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HORIS

Home Renovation Integrated Services

D3.4

Renovation packages definition

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Find the Project

Web: https://ieecp.org/projects/horis/

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About

Making our homes and buildings more energy efficient is crucial in the transition to a low-carbon future. An estimated 75% of the EU building stock is energy inefficient. The renovation of public and private buildings is an essential action and prioritised in the European Green Deal. The goal of the HORIS project is to improve the energy efficiency of residential buildings and reduce energy poverty.

HORIS will create a digital one-stop-shop (OSS) with the aim of empowering homeowners during the renovation process. Homeowners face several key barriers when deciding to retrofit, such as uncertainty and lack of trust about reported energy savings. They must also choose a home renovation professional and navigate the complexities of the financial process.

The OSS will help homeowners make decisions to improve energy efficiency; renewable energy solutions and identify support to reduce energy poverty. The Green Menu will simplify the home renovation process – by providing homeowners with relevant and credible information and helping them identify the best and most sustainable options. The HORIS project will build on the success of established tools like the 'Self Scan' developed by De Groene Grachten. By offering financial, legal and technical solutions, HORIS will facilitate a smooth customer journey, offering homeowners support on finding renovation professionals and guidance about financial schemes.

The project will engage with small and medium sized stakeholders, including local and regional public authorities and non-profit organisations and establish a network of approved home renovation service providers. Initially, the OSS will be set up in Italy, Spain and Portugal with the ambition of replicating in additional countries if needed.

Project partners

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inegi driving science & innovation
GNE FINANCE High Impact Investments
ANERR Asociación Nacional de Empresas de Rehabilitación y Reforma

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Abbreviations

DHW	Domestic hot water
EPS	Expanded polystyrene
ES	Spain
IT	Italy
MW	Mineral wool
OSS	One-stop-shop
PT	Portugal
XPS	Extruded polystyrene

1. EXECUTIVE SUMMARY

The HORIS Project seeks to transform home renovation processes by introducing innovative tools and frameworks to advance energy efficiency and sustainability in residential buildings. Central to this initiative is the HORIS Selfscan Tool, a dynamic platform that helps homeowners to identify and select the most appropriate energy efficiency measures based on their unique circumstances.

This report details the methodology used to develop the renovation packages and link those with the Selfscan Tool. **The pre-defined renovation packages provide an estimate of the potential impact of distinct combinations of energy-saving measures in Portugal, Spain, and Italy,** providing scalable solutions – low-cost, intermediate, and high-impact – tailored to specific building typologies. These packages, which combine technical reliability with cost-effectiveness, provide clear pathways for achieving significant energy, cost, and CO_2 emission reductions.

Meanwhile, the Selfscan Tool uses a logical flowchart to guide users through targeted questions, dynamically refining recommendations based on building characteristics, existing systems, and user preferences. B**y integrating technical expertise with user-centric solutions, this tool simplifies decision-making and ensures tailored results**.

By combining these structured renovation packages with the flexibility of the Selfscan Tool, **HORIS empowers homeowners to make informed decisions** that enhance energy efficiency, reduce costs, and contribute to accomplishing broader sustainability goals. This approach highlights the importance of aligning technical innovation with practical considerations to foster a more sustainable built environment.

2. INTRODUCTION

Home renovation is often a complex process, especially when homeowners do not have access to proper guidance and support. In the context of the European Union's efforts to enhance energy efficiency in residential buildings, the HORIS project aims to simplify and streamline the renovation process through a digital one-stop-shop (OSS) platform. This platform will provide a single point of entry for homeowners, offering comprehensive information on technical solutions, financial options, and legal procedures, with a particular focus on energy efficiency and renewable energy integration.

HORIS will be implemented in three Southern European countries – Portugal, Spain, and Italy – where the platform will be tailored to national contexts and needs. By offering personalized renovation packages, the platform will empower homeowners to make well-informed decisions about energy efficiency interventions, thereby contributing to the EU's overall sustainability goals.

Work Package 3 is dedicated to developing a sustainable and economically viable business model for the OSS platform, ensuring that it delivers value to both homeowners and service providers. Task 3.4, specifically, focuses on mapping and defining renovation packages that combine various technical solutions for energy efficiency improvements. These packages will prioritize measures that maximize energy savings and overall building energy performance, focusing on three key areas: investment in the passive component of the building, integrating renewable energy solutions, and upgrading equipment. These interventions will not only reduce energy consumption but also enhance comfort and value of residential buildings. In addition, the packages will consider factors such as cost-effectiveness and available subsidies, helping homeowners choose the most suitable interventions for their needs.

