



RINNO PROJECT

Report

**Transforming energy efficiency in
European building stock through
technology-enabled deep energy
renovation**

**Work Package 6
Deliverable D6.3: Pilot Planning and Setup**

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Executive Summary

This report is an update of the D6.2, describing the detailed **planning and set up** of the demonstration activities at the 4 demo sites, located in France, Greece, Poland, and Denmark.

The update focusses on progress since D6.2. The French demo site have finished renovation works. The Greek demo site expects to finish in January 2025, the demo site in Denmark has started in January 2025 and finish between April and June, and the Polish demo site is still waiting for the result of a tender. All demo sites are expected to finish within the prolonged timeframe of the RINNO project.

An important part of the envisioned work has been related to the use of the advanced technologies, constructing and monitoring techniques, supported by the RINNO SUITE. Not all these elements have been ready for use at the start of the planning and implementation of the renovations, and some of the processes have been “business as usual”.

Budgeting development projects has also been a challenge. E.g. expensive transportation costs and costs for static calculations and fire precautions have not been considered, when the RINNO project was designed and decided. In that relation, nothing has been “business as usual”, and, therefore, a challenge for advisors and constructing companies, which has cost extra time for planning and tendering.

On top of this, the inflation and rising prices have been a big challenge, as all the demo sites are social housing with limited possibilities of integrating extra costs in the renovation budgets. Moreover, the raise of rent for social housing is under political regulation in most countries, so raising the rents is not a solution as all the demo sites are social housing. The four demo sites have had to deal with this and find creative solutions for extra financing. Politically, it is important that the tenants in social housing shall NOT pay for innovation in the building sector.

To be mentioned is also challenges with the tenants understanding of the project and willingness to cooperate and accept the different challenges during the renovation process.

Finally, RINNO has also had the challenge of the Covid19.

As it looks now, we are happy to report that we can fulfil the expectations of testing not only all the RINNO technologies, but we have also succeeded in involving the stakeholders at the four demo sites in the testing of the RINNO SUITE. This will be described in D6.5, the final report on “Stakeholders’s Training Activities”.

The **results of the renovations** will be described in D6.6 “Pilots’ Demonstration”, and the **monitoring and evaluation** will be described in D6.7, “Evaluation Report for RINNO Pilots”.

Table of Contents

1	INTRODUCTION.....	7
1.1	SCOPE AND OBJECTIVES OF D6.3.....	7
1.2	RELATION TO OTHER TASKS AND DELIVERABLES	7
1.3	STRUCTURE OF THE DELIVERABLE	8
2	THE FOUR DEMOSITES' PLANNING AND SETUP FINAL	9
2.1	THE FRENCH DEMOSITE.....	9
2.2	THE GREEK DEMOSITE.....	17
2.3	THE POLISH DEMOSITE	30
2.4	THE DANISH DEMOSITE.....	35
3	DEVIATION FROM THE GRANT AGREEMENT	44
3.1	UPDATED SCHEDULE	44
4	CONCLUSION AND RECOMMENDATIONS BASED ON THE PLANNING AND SETUP	46
	ABOUT RINNO.....	47

LIST of FIGURES

Figure 1 WP6 interaction	8
Figure 2 Sarrazin, Wazemmes, Lille, France	9
Figure 3 Photo before and after renovation	10
Figure 4 The RINNO works (thermal insulation and technologies implementation)	15
Figure 5 Tavros project	17
Figure 6 Before the renovation	19
Figure 7 Gable at the demo site with graffiti.....	20
Figure 8 Overview of the 26 sponsors until June 2024 in Passivistas, the Tavros project.....	22
Figure 9 Image of the installed water heaters at the roof.....	23
Figure 10 Insulation at the facades with RINNO technology (K-FLEX).	24
Figure 11 Installation of the Thermo-chromic glass (GREEN-STRUCT).	24
Figure 12 The roof at the Tavros project during implementation of the insulation.....	25
Figure 13 Installation of the windows in the common spaces of the building.....	25
Figure 14 Seminar with Odyssea for the proper implementation of insulation.....	26
Figure 15 Visit from College Year of Athens students in November 2024	26
Figure 16 On site course with NTUA students in December 2024.....	26
Figure 17 Presence in the social media supports micro financing	27
Figure 18 Photo from the event with the stakeholder in June 2024 with the residents of the Greek demo.....	28
Figure 19 Photo with the mayor of Athens at the stakeholder event in June 2024	29
Figure 20 Rajszew - latitude and longitude — 52.3979837, 20.8412502	30
Figure 21 Construction drawings.....	32
Figure 22 Olufsgade 5-7, Slagelse.....	35
Figure 23 Olufsgade 5-7 - the West façade	36
Figure 24 The gable to the South.....	36
Figure 25 Construction drawings.....	37
Figure 26 Ongoing renovation works at Olufsgade - January 2024.....	41
Figure 27 InVentilate, micro ventilation system	42
Figure 28 Kitchen and colors at Olufsgade 5-7	43

List of tables

Table 1 Energy performance before and after (ambition) RINNO renovation.....	13
Table 2 Allocation of RINNO technologies.....	14
Table 3 Quantification of the technologies.....	14
Table 4 Time plan and next steps	16
Table 5 Energy performance before and after (ambition) RINNO renovation.....	20
Table 6 Allocation of RINNO technologies.....	21
Table 7 Quantification of the technologies.....	21
Table 8 Time plan and next steps	29
Table 9 Energy consumption.....	32
Table 10 Allocated technologies.....	33
Table 11 Quantification of the technologies.....	33
Table 12 Time plan and next steps	34
Table 13 Energy performance before and after (ambition) RINNO renovation.....	37
Table 14 RINNO technologies.....	38
Table 15 Quantification of the technologies.....	38
Table 16 Time plan and next steps	43
Table 17 Schedule for WP6 in the Grant Agreement	44
Table 18 Revised time plan	44
Table 19 Overview of implemented technologies.....	45

Abbreviations List

DHW	Domestic Hot Water
DSS	Decision Support System
EC	European Commission
GA	General Assembly
GA	Grant Agreement
KPI	Key Performance Indicators
LCA	Life Cycle Assessment
LCC	Life Cycle Costs
O&M	Operation & Maintenance
PES	Primary Energy Savings
RPDA	RINNO Planning & Design Assistant

1 Introduction

1.1 Scope and objectives of D6.3

Scope and objectives of D6.3 Planning & Setup are the final integration of the RINNO development activities at the four building renovation sites in France, Greece, Poland and Denmark, the organisation and execution of the large-scale demonstrations.

The overall process for the renovation at the four demo sites has been as follows:

- 1) Developing the BIM-based simulation scenarios and deciding on the optimal solution for each pilot building
- 2) Developing the innovative technologies
- 3) Analysis of the renovation scenarios
- 4) Agreement with building owners on the renovation scenarios
- 5) Appointing advisors
- 6) Project planning incl. budget for implementing the renovation scenarios
- 7) Tender for selection of retrofitting contractor and subcontractors
- 8) Agreement between buildings owners, advisors, and entrepreneurs on the project
- 9) Scheduling of the renovation scenario
- 10) Obtaining required licenses
- 11) Bill of Quantities
- 12) Material/Product orders
- 13) Site preparation
- 14) Delivery of material/products
- 15) Training of workers
- 16) Retrofitting (deployment/installation)
- 17) Monitoring

The demo sites have been managing point 4-17, starting during 2022 – Greek demo in January 2022, French demo in June 2022 and Polish in December 2022. The Danish demo site was changed by an amendment during the process of the project due to problems with time schedule for implementation and started in February 2023.

In the following, the renovation process is described for each of the four demo sites and the disposition of the descriptions is as follows:

- i) Short repetition of the main characteristics of the demo sites
- ii) Choice of scenarios
- iii) Allocation of technologies
- iv) Planning and tender process
- v) Monitoring => D6.7
- vi) Communication with stakeholders / tenants
- vii) Time plan / finalization of the renovation

The D6.3 Pilot Planning & Setup is based on and a follow up of the descriptions in D6.2 Pilot Planning & Setup *and* the four Quartal Reports, delivered to the Project Officer (PO) during 2023 and 2024. Latest, the PO has asked for a status (January 2025). This has been based on the draft for D6.3 and the two reports have been synchronized.

1.2 Relation to other tasks and deliverables

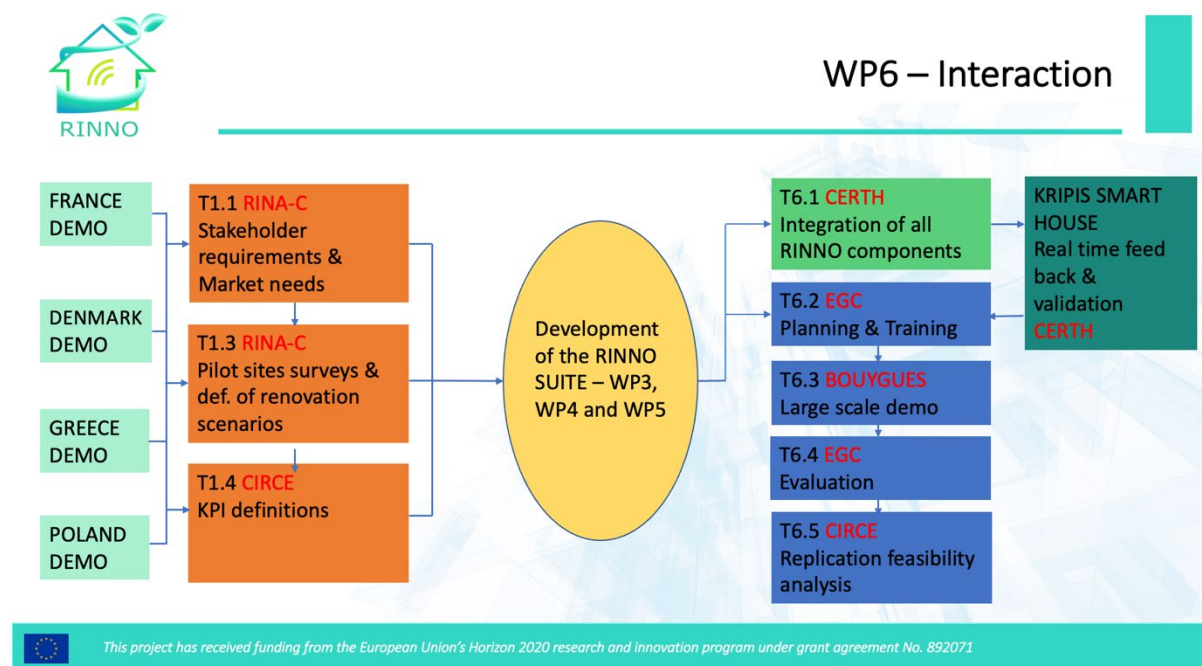


Figure 1 WP6 interaction

The four demo projects have provided information for the development of the RINNO Suite in WP1, WP3, WP4 and WP5 and are now implementing WP6, planning, training and evaluation. The planning of the renovations has been based on the scenarios developed in WP3.

