (France)

Énergies Demain (France)

Groupe Hors-Site (France)

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Housing Europe (Belgium)

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## Brief project summary

The Life Giga Regio Factory project recognises the need for a change of scale in order to target 10% of the market by 2030, and 1 million homes renovated in Europe to a guaranteed zero-energy level in an industrialised way.

This project is a complementary consortium from Italy, Belgium, Germany, and France that aims to address the issue through :

- The involvement of housing organisations and organisations acting as a market development team (with expertise in housing, energy, buildings typologies, industrialized approach, coaching and solutions, procurement process, comfort, desires, and needs of the end user)
- The bridging and building on existing initiatives, including the ones of the EU transnational open-source movement EnergieSprong that aims at supporting price decrease and rate acceleration of deep energy retrofit solutions, using plug and play prefab elements with higher quality. Such efforts have been started in social housing in Netherlands, France, Germany, and Italy. This concept could be activated in Belgium through this project as well.

Giga Regio Factory has 3 main axes:

1. Developing an open-source tool for the qualification of housings in order to better qualify them and developing smarter aggregation strategy to launch large-scale collective industrial retrofits at zero-energy level. This will involve the creation of a configurator combining the selection of suitable housings and available industrialised solutions, in order to generate buy-in-schemes with several thousand homes per region
2. A total solution integrator accelerator through the coaching of companies that integrate and assemble industrial solutions to enable them to develop a 100% of industrialised offers (design, methods, implementation, guarantee, and operation & maintenance)
3. An industrialisation giga factory kit to enable solution providers to scale-up so that they can meet massive demand, by supporting them in the development of their industrial tools to generate the investments that will enable them to renovate up to a 10,000 homes per region.