Building upon results from Task 4.3, which identified and detailed a wide range of technical solutions for home renovation across Portugal, Spain, and Italy, this deliverable takes those findings a step further by incorporating them into clearly defined renovation packages. The simplified tools and methodology developed previously – including a calculation tool to estimate energy savings, costs, and emissions reductions – will now be applied to provide homeowners with actionable renovation strategies. This ensures that the solutions presented are not only practical but also tailored to the specific characteristics of each building typology and national context.

3. METHODOLOGY FOR RENOVATION PACKAGE DESIGN

This chapter describes the methodology used to develop tailored renovation packages for Portugal, Spain, and Italy. The main objective was to identify measures that maximize energy efficiency while being economically feasible, resulting in packages applicable to each country.

3.1. ANALYTICAL TOOLS AND ALGORITHM

As part of the HORIS project, a selfscan tool was developed, incorporating an analytical algorithm designed to assess various factors such as building characteristics, geographic location, and existing energy systems. This tool was conceptualized to provide tailored recommendations by estimating energy needs, usage patterns, and associated emissions based on homeowner inputs. By entering basic data – such as size, year of construction, and energy use patterns of their dwellings – homeowners could receive personalized technical solutions aimed at improving energy efficiency.

The algorithm behind the selfscan tool accounts for a range of variables, enabling the evaluation of the potential impacts of measures such as insulation upgrades, renewable energy integration, and equipment improvements, supporting homeowners in identifying optimal renovation strategies based on their specific circumstances.

Although the current version of the HORIS digital OSS platform does not fully integrate the selfscan tool, the analysis and insights derived from its development have played a critical role in the design of the renovation packages presented in this deliverable. The methodologies and results from the tool ensured that the packages are grounded in a robust technical foundation and aligned with the overarching goals of energy efficiency, comfort improvement, and environmental impact reduction.

3.2. CONSTRUCTION OF RENOVATION PACKAGES

To ensure consistency and comparability of the renovation packages, a generic baseline scenario was established for each country and building typology (single-family and multi-family homes). These scenarios were defined based on:

- Average household size and dwelling size in each country;
- Most common construction periods (and their correspondent characteristics) of the existing housing stock – (identified within the previously selected construction periods: 1961 – 1980 for Portugal, 1946 – 1980 for Italy and pre-1979 for Spain);
- Energy carriers and systems predominantly used for heating, cooling, and domestic hot water;
- Typical lack of adequate thermal insulation, including:
    - Single-glazed windows;
    - Non-thermal break frames;
    - Insufficient insulation in walls, roofs, and floors.

From this baseline, three renovation packages were designed for each country and building typology, with increasing levels of investment and impact. These combinations of measures aim to progressively reduce energy needs and improve building performance, ensuring that higher investment levels deliver greater energy savings and environmental benefits. The packages are named as follows: low-cost package, intermediate package, and high-impact package.

The methodology prioritized measures with high cost-effectiveness, focusing on solutions eligible for funding whenever possible, acknowledging that such funding is currently available but may not be guaranteed in the future**.** While other combinations could have been explored, t**his approach emphasizes achieving the greatest energy cost reduction** with the lowest investment and maximizing financial feasibility through funding opportunities.

3.3. KEY MEASURES IN RENOVATION PACKAGES

The renovation packages were built around 19 key measures that deliver significant improvements in energy consumption, thermal comfort, and renewable energy use. Table 1 summarizes these measures, indicating their eligibility for funding and the estimated range of implementation costs.

Table 1: Key renovation measures, funding availability, and estimated implementation costs

Key Measure	Funding Availability			Estimated Cost (€)
	PT	ES	IT	
Sloped roof exterior insulation	Yes	Yes	Yes	20-40/m²
Flat roof exterior insulation	Yes	Yes	Yes	14-30/m²
External insulation of the external wall	Yes	Yes	Yes	9-30/m²
Internal insulation of the external wall	Yes	Yes	Yes	15-20/m²
Secondary windows (outside)	-	-	Yes	250–500/unit
Thin double glazing and thermal break	Yes	Yes	Yes	400-600/unit
Solar panels	Yes	Yes	Yes	1,500–1,9000/system
Solar thermal system	Yes	Yes	Yes	2,500-4,000/system
Air-conditioning single	Yes	Yes	Yes	900–2,100/unit
Air-conditioning multi	Yes	Yes	Yes	1,500–6,500/system
Air to water heat pump (climatization)	Yes	Yes	Yes	4000-15000/system
Biomass boiler (climatization)	Yes	Yes	Yes	6,000–10,000/system
Condensing boiler	-	-	Yes	2000-4000/system
Biomass/pellets stoves	Yes	Yes	Yes	1250-2000/system
Infrared heating	-	-	Yes	30-60/unit
Air to water heat pump (DHW)	Yes	Yes	Yes	1,000-4,000/system
Biomass boiler (DHW)	Yes	Yes	Yes	6,000–10,000/system
Efficient gas-heater	-	-	Yes	600-1,000/system
Gas-powered condense boiler	-	-	Yes	1,300-6,000/system