1.3 Structure of the deliverable

Part 1 is the introduction above.

Part 2 provides an illustrated description of the progress at the four demo sites, the chosen renovation scenarios, and the goals for the renovation.

Part 3 describes deviations from the Grant Agreement and discusses the challenges, recognized at the time of the deliverable.

Part 4 is a summary of the experiences gained through the renovation processes in the four countries.

2 The four demosites' planning and setup final

2.1 The French demosite

FRENCH demo site location: Sarrazin, Lille, France (see map below)

Address: [35 Rue des Sarrazins](#)



Figure 2 Sarrazin, Wazemmes, Lille, France

Short characteristic of the project

The residence is located in Wazemmes, district of Lille. It is built in 1970's. The multi-family house has 6 floors and is composed of 29 flats and one individual housing.

The building had not undergone any comprehensive rehabilitation since its construction. Despite major maintenance interventions (waterproofing repair and replacement of joinery under renovation in the 1990s, complete renovation of electricity in housing in 2016, etc.), this building had a very unfavourable energy label, on which it was useful to intervene in thermal renovation.

The rehabilitation program of this residence will not be limited to an intervention on the improvement of energy performance with the achievement of the level BBC Effinergie Renovation and the desire to move towards a label A for collective dwellings. It will also aim to improve the comfort of use of all dwellings by:

- Replacement of all showers,
- Floor and wall embellishments of all shower rooms and pantry,
- The replacement of degraded sanitary facilities,
- The transformation of the ground floor housing into PMR housing,
- Making the elevator accessible,
- Improvement of outdoor spaces and common areas (landscaping, lighting, access control, etc.)

At the same time, 8 dwellings have been equipped with systems for collecting information on consumption, temperatures and other variables, which will enable the impact of energy improvements to be assessed.

The building was also chosen to serve as a full-scale support for 1 test of implementation of exterior insulation by projection by Bouygues International and its partner, this technology being studied and developed as a tool of facilitation of implementation.

Begun in March 2023, the reception of the works had been pronounced in the end of March 2024.



Figure 3 Photo before and after renovation

Photos of the rehabilitation works finalized:





Energy performance before and after (ambition) RINNO renovation

Goal	Baseline kWh/m2	Effective Reduction (%)	Reduction from Proposal (%)
Energy Consumption	321	60	67
Heating Consumption	205	72	68
DHW Consumption	117	71	71

Table 1 Energy performance before and after (ambition) RINNO renovation

Chosen scenario

Before the renovation, an analysis of the building was performed to find the optimal renovation scenario for the French demo site. This was described in D6.2.

“The scenario that will be implemented by the French demo leader, LMH, is Scenario 3. It is apparent that there is a deviation between the scenario selected by the DSS following the multi-criteria assessment (Scenario 1) and the one that is going to be implemented (Scenario 3). There are two reasons for this deviation. Firstly, the Scenario 1, although close, does not meet all the performance targets set out in the Grant Agreement regarding the renovation of the building, whilst scenario 3 meets these targets. The second reason is that Scenario 3 includes an additional RINNO technology (the Microvent ventilation unit) and it was decided by LMH to demonstrate as many RINNO solutions as possible in the demo building.

French Scenario 3 aims to improve both the building envelope and also to use of highly efficient energy systems. The envelope is enhanced in order to minimize thermal losses and so to reduce energy needs. Below, the retrofitting interventions of the building are listed:

A) Adding Insulation mineral insulation

Goal: Reduce the thermal losses, reduce the U-value, reduce the absorbance of solar irradiation.
External walls: Addition of 20 cm insulation with $k=0.035$ W/mK; the new U-value is 0.18 W/m²K.

B) Windows and doors replacement

Goal: Reduce the thermal losses, reduce the infiltration rate and manage properly the solar irradiation.
Use of advanced double windows. Window with total U-value= 1.4 W/m²K (75% glass and 25% frame) and g-value=0.7. The airtightness of the envelope (infiltration - N50 = 5 ACH) will be reduced from 0.4 air changes per hour to 0.25 air changes per hour (infiltration).

C) Piping and vanes insulation (KFLEX)

Goal: Reduction of the distribution of thermal losses.

Use of Bio-based pipes insulation and K-BOX units to insulate the pipe network and vanes with low thermal conductivity of 0.038 W/mK.

D) Decentralized Mechanical Ventilation with heat recovery (EKOLAB)

Goal: Provide the proper fresh air by reducing the load due to the use of heat recovery.

Addition of the proper mechanical ventilation systems in every apartment.

- 8 apartments will use the Microvent decentralized ventilation system with heat recovery,
- 21 apartments will use a new, central single flow hygro adjustable ventilation system.

E) Electrical air-to-water heat pump

Goal: Cover the heating and DHW needs with an efficient energy system.

Two highly efficient electric heat pumps (PAC 2xHRC70) with 60 kW capacity are used. These heat pumps produce space heating at a temperature level close to 40°C and DHW at a temperature level close to 60°C.

F) Centralized double coil heat storage tank

Goal: Store the hot water from the heat pump in a proper storage device.

Use of an insulated storage tank with two coil heat exchangers with a total volume of 1 m³ for covering the space heating and the DHW needs.

G) Installation of PV panels

Goal: Electricity production from solar irradiation in order to cover all the possible needs and be positive.

Installation of around 40 m² of highly efficient PV panels on the roof. These panels will be located with a slope of around 10° and 75% will be in the southwest direction, while the other 25% to the northeast direction. Every panel has an area of 1.92 m², maximum power of around 400 W and maximum efficiency of 20.8%².

H) Installation of motion detector for the lighting in the common spaces

Goal: Reduction of the electricity demand in the common spaces

A typical motion detector is selected which reduces the electricity demand by around 40%. This detector regards the common spaces with an area of around 157 m²."

Allocation of RINNO technologies

In France, originally, the PINK technology was to be implemented, but it was challenged due to local regulations, which – among other things - prohibits installation of individual solutions for hot water. So - the following technologies were allocated to the French demo site, based on the chosen scenario:

RINNO Technology	Chosen SC3
Bio-based pipes and sheets (K-FLEX)	1
K-BOX bio-based insulation (K-FLEX)	1
MicroVent system (EKOLAB)	1
Total of implemented RINNO technologies	3

Table 2 Allocation of RINNO technologies

Below the quantification of the technologies according to the distribution between the four demo sites:

RINNO Technology	Quantity
Bio-based pipes and sheets (K-FLEX)	Linear meters (m) - 300
K-BOX bio-based insulation (K-FLEX)	Number of units - 30
MicroVent system (EKOLAB)	Number of units - 16

Table 3 Quantification of the technologies

Planning and tender process

In the beginning of January 2024, the renovation work was completed.

There have been some difficulties during the process, e.g.:

- Delay of furniture heating pump and KFLEX materials (+1 month) and additional works (replacement of landing doors and every sanitary equipment of sanitary + 1 month too).
- The technical controller did not accompany us properly to allow us to keep the projected insulation after the test -> we have been forced to deposit it to comply with French regulations.
- One tenant didn't leave his apartment in time

In general, the construction site was not easy; the population living in this building being very precarious, relations were not always simple; 50% of tenants after renovation work are not the same as before (some left on their own, others did not want to give access to their housing, LMH worked out with them a rehousing, still others were very unpleasant even violent and threatening with the construction crews. Others, are malicious (unfounded speech and will do harm) or fear reprisals if they do not allow access to squatters, who have regained possession of the premises; the latter deteriorate and steal equipment located in common areas (while the site is not even delivered; the company has already had to replace several times the doors of technical seeds, and access to the building). Installation of a portal should limit these things; however we are not convinced that this provision really works if the tenants open to anyone, who wishes to enter.



Figure 4 The RINNO works (thermal insulation and technologies implementation)

Monitoring

Monitoring has been installed in October 2021, on the 8 apartments concerned by Inventilate equipment.

Concerning monitoring, LMH has encountered a lot of difficulties on the subject since the beginning of the project:

- > problems of sensor supply
- > problems of their proper functioning, which required the implementation of additional sensors or other solutions to collect data (operator of heating installations, electricity supplier, transport...)
- > communication issues between the collection platform of our French service provider and that of the consumer group in charge of data collection of the European project (ITI).

LMH has also encountered great difficulty with the data collection equipment, which partly was stolen several times. The turnaround time for new equipment was long, which could lead to some discontinuities in the information recorded.

LMH has also had difficulties with the tenants, who disconnected the measuring equipment, or even with thefts of data transmission facilities installed in common areas in the technical ducts. LMH has already had to buy 3 sets of equipment since the initial installation.

The tenants are also responsible for data collection problems, because they lose or disconnect the equipment, despite the information work and explaining to them the purpose of these facilities. Thus, we have recently agreed with the rental agency and our provider to no longer re-install equipment in the flats of some of our non-cooperative tenants. To date, only 5 dwellings will remain equipped of the initial 8.

In addition, LMH has encountered many problems with connection between the equipment on site and our data collection platform, but also between our platform and ITI. LMH is still working with the monitoring provider to find solutions to the difficulties of connections encountered. The data was recently transmitted in Exel format to allow ITI to work on the data collected.

LMH also asked ENEDIS (electricity distributor in France) to obtain the consumption data of the common parts of the building since 2021; Unfortunately, ENEDIS is currently having difficulties with their platform and the data are not yet received.

Anyway, the monitoring partner have developed a tool which help LMH to visualize the number of values collected all day. So now, LMH can easily see if there is a problem.

Communication with stakeholders

Actions of communication and sharing with the tenants were put in place from the start of the project. First, a survey was carried out before the work started; the aim was to identify the problems encountered by the occupants, even beyond the technical malfunctions already identified by the LMH management teams. We then met them in 3 public meetings; unfortunately, despite the individual invitations deposited in their mailboxes, only a few of them showed up. We then went to meet them on site to explain the content of the work and the impact of the work on their rent and expenses.

Since the start of the work, the relationship between the tenants and the company that carries out the work is managed by a dedicated person on the site. This person is responsible for arranging appointments, ensuring that the work goes smoothly and does not pose any difficulties to tenants, etc. He is present on site several times a week to ensure optimal communication with the occupants. It will also contribute after the completion of the work to explain the proper functioning of the new housing equipment as well as the maintenance and proper use to be made to really feel the impacts of the renovation.

As the work is now complete, we are preparing with the company that carried out the work a satisfaction questionnaire to be carried out with our clients-tenants. Tenant training will also be carried out by the company to explain to users the right actions to maintain and use the new equipment. A presentation booklet will also be produced to be provided to existing tenants and then to newcomers.

Maintenance teams are also trained by the companies that installed the equipment.

The communication with the tenants is now more difficult than during the works. In fact, tenants are not interested in the RINNO project; they only wanted to have a better situation in their apartment and now that the works are finished, they think that all is finished.

We will also distribute at this time the RINNO evaluation questionnaire prepared by European Green Cities (EGC) and each development site.

An inauguration with representatives of the Lille City Hall is planned for January 2025.

Time plan and next steps

Steps of the building renovation	Start	End
Delivery of materials/products	April 2023	October 2023
Building Retrofitting	March 2023	January 2024
Training (WP3 and 5)	June 2024	December 2024
Training (WP4)		June 2025
Qualitative Interviews/Evaluation		February 2025
Metering	January 2024	August 2025

Table 4 Time plan and next steps

WP4 trainings are postponed to June 2025.

Qualitative interviews will take place in May 2025.

2.2 The Greek demosite

GREEK demo site location: Athens, in Moschato-Tavros (see map)

Address: The Tavros project, Karaiskaki, Moschato-Tavros

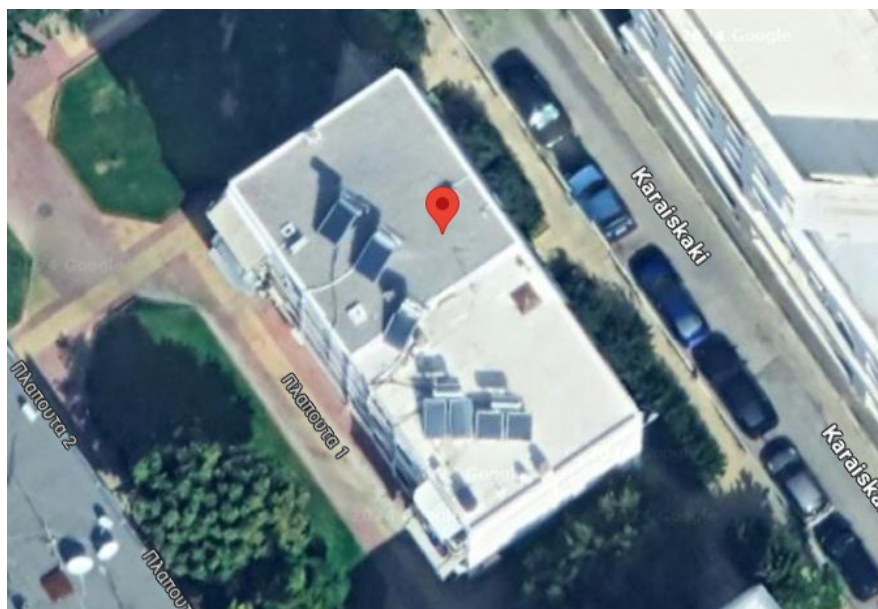
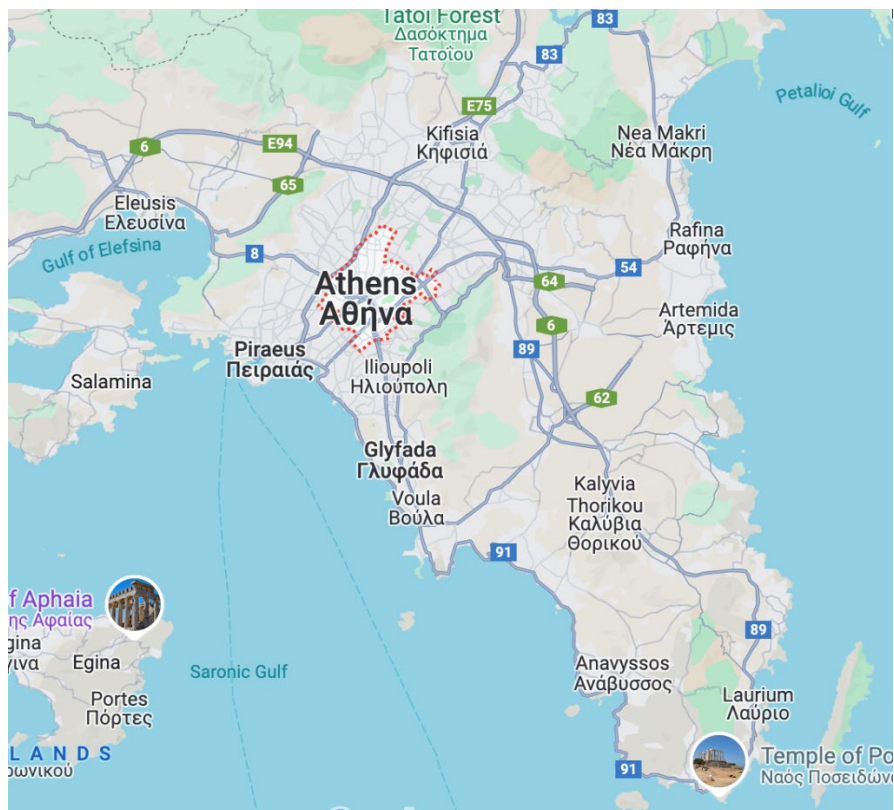


Figure 5 Tavros project

Short characteristic of the project

The Tavros project building is a standard social multi-family house, built in the 1970s to accommodate immigrants and locals in the suburb Moschato-Tavros, Athens, with an area of approximately 750 m².

The building is a block of 4 floors with 8 flats, 2 flats per floor, each of 75 m², with a concrete frame structure and hollow brick infill, built in 1970 in the context of a large social housing complex. It was built without any measures to reduce energy consumption, neither for heating nor for cooling. It has a shell with low thermal resistance and low inertia, thus inadequate to guarantee the necessary thermal phase shifting and attenuation during the summer season. The windows are provided with aluminum frames, without thermal break, and single glazing, while the external shutters are sliding blinds or rolling shutters, which do not allow the light to be adjusted according to the sunlight at different times of the day. Only one apartment instead of aluminum had wooden frames.





Figure 6 Before the renovation

The building is being refurbished with regard to its energy efficiency in accordance with the Passive House Standard.

The energy efficient study according to the Passive House Standard has been completed and its implementation on the actual building has started in the summer of 2023. It is important to mention that the renovation takes place while the owners continue to stay at their homes, thus construction scheduling is a challenge. After the renovation, as long as the construction requirements are followed, the building will be able to achieve EnerPHit Premium certification.

Regarding the energy efficient study, among the results we can point out the following significant observations:

- The heating demand of the building is projected to decrease by 90% compared to the state before the refurbishment. Heated only by means of electric energy. The heating demand before the refurbishment has been calculated with indoor conditions from 20 to 25 Celsius degrees.
- The energy generation of the solar panels is expected to exceed the overall energy needed for the operation of the building leading to supplying the grid with more clean energy compared to its usage.
- It is estimated that the equivalent CO₂ emissions will be reduced by almost 80%. The surplus of energy from the solar panels will lead to a negative balance of CO₂ emissions, meaning that its carbon footprint will be practically eliminated.

Regarding the exterior of the building, the construction tasks had been delayed. Interventions at the exterior (external insulation) had to await permission from the architectural council at first. The main reason of the delay was the graffiti on one of the building's gables and how it was going to be replaced after the renovation. Then the main reason for the delay was the unavailability of the contractor.



Figure 7 Gable at the demo site with graffiti

Energy performance before and after (ambition) RINNO renovation

Goal	Baseline kWh/m ²	Effective Reduction (%)	Reduction from Proposal (%)
Energy Consumption	250	85	82
Heating Consumption	100	96	91.5
DHW Consumption	30	80	67
Cooling Demand	70	94	78.5
Other Demand	50	61	60

Table 5 Energy performance before and after (ambition) RINNO renovation

Scenario chosen

The **Greek scenario 3** aims to improve the building envelope and use highly efficient energy systems. Moreover, it includes an important retrofitting of the existing equipment, and it aims to produce net electricity for the grid (positive building). The envelope is enhanced in order to minimize thermal losses and so to reduce energy needs. Below, the retrofitting techniques of the building are listed:

A) External Insulation (K-FLEX)

Goal: Reduce the thermal losses, reduce the U-value, reduce the absorbance of solar irradiation.