4. RENOVATION PACKAGES BY COUNTRY

4.1. SINGLE-FAMILY HOMES

4.1.1. LOW-COST PACKAGE

Low-Cost Package **Thermal Insulation (External Walls + Roof) with Mineral wool (MW), extruded polystyrene (XPS), or expanded polystyrene (EPS)**			
	PT	ES	IT
Final energy reduction	42.1%	48.2%	28.1%
Energy cost reduction	45.1%	51.2%	29.8%
Emissions reduction	44.3%	50.6%	29.3%
Estimated cost	4 045 €	3 859 €	3 716 €

For Portugal, the proposed measures in the Low-Cost Package are expected to achieve reductions of **up to** 42.1% in yearly energy consumption, 45.1% in energy costs, and 44.3% in CO_2 emissions, specifically for DHW, heating, and cooling. The estimated implementation cost is around 4 045 €.

For Spain, the proposed measures in the Low-Cost Package are expected to achieve reductions of **up to** 48.2% in yearly energy consumption, 51.2% in energy costs, and 50.6% in CO_2 emissions, specifically for DHW, heating, and cooling. The estimated implementation cost is around 3 859 €.

For Italy, the proposed measures in the Low-Cost Package are expected to achieve reductions of **up to** 28.1% in yearly energy consumption, 29.8% in energy costs, and 29.3% in CO_2 emissions, specifically for DHW, heating, and cooling. The estimated implementation cost is around 3 716 €.

4.1.2. INTERMEDIATE PACKAGE

Intermediate Package **Thermal Insulation (External Walls + Roof) with MW, XPS or EPS** **+** **Window Replacement (PVC frames + Double glass)** **+** **Heat Pump (DHW)**			
	PT	ES	IT
Final energy reduction	56.2%	58.8%	38.0%
Energy cost reduction	53.1%	56.3%	34.2%
Emissions reduction	53.9%	56.8%	35.3%
Estimated cost	15 134 €	14 385 €	13 818 €

For Portugal, the proposed measures in the Intermediate Package are expected to achieve reductions of **up to** 56.2% in energy consumption, 53.1% in energy costs, and 53.9% in CO_2 emissions, specifically for DHW, heating, and cooling. The estimated implementation cost is around 15 134 €.

For Spain, the proposed measures in the Intermediate Package are expected to achieve reductions of **up to** 58.8% in energy consumption, 56.3% in energy costs, and 56.8% in CO_2 emissions, specifically for DHW, heating, and cooling. The estimated implementation cost is around 14 385 €.

For Italy, the proposed measures in the Intermediate Package are expected to achieve reductions of **up to** 38.0% in energy consumption, 34.2% in energy costs, and 35.3% in CO_2 emissions, specifically for DHW, heating, and cooling. The estimated implementation cost is around 13 818 €.

4.1.3. HIGH-IMPACT PACKAGE

High-Impact Package

Thermal Insulation (External Walls + Roof) with MW, XPS or EPS
+
Window Replacement (PVC frames + Double glass)
+
Heat Pump (DHW)
+
Multi-Split
+
Solar Thermal
+
Solar PV

	PT	ES	IT
Final energy reduction	87.3%	87.9%	80.8%
Energy cost reduction	86.4%	87.1%	79.6%
Emissions reduction	86.7%	87.3%	79.9%
Estimated cost	23 928 €	23 179 €	22 612 €

For Portugal, the proposed measures in the High-Impact Package are expected to achieve reductions of **up to** 87.3% in energy consumption, 86.4% in energy costs, and 86.7% in CO_2 emissions, specifically for DHW, heating, and cooling. The estimated implementation cost is around 23 928 €.

For Spain, the proposed measures in the High-Impact Package are expected to achieve reductions of **up to** 87.9% in energy consumption, 8.1% in energy costs, and 87.3% in CO_2 emissions, specifically for DHW, heating, and cooling. The estimated implementation cost is around 23 179 €.

For Italy, the proposed measures in the High-Impact Package are expected to achieve reductions of **up to** 80.8% in energy consumption, 79.6% in energy costs, and 79.9% in CO_2 emissions, specifically for DHW, heating, and cooling. The estimated implementation cost is around 22 612 €.