- **External walls:** Addition of 8 cm insulation (K-FLEX) with $k=0.027$ W/mK; the new U-value is 0.274 W/m²K.
- **Roof:** Addition of 20 cm insulation (EPS 200 White) with $k=0.033$ W/mK; the new U-value is 0.156 W/m²K.
- **Basement ceiling:** Addition of 8 cm insulation (K-FLEX) with $k=0.027$ W/mK; the new U-value is 0.284 W/m²K.
- **Cool paint** for reflecting solar irradiation
- **Elimination of the thermal bridges.**

B) Windows replacement (GREENSTRUCT)

Goal: Reduce the thermal losses, reduce the infiltration rate and manage properly the solar irradiation.

- Use of thermochromic windows in the southwest direction for the 2nd and 3rd floors.
- Use of triple-glazed low-e aluminium/pvc/wooden windows in the remaining cases.

The airtightness of the envelope will be reduced from 6 air changes per hour to 1 air changes per hour.

C) Decentralized Mechanical Ventilation with heat recovery

Goal: Provide the proper fresh air by reducing the load due to the use of heat recovery.

Addition of the proper mechanical ventilation systems in every apartment. The flow rate is about to corresponds to 0.4 air changes per hour. The systems include a heat recovery heat exchanger with an effectiveness of 80 % (as per the recommendations from HPHI).

D) Installation of decentralized air to air Heat Pumps

Goal: Cover the heating and cooling loads with relatively low energy demand.

Use of decentralized highly efficient reversible air-to-air heat pumps in all the apartments in order to cover the heating loads during winter and the cooling loads during summer. These heat pumps present a SEER=6.0 and a SCOP=3.31, values provided by the Hellenic Institute of Passive Institute.

E) Solar thermal collectors coupled to storage tanks

Goal: Provide domestic hot water by exploiting solar irradiation and avoiding electricity demand.

Use of an integrated solar thermal system in every apartment separately. Highly efficient selective solar thermal collectors of 2.0 m² coupled to a storage tank of 120 L, are selected. The collectors are located in the south direction with an inclination angle of 55°. The system includes auxiliary electrical resistance.

F) Installation of PV panels

Goal: Electricity production from solar irradiation.

- Installation of highly efficient PV panels (Polycrystalline silicon) in the roof with a 10° tilt. Totally, the PV area is 72.6 m² which includes 30 modules of 2.42 m² of each module. The maximum efficiency of the panel is 21.3%.

- Installation of vertical BIPV in the southeast direction (**GREENSTRUCT**). Totally 4 panels were selected to be installed on the 3rd floor. Every panel has dimensions of 2.45 m x 1.25 m, a total area of 3.06 m² and maximum efficiency of 5.8%.

G) Improvement of the lighting installation

Goal: Partial reduction of the electricity demand.

Replacement of the lighting equipment with energy-efficient systems. The nominal specific lighting power becomes equal to 1 W/m² with an operating fraction of 10%, while the appliance's operating fraction is 40% and the specific power remains at 4 W/m².

Allocation of RINNO technologies	SC3
Bio-based double layer panels (K-FLEX)	1
Thermochromic glass (GREENSTRUCT)	1
Building integrated photovoltaic panels (GREENSTRUCT)	1
Total of implemented RINNO technologies	3

Table 6 Allocation of RINNO technologies

Below the quantification of the technologies according to the distribution between the four demo sites:

RINNO Technology	Quantity
Bio-based double layer panels (K-FLEX)	Sqm of material (m ²) - 572 Thickness (mm) - 80
Thermochromic glass (GREENSTRUCT)	Sqm of material (m ²) - 34.6
Building integrated PV glass (GREENSTRUCT)	Sqm of material (m ²) - 12.24

Table 7 Quantification of the technologies

Planning and tender process

The project is funded partially by HPHI's own funding (more than 40%) and companies, which sponsor the building's renovation with innovative materials and systems according to the study's requirements of the Hellenic Passive House Institute and by citizens through an international crowdfunding campaign (890€).

The sponsors are technical companies that offer their products for the renovation of the apartments. There was a collaboration with Greenpeace in order to concentrate money to cover expenses related to the construction (construction workers, materials not funded by companies) with crowdfunding that resulted with 890 euros (a minimum of 40k was expected) in a project with an approximate budget of 300k.

A big percentage of the materials and systems have been funded by 26 companies until June 2024 (Fig. 8). After an event in June, three more sponsors approached HPHI for the project. In total the pilot responsible collaborated until January 2025 with 29 sponsors.



Figure 8 Overview of the 26 sponsors until June 2024 in Passivistas, the Tavros project.

Simultaneously, SHAPE European Affordable Housing Consortium was approached to offer consulting in order to help us gather extra funding to complete the project. At the end, additional funding was not found.

Due to previous failed projects in the area, the commitment of the 8 households was not certain as they didn't trust anyone to renovate their apartment even though HPHI signed a contract with the owners that they will not pay anything. After many discussions and by crafting a personal relationship between HPHI (team of 13 people) and the owners (20 people), HPHI started renovating one apartment (FLAT 3B) firstly in order to be the case study for all the others. After seeing the result and the whole construction process (while the tenants were living inside), all the apartments left (7) were convinced to proceed with the full renovation.

After the agreement of the rest of the residents/tenants, HPHI team proceeded with the study for the implementation of the technologies to minimize the disturbance of the people living in the building. Streamlining the renovation process involves organizing and executing the steps of a renovation project efficiently, minimizing delays, waste, and costs. At the case of the ventilation installation, the design and implementation phases were optimized. The mechanical ventilation units and their distribution pipes were successfully installed to 6 apartments in less than 2 working days each while the typical duration of the installation lasts around 5. Regarding the installation of the insulation and the windows, since the systems were covered by the sponsors, it was difficult to minimize the disturbance of the residents because the time schedule was defined by the availability of the companies and the technicians.

More specifically regarding the implementation of the renovation:

- The designs for the **mechanical ventilation** for the rest of the 7 apartments have been done and according to the plan and executed within 1.5 day (average MVHR installation is 5 days), the 5 MVHRs were installed by the end of December of 2023.
- **Window frames** were placed between December 2023 – February 2024 after the permission from the council was secured according to the availability of the sponsors. The last occupied apartment changed windows in the end of August 2024 due to the availability of the sponsor and the necessity of the scaffold to conduct the work. During the last week of August 2024, the replacement of the windows in the last living apartment was conducted. The empty apartment windows' installation will occur when the windows are acquired. It is scheduled to be placed from an external sponsor within the month of February 2025.
- Regarding **the heating/cooling system**, the existing functional air conditioning units of the apartments have been moved to create available space for insulation. The air conditioning units will remain in the façade of the building. Six air conditioning units were bought to be placed in the apartments. The natural gas in one apartment was removed and all the new air conditioning units have been installed. In a Passivhaus building the heating/cooling load is 10W/m², so one split unit of 2kW was more than enough to cover each apartment, even though the tenants couldn't believe that statement before actually living that. As a result, some of the apartments kept some of their old units. The units were installed during summer, from June 2024 till the start of September 2024, in order to match the availability of the technicians with the residents due to summer vacation.
- Regarding **domestic hot water**, HPHI managed to find sponsorship for solar thermal collectors coupled to storage tanks for the apartments to cover their needs. an old non-functioning was replaced, because it did not function properly, and 3 others were added for the apartments that were lacking. In November 2025, the new solar water heaters that were partially sponsored were placed.

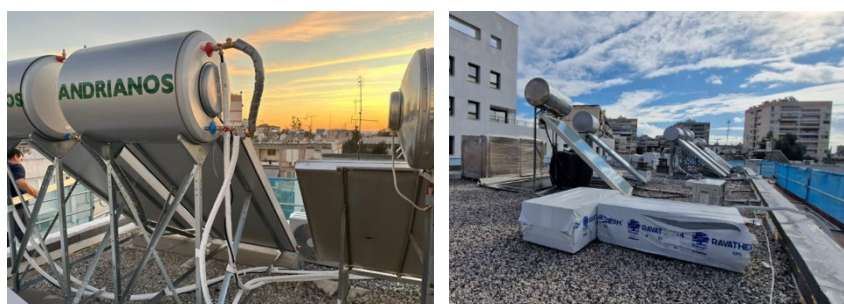


Figure 9 Image of the installed water heaters at the roof.

- In the end of March 2024, the scaffold was installed on site to perform work in the **exterior of the building** (insulation, painting, outside piping, placement of BIPV). From this day, the presence of HPHI (at least one HPHI supervisor) on site is constant when the contractor is there. In Fig.9 and Fig.10, photos from the installation of 2 RINNO technologies are presented. An important note is that the implementation cost of the insulation material was not funded. During the week of 15-19 of July 2024 the placement of the insulation on the roof of the building was realized (Fig.10). The static study for the placement of the BIPVs in the side view was conducted and now HPHI is under communication with the technicians to implement the design within February 2025. For the installation of the BIPV on the southern facade of the building, static and wind resistance calculations were necessary to install the system on the 3rd floor of the building. It was not a part of the delivery from GREENSTRUCT, the technology provider, and a special effort had to be made to get the calculation signed by an experienced and official engineer for the installation of the system in the specified building. Otherwise, the engineers in charge and the building authority wouldn't allow the installation of the system.

There are also still some delays from the contractor and material providers, HPHI remains constantly in touch with him. The pending tasks regarding exterior work are the following:

1. Insulation of the last view of the building.
2. Insulation of the roof of the basement.
3. Painting of the building
4. Placement of the BIPV



Figure 10 Insulation at the facades with RINNO technology (K-FLEX).



Figure 11 Installation of the Thermo-chromic glass (GREEN-STRUCT).



Figure 12 The roof at the Tavros project during implementation of the insulation.

- The placement of the windows and the door of **the common spaces** was realized on November 2024.