4.2. MULTI-FAMILY HOMES

4.2.1. LOW-COST PACKAGE

Low-Cost Package **Thermal Insulation (External Walls) with XPS or EPS** **+** **Heat Pump (DHW)**			
	PT	ES	IT
Final energy reduction	56.7%	24.7%	22.9%
Energy cost reduction	45.7%	18.5%	16.3%
Emissions reduction	49.0%	19.9%	18.3%
Estimated cost	4 014 €	4 081 €	4 054 €

For Portugal, the proposed measures in the Low-Cost Package are expected to achieve reductions of **up to** 56.7% in energy consumption, 45.7% in energy costs, and 49.0% in CO_2 emissions, specifically for DHW, heating, and cooling. The estimated implementation cost is around 4 014 €.

For Spain, the proposed measures in the Low-Cost Package are expected to achieve reductions of **up to** 24.7% in energy consumption, 18.5% in energy costs, and 19.9% in CO_2 emissions, specifically for DHW, heating, and cooling. The estimated implementation cost is around 4 081 €.

For Italy, the proposed measures in the Low-Cost Package are expected to achieve reductions of **up to** 22.9% in energy consumption, 16.3% in energy costs, and 18.3% in CO_2 emissions, specifically for DHW, heating, and cooling. The estimated implementation cost is around 4 054 €.

4.2.2. INTERMEDIATE PACKAGE

Intermediate Package **Thermal Insulation (External Walls) with XPS or EPS** **+** **Window Replacement (PVC frames + Double glass)** **+** **Heat Pump (DHW)**			
	PT	ES	IT
Final energy reduction	71.0%	28.3%	26.7%
Energy cost reduction	63.6%	22.4%	20.5%
Emissions reduction	65.8%	23.7%	22.4%
Estimated cost	12 320 €	11 724 €	11 273 €

For Portugal, the proposed measures in the Intermediate Package are expected to achieve reductions of **up to** 71.0% in energy consumption, 63.6% in energy costs, and 65.8% in CO_2 emissions, specifically for DHW, heating, and cooling. The estimated implementation cost is around 12 320 €.

For Spain, the proposed measures in the Intermediate Package are expected to achieve reductions of **up to** 28.3% in energy consumption, 22.4% in energy costs, and 23.7% in CO_2 emissions, specifically for DHW, heating, and cooling. The estimated implementation cost is around 11 724 €.

For Italy, the proposed measures in the Intermediate Package are expected to achieve reductions of **up to** 26.7% in energy consumption, 20.5% in energy costs, and 22.4% in CO_2 emissions, specifically for DHW, heating, and cooling. The estimated implementation cost is around 11 273 €.

4.2.3. HIGH-IMPACT PACKAGE

High-Impact Package

Thermal Insulation (External Walls) with XPS or EPS
+
Window Replacement (PVC frames + Double glass)
+
Heat Pump (DHW)
+
Multi-Split

	PT	ES	IT
Final energy reduction	82.0%	72.8%	73.3%
Energy cost reduction	77.4%	70.6%	71.1%
Emissions reduction	78.8%	71.1%	71.8%
Estimated cost	16 610 €	16 014 €	15 563 €

For Portugal, the proposed measures in the High-Impact Package are expected to achieve reductions of **up to** 82.0% in energy consumption, 77.4% in energy costs, and 78.8% in CO_2 emissions, specifically for DHW, heating, and cooling. The estimated implementation cost is around 16 610 €.

For Spain, the proposed measures in the High-Impact Package are expected to achieve reductions of **up to** 72.8% in energy consumption, 70.6% in energy costs, and 71.1% in CO_2 emissions, specifically for DHW, heating, and cooling. The estimated implementation cost is around 16 014 €.

For Italy, the proposed measures in the High-Impact Package are expected to achieve reductions of **up to** 73.3% in energy consumption, 71.1% in energy costs, and 71.8% in CO_2 emissions, specifically for DHW, heating, and cooling. The estimated implementation cost is around 15 563 €.

5. SELFSCAN FLOWCHART

As part of the HORIS project's mission to streamline the home renovation process, a selfscan tool has been developed to assist homeowners in identifying the most suitable energy efficiency measures for their specific situations. Unlike the renovation packages, which offer pre-defined solutions, the selfscan tool provides a dynamic and personalized experience. Homeowners interact with the tool by answering a series of targeted questions, enabling the platform to tailor recommendations based on their circumstances and preferences.

The decision-making framework of the selfscan tool is structured around a logical flowchart that systematically evaluates the homeowner's responses. This flowchart acts as the foundation for identifying and excluding specific energy efficiency or renewable sources measures, ensuring that the recommendations are tailored to the individuals' circumstances.