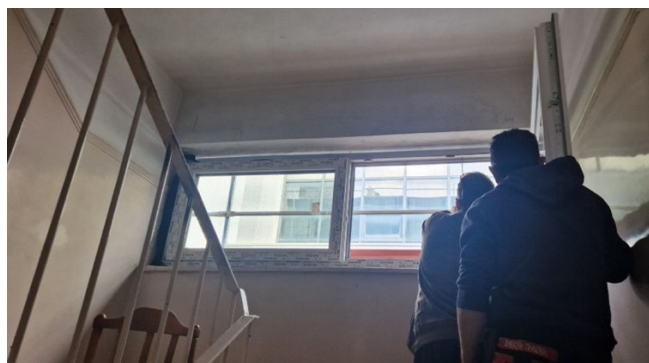


Figure 13 Installation of the windows in the common spaces of the building

Living lab

The building was agreed to function as a living lab for highly energy efficient buildings for five years. With the consent of the users, educational visits and demonstration will be carried out throughout the refurbishment process and the operation for different stakeholders, including students, engineers, tradespersons and the general public, aiming to spread the word and inspire similar projects all around Greece. In total 11 workshops have been held.

- **Training:** In an effort to complete the construction work, while helping the community, we contacted Odyssea. Odyssea is a non-profit organization that supports young vulnerable people to have access to employment opportunities in society. In January of 2024 we conducted a seminar with them for the installation of the insulation.



Figure 14 Seminar with Odyssea for the proper implementation of insulation.

- **Workshops:** HPPI has already conducted several on-site workshops (11) for students, engineers and technicians, not only dedicated to RINNO Technologies, but to raise awareness for Positive Energy Buildings and Streamlined renovation process.
- **Educational visits:** In November 2024 and in December 2024 two important educational events took place. One to inform students College Year of Athens about Tavros project and one interdisciplinary course with architecture and mechanical engineering students from NTUA about energy efficient design. More than 70 students participated in these two events.



Figure 15 Visit from College Year of Athens students in November 2024



Figure 16 On site course with NTUA students in December 2024

Monitoring

HPPI is collaborating with the Centre for Research and Technology Hellas (CERTH) regarding the monitoring system which is installed in the apartments and will allow the building to be a living lab for 5 years. Due to the lack of internet connection, the monitoring system was not always working properly. The monitor equipment also did not permit to monitor CO₂ concentration in the apartments. HPPI found a way to integrate into the monitoring system the CO₂ emissions with new NETATMO equipment, because the ones from MEAZON did not measure them.

Monitoring had been installed in July 2021, on 6 out of 8 apartments. Concerning monitoring, HPHI has encountered a lot of difficulties on the subject since the beginning of the project:

- > problems of accessing the data in an editable form, such as csv
- > difficulties with the tenants, who disconnected the measuring equipment, or even lost part of the equipment. In January 2025, only 5 of these 6 apartments have data loggers

CERTH informed HPHI that there was an issue regarding access to the data after requests to access them to evaluate the changes in the living conditions. HPHI is in contact with the company that provided the equipment to find the data describing the living conditions before the renovation.

HPHI is still working with the CERTH, which recently suggested adding more equipment since PVs are going to be installed to the roof and some of the residents kept some of their old cooling systems. The platform built from CERTH used the monitoring data from the NETATMO equipment, which was placed in the middle of the renovation processes (March 2024) and also has its own platform to visualize the data where HPHI has access to. The NETATMO equipment measured the minimum temperature 10 degrees in March 2024 and maximum temperature 37 degrees in the summer of 2024.

HPHI did an extraction of the data from the equipment at the start of January 2025 to acquire access. Among the next steps is to

- translate the exported data from January 2025 (that include a history of the measurements from July 2021 to January 2025) to create a complete picture before and after the renovation
- Supplement, where necessary the equipment, to match with the new
- Solve accessibility issue and problem regarding the connectivity
- Replace the lost equipment or find a solution to get the measurements from one datalogger placed in the same floor

Start date of monitoring: July 2021

End date of monitoring: August 2025

Communication with stakeholders

- **Social media:** HPHI social media accounts turned more active to attract more companies and raise awareness about the Tavros pilot. Our marketing campaigns are not sponsored. Sponsors of the project also communicate their contribution to their communication channels, such as Alumil (Fig.17).



Figure 17 Presence in the social media supports micro financing

- **Documentary:** In between, there is constant communication with the videographer responsible for the creation of the documentary to report the progress of the project.
- **Events:** As mentioned in the living lab section many events have been held at the pilot (education events, workshops, lessons, demonstration to outside the consortium partners). The most successful event was in June 2024 to inform all the stakeholders involved in the project about the progress of the project. In this event, four mayors of major municipalities (Athens, Moscatos-Tavros and two other members of the Athenian Energy Coalition), sponsors of the project, companies from the construction sector in Greece, students and residents were present. The reach was more than 100 people. Photos from the event are in figures 18 and 19.



Figure 18 Photo from the event with the stakeholder in June 2024 with the residents of the Greek demo





Figure 19 Photo with the mayor of Athens at the stakeholder event in June 2024

The following bullet points summarize our actions with the stakeholders:

- Communication for the installation of technologies with the residents and the contractor
- Communication with the sponsors
- Training courses with students and technicians
- Constant social media presence of Tavros project to HPHI's channels
- Articles in sites and conventional news about the project
- Creation of a documentary with the process of the renovation

Time plan and next steps

Steps of the building renovation	Start	End
Delivery of materials/products	March 2023	May 2023
Building Retrofitting	June 2023	February 2025
Training (WP3 and 5)	June 2024	December 2024
Training (WP4)		June 2025
Qualitative Interviews/Evaluation	-	May 2025
Metering	February 2025	August 2025

Table 8 Time plan and next steps

There have been some delays due to the funding situation and the contractor. The renovation is now progressing to be finalized in February 2025. So, the next steps are the following:

- Install the BIPV technology on the third floor
- Finish the insulation of the one side of the building and the basement roof
- Finish the painting of the building
- Fix issues regarding accessibility in the monitoring data
- Analyze monitoring data
- Interview the residents when the scaffold is removed from the site for evaluation

2.3 The Polish demosite

Polish demo site location: Jablonna Commune, Rajszew, Poland (see map)

Address: Storczykowa 10 (<https://maps.app.goo.gl/eATXcbDouZk3FHty7>)

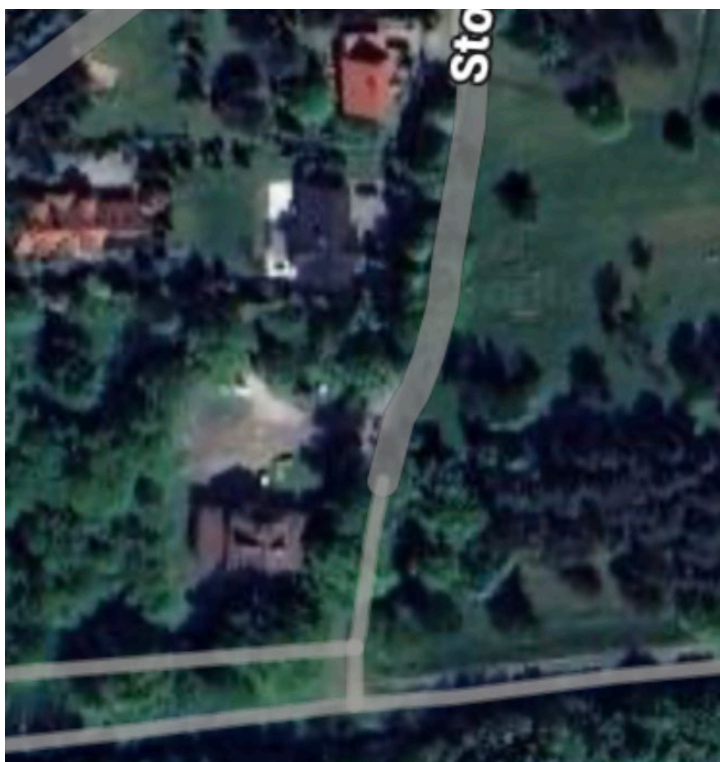
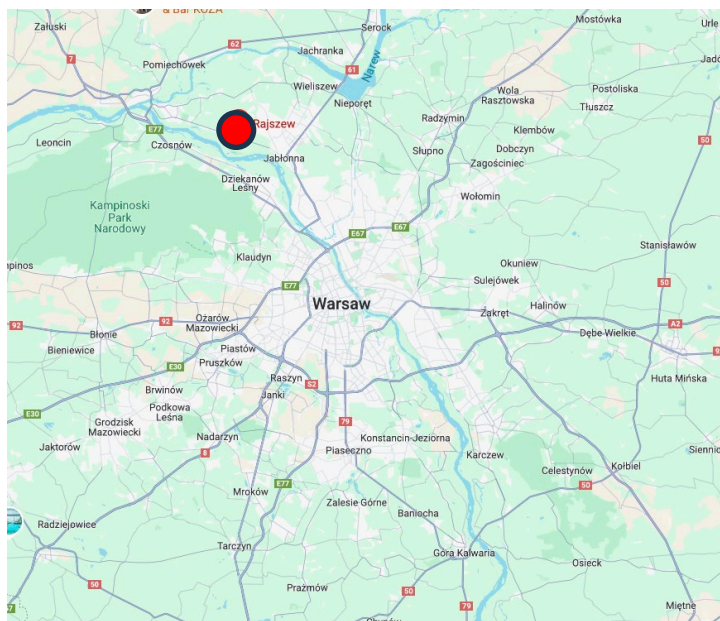
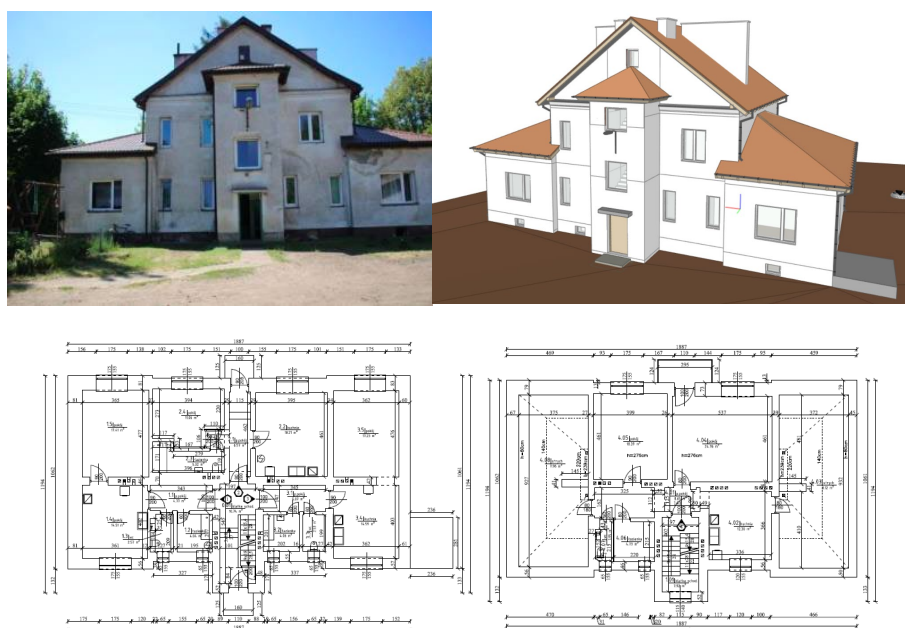