The methodology follows these steps:

- Key Questions: The flowchart begins with all potential energy efficiency measures available (key measures listed in Table 1). A series of targeted questions progressively refines the options by excluding measures that are not suitable based on the homeowner's responses. These questions cover aspects such as:
    - The year of construction;
    - The shape and layout of the roof;
    - The presence or absence of insulation in various areas;
    - The type of energy sources and equipment's currently in use.
- Sequential Logic: Each response contributes to narrowing down the pathways by systematically eliminating measures that are not applicable. This iterative logic ensures the flowchart dynamically adapts to the specifics of the building and homeowner preferences, maintaining a tailored focus throughout the process.
- Tailored Outcomes: The structured logic ensures that the homeowner receives a concise set of recommendations, avoiding redundancy and irrelevant options.

The flowchart, presented between Figures 1 and 8, visually represents the decision-making process, illustrating how the tool dynamically refines recommendations.

Figure 1: Flowchart representation (part 1)

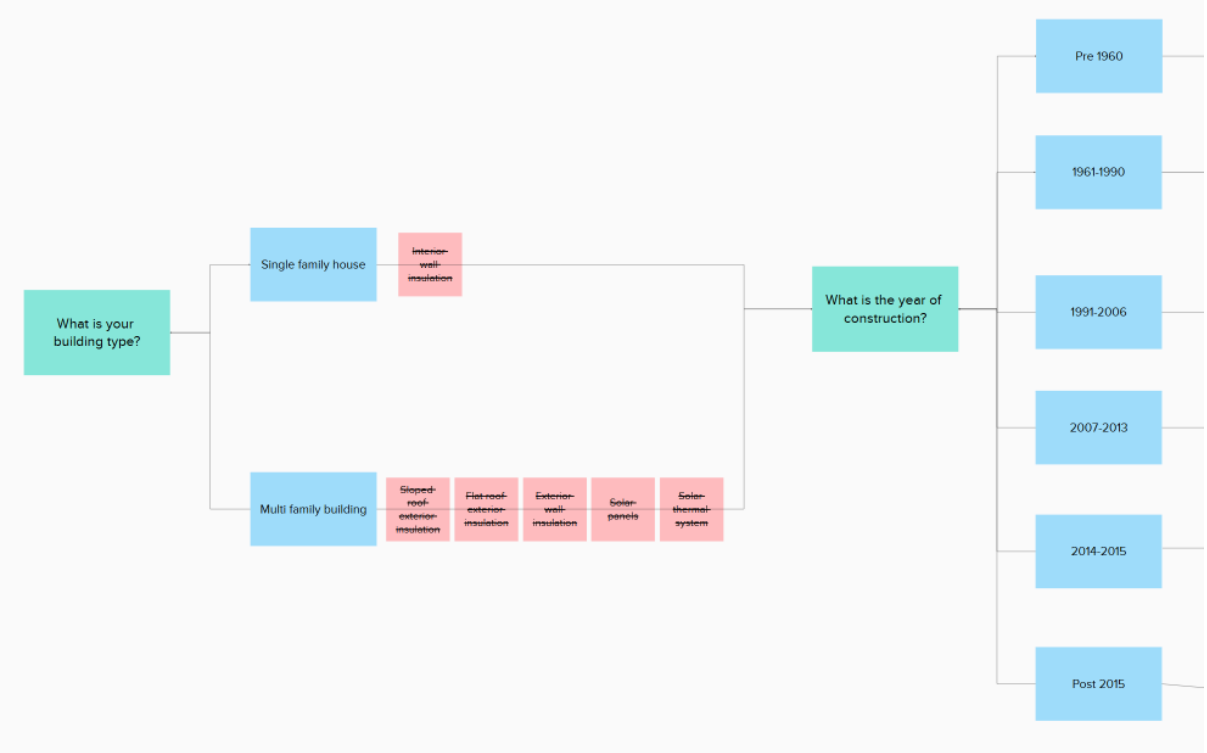

Figure 2: Flowchart representation (part 2)