Figure 20 Rajszew - latitude and longitude — 52.3979837, 20.8412502



The building is located in Rajszewo in the Mazowieckie voivodship, a suburban village located near Warsaw on the right bank of the Vistula River. It is owned by the municipality of Jablonna. The three-story, multi-family building was built in 1949. It consists of five apartments with a total area of 258 m². It also has a partial basement. The building was never fully renovated. Exterior walls of varying thickness are made of solid brick masonry without insulation, finished with cement-lime plaster. Roof is in wooden construction covered with tile. The building has PVC framed windows. In the apartments and in the staircase the windows were replaced about 20 years ago. The wooden exterior doors need to be replaced.

Each of the five apartments in the building is equipped with its own installation of heating and hot water preparation system. In each case, the heat source is a condensing gas boiler feeding a water system with panel radiators (gas boilers replaced coal and wood boilers and stoves in 2021). The building uses a gravity ventilation system.



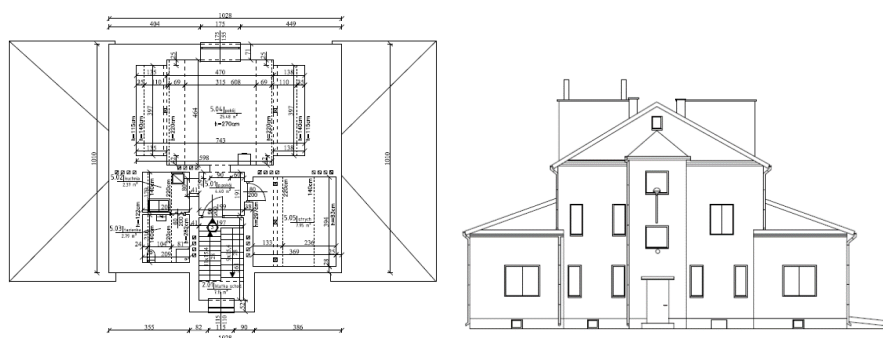


Figure 21 Construction drawings

The planned renovation measures involve – apart from the RINNO technologies – the following:

- Thermal insulation of external walls
- Insulating ceilings under an unheated attic
- Insulating the ceiling over an unheated basement
- Replacement of windows with new ones along with the installation of window ventilators
- Replacement of external doors
- Installation of a photovoltaic system on the roof of the building and partially on the south façade

The renovation aims to improve both the building envelope and also to use of highly efficient energy systems. The envelope is enhanced in order to minimize thermal losses and so to reduce energy needs.

Goal	Baseline kWh/m2	Effective Reduction (%)	Reduction from Proposal (%)
Energy Consumption	300	67	79
Heating Consumption	250	84	84
DHW Consumption	50	47	54
Other Demand	10	50	50

Table 9 Energy consumption

Chosen scenario

The **Polish scenario 4** aims to improve the building envelope, use highly efficient energy systems and produce electricity by using photovoltaics. The envelope is enhanced in order to minimize thermal losses and so to reduce energy needs. Below, the retrofitting interventions of the building are listed:

A) Adding Insulation

Goal: Reduce the thermal losses, reduce the U-value, reduce the absorbance of solar irradiation.

- External walls: Addition of 20 cm insulation with $k=0.033$ W/mK; the new U-value is 0.15 W/m²K.
- Roof: Addition of 21 cm Isocell insulation with $k=0.037$ W/mK; the new U-value is 0.15 W/m²K.
- Basement ceiling: Addition of 8 cm insulation with $k=0.026$ W/mK in an area of 60 m²; the new U-value is 0.25 W/m²K (double layer panels from K-FLEX).

B) Windows replacement

Goal: Reduce the thermal losses, reduce the infiltration rate and manage properly the solar irradiation.

Use of triple-glazed low-e aluminium/pvc windows. Window with total U-value= 0.9 W/m²K (75% glass and 25% frame) and g-value= 0.75 . The airtightness of the envelope will be reduced from 0.7 air changes per hour to 0.6 air changes per hour.

C) Solar photovoltaic panels

Goal: Provide electricity for covering a part of the building needs.

Use typical PV panels of 10 kW_p capacity separated into east and west with capacities of 5 kW_p and 5 kW_p respectively. The PV slope is the same as the roof slope and it is 36° for both sides. An inverter efficiency of 95% is assumed with a net-metering connection.

D) Installation of a natural gas boiler

Goal: Cover the heating and DHW needs with an efficient energy system.

The highly efficient natural gas boiler is used both for heating and DHW purposes.

Heating mode: Average seasonal efficiency at 83%, taking into account 93.5% nominal efficiency, 100% distribution efficiency and 89% regulation efficiency.

DHW mode: Average seasonal efficiency at 68%, taking into account 93.5% nominal efficiency, 85% distribution efficiency and 85% regulation efficiency.

E) Zappa PV Facade solutions (EKOLAB)**Goal: Electricity production from solar irradiation and insulating the south wall.**

Installation of highly efficient PV panels in the south façade and insulating properly the south wall. The ZAPPA technology 20 m² of photovoltaic panels has a nominal electrical efficiency of 13.3% and a capacity of 2 kWp. An inverter efficiency of 95% is assumed with a net-metering connection.

F) Improvement of the lighting installation**Goal: Partial reduction of the electricity demand.**

Replacement of the lighting equipment with energy-efficient systems in the common areas. The nominal specific lighting power becomes equal to 2.3 W/m² from 2.5 W/m² in the baseline scenario.

Allocated technologies	RINNO technologies SC2
Bio-based double layer panels (K-FLEX)	1
Bio-based pipes and sheets (K-FLEX)	1
Isocell Cellulose Insulation (EKOLAB)	1
Zappa PV -Roof and -Facade solutions (EKOLAB)	1
Total of implemented RINNO technologies	4

Table 10 Allocated technologies

It was planned to use PINK technology in the Polish demo sites, but the use of PINK technology was excluded in Poland, as the demo site had a newly installed hot water system.

Below the quantification of the technologies according to the distribution between the four demo sites:

RINNO Technology	Quantity
Bio-based double layer panels (K-FLEX)	Sqm of material (m ²) - 58.5 Thickness (mm) - 80
Bio-based pipes and sheets (K-FLEX)	Linear meters (m) - 25
Isocell cellulose insulation (EKOLAB)	Sqm of material (m ²) - 198 Thickness (cm) - 25
Zappa PV-roof and façade solutions (EKOLAB)	Sqm of material (m ²) - 20

Table 11 Quantification of the technologies

Renovation and tender process

During first quarter of 2024 Comunne Jablonna modernized the electric system (on their own costs) in order to adjust it for future PV installation. Therefore, the prepared documentation of planned works had to be updated accordingly, and it caused delay.

In previous plans for the tender, the PV installation was supposed to be announced as “project and install”. This means that the contractor prepares the documentation and install the PV on the roof and on the façade (ZAPPA). Therefore, the details in the project of the installation were not prepared. As per information from BGK (where part of the funding that will be obtained), the project of PV installation including permit from the fire department must be prepared before signing the agreement with the contractor. The permission from fire department took longer than expected, and the full documentation for the tender was not delivered to Jablonna (owner of the building) until the beginning of December.

Anyway, the tender process is ready and can be implemented in the beginning of 2025. See also the revised time plan.

Monitoring

In place since 2021.

The gas metering is individual, and bills and / or Excel files will be provided.