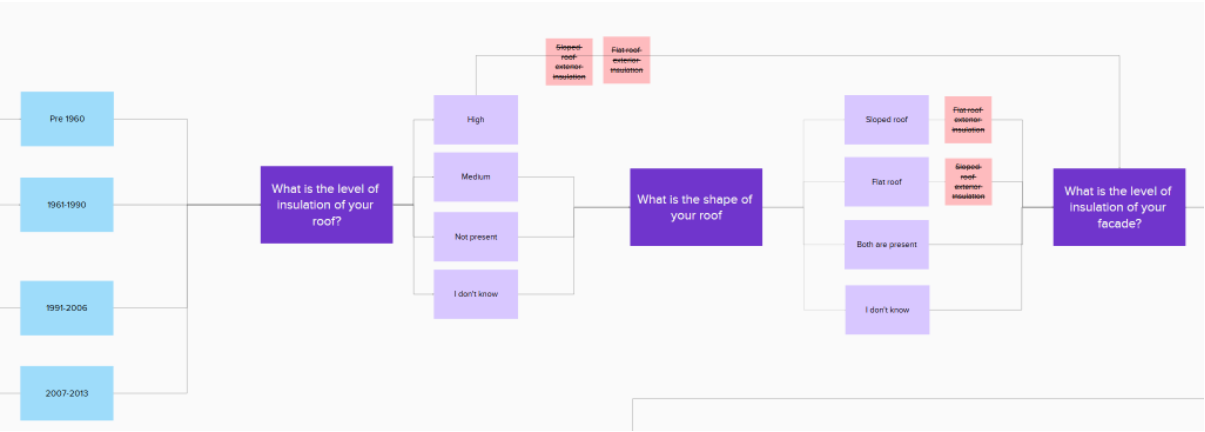

Figure 3: Flowchart representation (part 3)

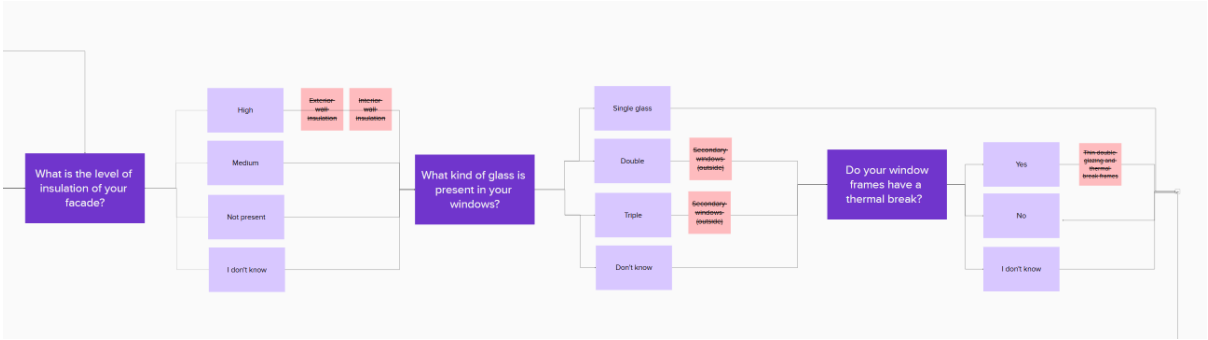

Figure 4: Flowchart representation (part 4)

Figure 5: Flowchart representation (part 5)

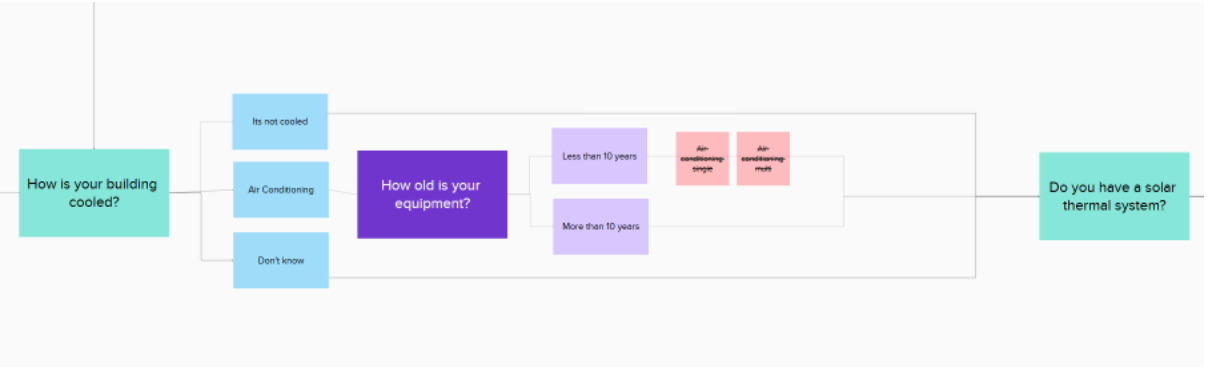

Figure 6: Flowchart representation (part 6)