Communication with stakeholders

Meetings with inhabitants of the building has been as follows:

- 03.11.2022 meeting to present the modernization plans and first outcomes of monitoring
- Meetings and communication with Commune Jablonna on daily basis
- Direct contact with inhabitants (checking the monitoring, obtaining additional data f.e. invoices)

Time plan and next steps

Steps of the building renovation	Start	End
Delivery of materials/products	March 2025	June 2025
Building Retrofitting	March 2025	April/June 2025
Training (WP3 and 5)	June 2024	December 2024
Training (WP4 and AR)		June 2025
Qualitative Interviews/Evaluation	-	May 2025
Metering	June 2025	August 2025

Table 12 Time plan and next steps

2.4 The Danish demosite

Danish demo site location: Slagelse, Denmark (see map)

Address: Olufsgade 5-7, 4200 Slagelse

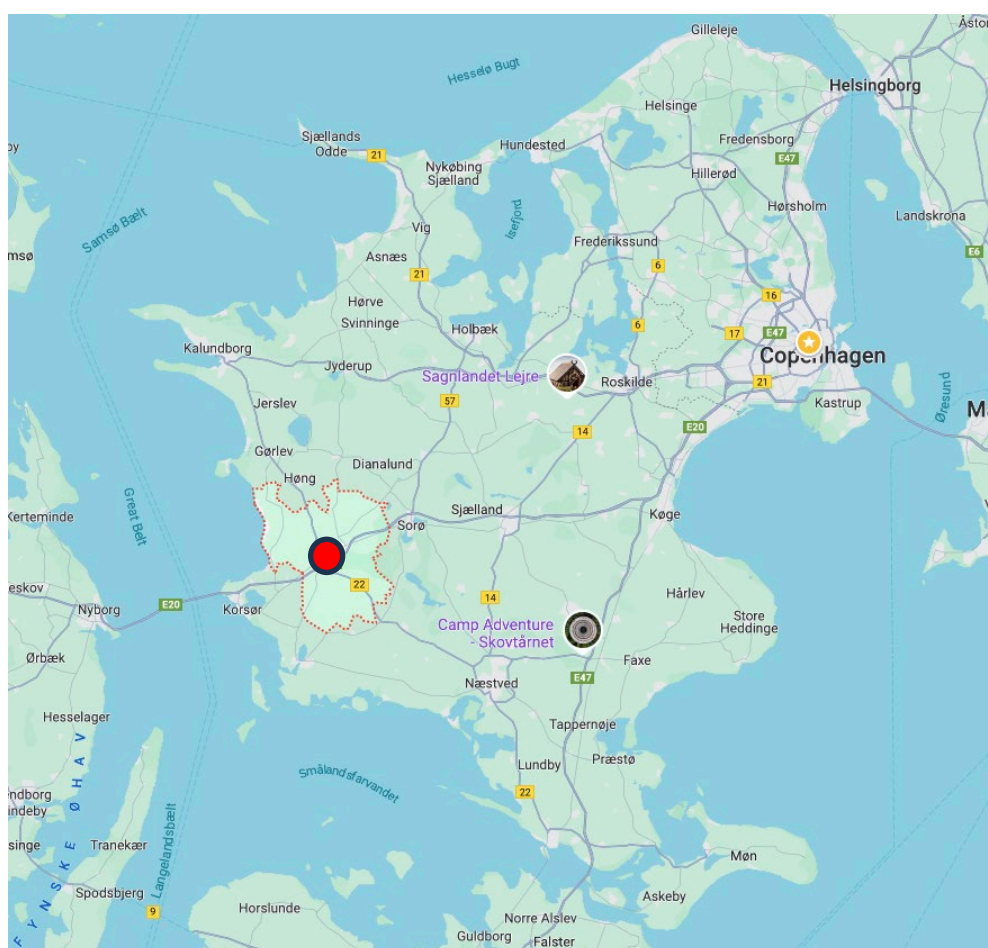


Figure 22 Olufsgade 5-7, Slagelse

Short characteristic of the project

The Danish demo building is from 1913, located in the centre of Slagelse – a middle size city, about a 100 km from Copenhagen. The multi-family house is situated very close to the railway station. It was renovated in 1988 with new closed balconies to the west, a new, wooden gable to the south, provided with solar collectors, and a new central ventilation system with CAV and heat recovery.

The building has a total of 839 M2, has four floors and 12 flats – the top flats are in two stories. See also: https://fob.dk/media/7184/22036_projektforslagsmappe-marts-2024.pdf

The West and East façades as well as the windows are in deep need of being renovated. The central ventilation system is 35 years old, still functioning, but the tenants are obstructing the air vents because of discomfort. The solar collectors. doesn't function and must be exchanged or removed. The gable must be insulated.



Figure 23 Olufsgade 5-7 - the West façade



Figure 24 The gable to the South

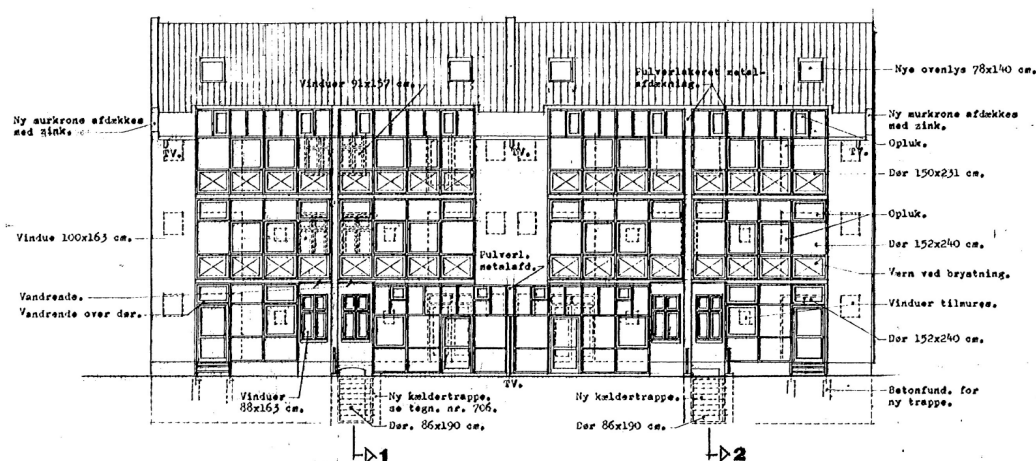


Figure 25 Construction drawings

Energy performance before and after (ambition) RINNO renovation

Goal	Baseline kWh/m2	Calculated Reduction (%) *)	Reduction (from Proposal %)
Energy Consumption	159	22	32.1
Heating Consumption	97	21	41.4
DHW Consumption	29	21	10
Other Consumption	34	27	50

Table 13 Energy performance before and after (ambition) RINNO renovation

*) The renovation scenario was only recently finalised and, therefore, the data for scenario 2 has been changed since D6.2. The figures are the preliminary calculation.

Chosen scenario

Before the renovation, an analysis of the building was performed to find the optimal renovation scenario. This was described in D6.2.

The chosen Danish **Scenario 2** aims to improve both the building envelope and the use of highly efficient energy systems. The envelope is enhanced to minimize thermal losses and to reduce energy needs. Below, the retrofitting interventions of the building are listed:

A) Adding Isocell Cellulose Insulation in the south and west external walls (EKOLAB)

Goal: Reduction of the thermal losses, reduction of the U-value, reduction of the absorbance of solar irradiation.

External walls: Addition of 10 cm Isocell insulation with $k=0.035$ W/mK.

B) Windows replacement

Goal: Reduction of the thermal losses, reduction of the infiltration rate and proper management of the solar irradiation.

Use of advanced triple-glazed windows. Windows with total U-value=0.9 W/m²K (75% glass and 25% frame) and g-value=0.65. The airtightness of the envelope (infiltration) will be reduced from 0.4 air changes per hour to 0.3 air changes per hour.

C) Piping insulation (K-FLEX)

Goal: Reduction of the distribution of thermal losses.

Use of bio-based pipes insulation with low thermal conductivity of 0.038 W/mK.

D) Decentralized Mechanical Ventilation with heat recovery (EKOLAB)

Goal: Provide the proper fresh air by reducing the load due to the use of heat recovery.

Retrofitting of the mechanical ventilation system in every apartment (MicroVent – EKOLAB).). The total mechanical ventilation rate will be around 0.8 air changes per hour with a heat recovery efficiency of 90% and an electricity consumption of 300 J/m³.

E) Installation of PV panels (EKOLAB)

Goal: Electricity production from solar irradiation in order to cover all the possible needs and be positive.

Installation of 109 m² of ZAPPA with a PV area of 33 m². on the southern gable. The ZAPPA facade is consisting of 76 m² slate and – as mentioned - 33 m² PV panels.

FOB (the building owner) accepted to test the PINK solution. It was added in order to achieve further energy savings and optimize the use of electricity produced by the PV on the gable.

Allocated technologies

For the implementation of the renovation, the following technologies were chosen:

RINNO technologies

Chosen SC2	Technologies SC2
Bio-based pipes and sheets (K-FLEX)	1
K-BOX bio-based insulating system for parts of energy systems (KFLEX)	1
Zappa PV -Roof and -Facade solutions (EKOLAB)	1
MicroVent sustainable Ventilation system (EKOLAB)	1
Isocell Cellulose Insulation (EKOLAB)	1
De-centralized domestic hot water solution (PINK)	1
Total of implemented RINNO technologies	6

Table 14 RINNO technologies

FOB has been very cooperative towards the RINNO project and has managed to include all six technologies in the renovation incl. PINK, which was rejected by the French and Polish demo sites, and in spite of technical and financial challenges.

Below the quantification of the technologies according to the distribution between the four demo sites:

RINNO Technology	Quantity
K-BOX bio-based insulation (KFLEX)	Number of units - 15
Bio-based pipes and sheets (K-FLEX)	Linear meters (m) - 10
Isocell cellulose insulation (EKOLAB)	Sqm of materials - 252 Thickness (cm) - 10
MicroVent sustainable Ventilation system (EKOLAB)	Number of units - 12
De-centralized domestic hot water solution (PINK)	Number of units - 12
Zappa PV-roof and façade solutions (EKOLAB)	Number of PV panels - 130

Table 15 Quantification of the technologies

Planning and tender process

The renovation process has been challenging. From the start, the main objective of the Olufsgade project has been to meet the building's energy needs and to improve the residents' indoor climate and everyday comfort.

This is to be achieved, among other things, by installing decentralized micro ventilators from InVentilate in the facades towards Olufsgade. The fans reuse the heat from the exhaust air to heat the new fresh supply air. On the gable, approx. 33 m² of highly efficient solar cells will be installed, and

the gable will be insulated with paper insulation from Isocell. The project will also implement new decentralized hot water tanks from Austrian PINK in connection with the kitchen renovation.

Renovation period

The renovation process has met several big challenges. As mentioned in the Q3 report, unfortunately, progress had not had the momentum that could have been desired, mainly due to the fact that the tenants couldn't accept the proposed renovation project and the derivative raise in the rent. Since FOB is a social housing association, it is paramount that the residents can see the sense in the project and are willing to pay for it. Projects can only be initiated when the residents have voted yes at a voting meeting. The residents voted no at the voting meeting. This meant that FOB had to revise the approach to the renovation.

An important idea to solve the situation was to revise the project, e.g. from including renovation of bathrooms to renovation of kitchens, which was a wish from the tenants. This change didn't affect the inclusion of the hot water tank from PINK, as it was possible to integrate it into the kitchen instead of the bathroom. But the project had to be redesigned.

The revised project includes the following:

- Existing kitchens are replaced, including white goods and extractor hood. In the kitchen water heaters from **PINK** are established.
- Facades are renovated cf. recommendation described by adviser after building inspection Oct. 2022 and external investigations.
- Doors & windows are replaced. This does not concern the glass facades on the garden side.
- Microventilation from **InVentilate** will be established in the facade facing Olufsgade and solar cells and insulation from respectively **ZAPPA** and **Isocell** on the gable.
- Upgrading, servicing and adjustment of existing ventilation systems is also part of this recommendation.

Items that have been deleted since the last setting:

- Renovation of glass façade
- Renovation of bathrooms.

Quite late in the tender process, it showed that the result would be around 100 % more expensive than expected. This threatened the whole project to fall apart. Fortunately, the Danish partners have been skilled enough to get a non-profit foundation to support the project with the missing funding. The Landsbyggefonden, commonly known as LBF, has noticed many of the innovative and sustainable solutions that the project is trying to include.

The Landsbyggefonden is an independent institution founded by social housing organizations and established by law. The purpose is to promote the self-financing of social housing.

The foundation uses as a criterion that many of the renovation initiatives we are testing can be exciting in a larger context and clearly scalable.

The new time plan shows that the renovation can be finished within the new timeline of RINNO. The plan is to renovate the two sections of the building apart to be able to measure results of RINNO a.s.a.p. – at the latest from mid April. This gives us the last part of the winter and still cold nights.





Figure 26 Ongoing renovation works at Olufsgade - January 2024

Monitoring

FOB has installed ICMeters (indoor climate meters) in 4 apartments. The IC Meter meters are not accepted by the majority of tenants, but FOB is negotiating with the tenants. It is expected to have data from 3-4 flats before and after renovation.

There have been problems in the communication between the meters for heating and hot water in the building and CERTH. It is being solved by involving a company, specialized in metering, Neogrid (www.neogrid.dk). Pending is the metering of electricity, which is an ongoing challenge as electricity in Denmark is based on individual contracts with supply companies.

Communication with stakeholders

As mentioned above, there has been challenges with communicating the project to the tenants. The tenants have been notified of the imminent renovation. It will be specified more precisely, the closer we get to the starting time of the renovation. Their questions are often of a practical nature.

The director of FOB is of the opinion that we will have to have a much closer dialogue with the residents, so that together we can find the solutions that are the best for them and not least the best for the house. This is a natural reaction to the fact that the tenants have said no to what FOB has previously been recommended.

Fortunately, the tenants have accepted the revised project, which includes new kitchens with the PINK water heater and the InVentilate micro ventilation system.



Figure 27 InVentilate, micro ventilation system

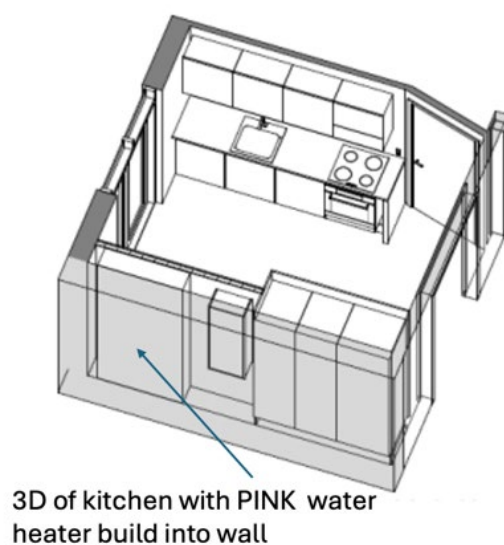


Figure 28 Kitchen and colors at Olufsgade 5-7

The tenants will have to make choices in the last phase of the project. It could e.g. be kitchen colour, etc. This is expected to help them engage in the project.

Time plan and next steps

Steps of the building renovation	Start	End
Delivery of materials/products	January 2025	February 2025
Building Retrofitting – Olufsgade 5	January 2025	March 2025
Building Retrofitting – Olufsgade 7	April 2025	June 2025
Training (WP3 and 5 and AR)	October 2024	April 2025
Training (WP4)		June 2025
Qualitative Interviews/Evaluation		May 2025
Metering (ICMeter)	June 2023	August 2025

Table 16 Time plan and next steps

3 Deviation from the Grant Agreement

3.1 Updated Schedule

The schedule for WP6 in the Grant Agreement is as follows:

	YEAR 1												YEAR 2												YEAR 3												YEAR 4											
WP6: Integration, Demonstration, Evaluation & Replication Potential																																																
T6.1 Integration of RINNO Components and Acceptance Tests																																																
T6.2 Pilot Evaluation Framework, Planning, Setup and Training of Stakeholders																																																
T6.3 Large Scale Demonstration of RINNO system on Real Renovation Projects - (FR, DK, GR, PL)																																																
T6.4 Quantitative and Qualitative Evaluation of Demonstrators (KPIs Measurement)																																																
T6.5 Replication Feasibility Analysis																																																
WP7: RINNO Impact Assessment, Business Model & Service Innovation																																																

Table 17 Schedule for WP6 in the Grant Agreement

Large scale demonstration should start M 25, which was in June 2022. The first demo started in April 2023, the last is expected to start in January 2025. So, the delay is remarkable.

The deadlines for implementation of retrofitting have been revised to regain some of the delay from the other WPs and from challenges during the renovation process. According to the plan, the first demo site (France) was finished in March 2024, The Greek demo site is expected to finish in January 2025, and it is expected that the Danish demo site is ready for monitoring results in April 2025. The Polish is in the tendering process and start date is expected in April. The revised plan is as follows:

No	List of tasks	Deadline
T1	Finalisation of monitoring equipment installation and data retrieval	Ongoing
T2	Selection of the Renovation Scenario to be executed	Done
T3	Appointing Design Office	Done
T4	Finishing detailing of project	Done
T5	Tender / appointing Contractor and sub-contractors	Done
T6	Bill of Quantities / order of materials	Done
T7	Optaining required licenses	Done
T8	Delivery of Materials/Products	ASAP
T9	Preparation of sites	Ongoing
T10	Start works	Last demos: April '25
T11	Completion of Retrofit	Last demos: Apr/June '25
T12	Monitoring	March 2023-August 2025

Table 18 Revised time plan

Technologies

It was a condition in the Grant Agreement that all technologies should be tested at least at two demo sites. Fortunately, it has been possible to implement all nine technologies at the four demo sites. Six of the nine technologies have been implemented at two or more demo sites. Three of the nine technologies have only been implemented at 1 demo site.

Below the overview – marked with green are the technologies, implemented at two or more demo sites, and with orange, the ones only implemented at one demo site.

RINNO Technology	Integrated at demo sites
Bio-based double layer panels (K-FLEX)	2
Bio-based pipes and sheets (K-FLEX)	3
Building integrated PV panels (GREENSTRUCT)	1
De-centralized domestic hot water solution (PINK)	1
Isocell Cellulose Insulation (EKOLAB)	2

K-BOX bio-based insulation (K-FLEX)	2
MicroVent system (EKOLAB)	2
Thermochromic glass (GREENSTRUCT)	1
Zappa PV -Roof and -Facade solutions (EKOLAB)	2

Table 19 Overview of implemented technologies

The monitoring and evaluation will be described in D6.7.

4 Conclusion and recommendations based on the planning and setup

The experiences from the planning and setup of the renovations at the demo sites are described above, but can be summarized as follows:

Tenants

- It is extremely important to involve the tenants as early as possible in the renovation process and in the project as such, especially when it is an innovative project with special demands. If the tenants have the opportunity of participating in the decision process from the beginning, they will more likely get ownership and a larger tolerance towards the challenges to be met during the project.
- The project leader or someone from the company should be present at the demo site on a daily basis. This improves the relation to the tenants.
- It is an advantage to involve a dedicated person on site to communicate with the tenants.
- Information is to be disseminated as early as possible on the planning of the project and the decision processes.

IT tools

It is important to integrate users in the development process of the IT-tools. It is too late to have their opinion, once the tools are (more or less) finished.

Process

The building owners should be more involved in the development of the renovation scenarios. It is important that they understand the selection methods and the expected results. At the early stage, the advisors are not necessarily chosen yet. Else they should be involved as well.

It is very important to be specific on the relevant stakeholders for the different IT-tools.

Technologies

All the technology providers should be partners in the project and involved in the distribution of the technologies. They can give valuable advice to the demo sites.

Especially the installation of the advanced PINK water heaters at the Danish demo site has been challenging. Problems with the management of the IT-system have been solved, but the integration and collaboration with the existing systems in the building are not yet finally solved.

At the Greek demo site, problems with the financing of static and wind resistance calculations were causing problems and delays, as this was not a part of the deliverance from GREENSTRUCT. So, it's important to include this in the project description.

In Poland, the ZAPPA façade was not accepted, until the municipality had received a permit from fire department. This must also be considered in future projects.

Monitoring

Monitoring equipment must be selected and ready in the early phases of the project. It is challenging to get the data on-line and important that it is properly planned, how to do it.

Funding

The Greek demo site has had a big challenge in getting the renovation sponsored. But they have managed through hard work and micro funding. This has been extra challenging concerning the planning of the renovation. It is important to integrate time for this in the process.

In general, the inflation and rising prices have been a big challenge, as all the demo sites are social housing with limited possibilities of integrating extra costs in the renovation budgets.

ABOUT RINNO

RINNO is a four-year EU-funded research project that aspires to deliver greener, bio-based, less energy-intensive from a life cycle perspective and easily applicable building renovation elements and energy systems that will reduce the time and cost required for deep energy renovation, while improving the building energy performance. Its ultimate goal is to develop, validate and demonstrate an operational interface with augmented intelligence and an occupant-centered approach that will streamline and facilitate the whole lifecycle of building renovation.

For more information, please visit <https://rinno-h2020.eu/>



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