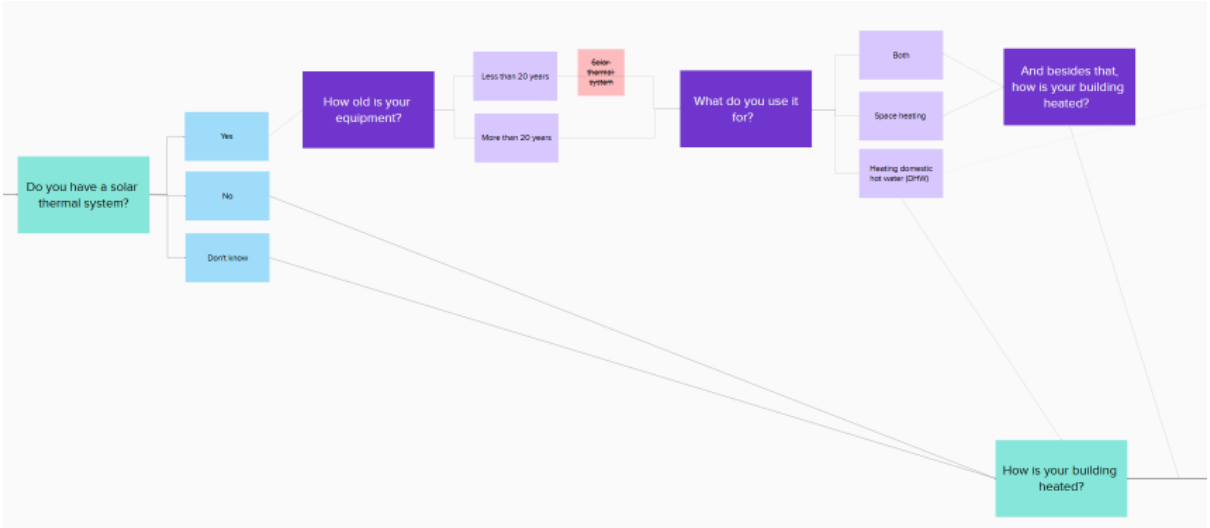

Figure 7: Flowchart representation (part 8)

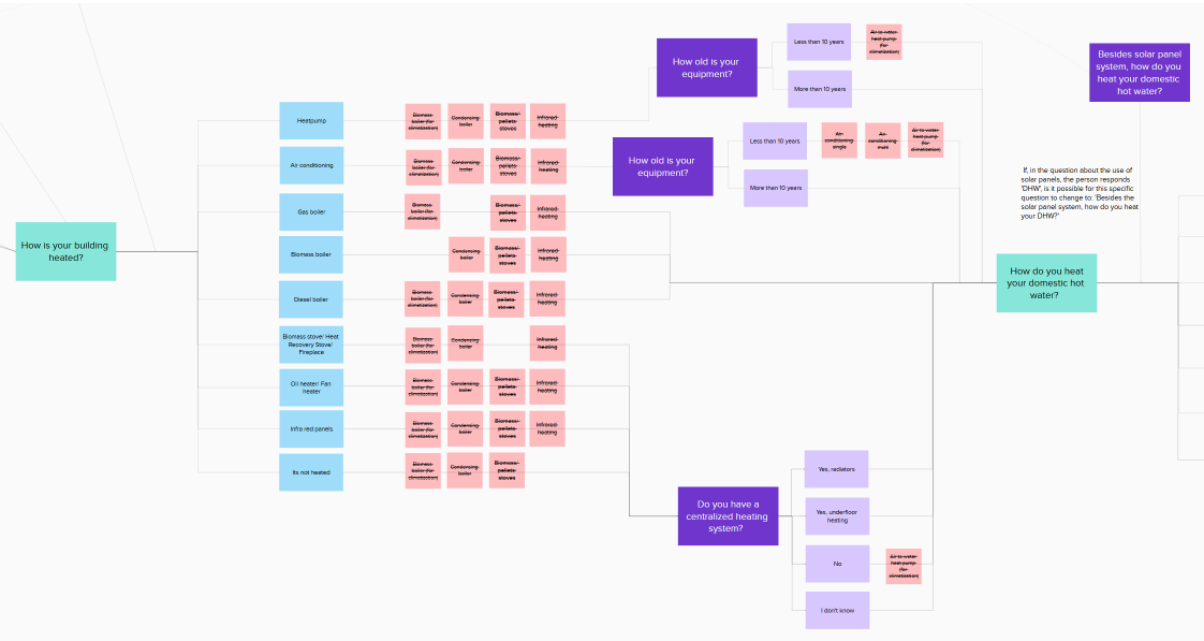

Figure 8: Flowchart representation (part 8)

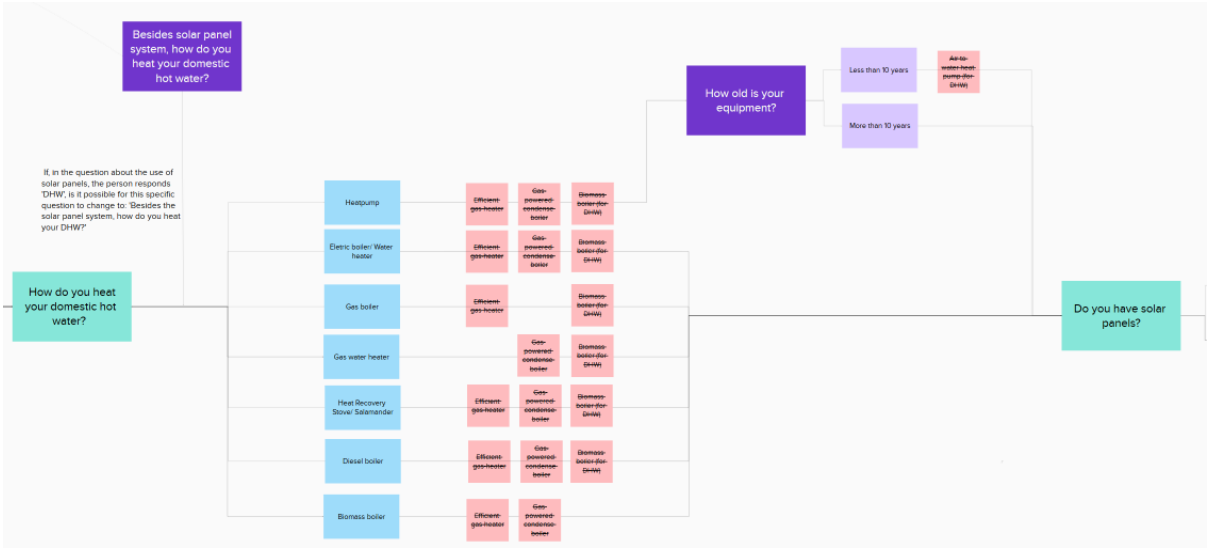

Figure 9: Flowchart representation (part 9)

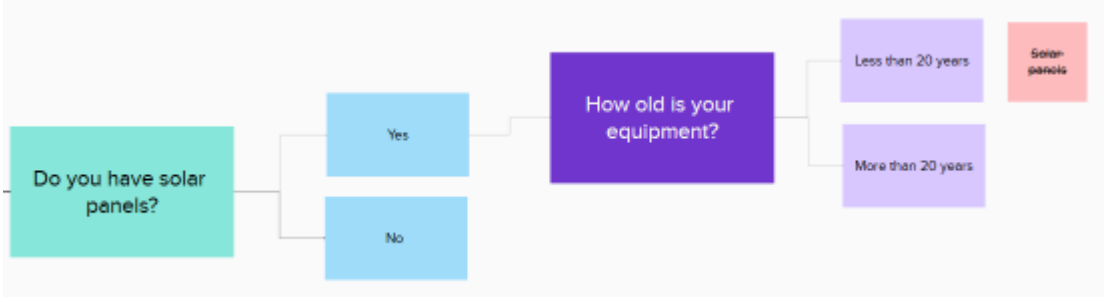

Figure 10: Flowchart representation (part 9)

6. CONCLUSION

The HORIS Project delivers a robust framework to address critical challenges in the home renovation of Portugal, Spain, and Italy. By offering structured renovation packages and the Selfscan Tool, the initiative simplifies the process of identifying and implementing energy-efficient measures. These solutions, tailored to diverse building typologies and national contexts, offer tangible benefits, including significant reductions in energy consumption, costs, and CO_2 emissions, while improving residential comfort and property value.

The renovation packages – ranging from low-cost to high-impact – serve as practical and scalable pathways for energy efficiency improvements. By adopting representative baseline scenarios and prioritizing high cost-effectiveness and funding opportunities, the project ensures that these measures remain financially accessible to homeowners while offering flexibility to accommodate future changes in homeowner needs or market conditions. Feasibility constraints also need to be considered to ensure that the proposed solutions remain adaptable and aligned with different contexts. For example, external insulation may not be suitable in historical areas due to preservation regulations, or rooftop solar panels may require structural assessments. These considerations, along with all the technical advice related to the packages, demonstrate how combinations of measures can achieve impactful results with minimal investment, while maximizing available subsidies.

Complementing these renovation packages, the Selfscan Tool introduces a dynamic and user-centered approach to tailoring solutions. This tool employs an interactive flowchart to guide homeowners through a series of structured questions, dynamically refining recommendations based on the answers. Its logical progression ensures actionable results, bridging technical complexity with ease of use.

By integrating technical precision with user-centric solutions, HORIS provides a foundation for sustainable home renovations that align with EU climate and energy goals. Moving forward, the methodologies and insights developed here can inform further refinements to renovation strategies, fostering a more energy-efficient and sustainable built environment across Europe.

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