Rural Energy Efficiency Renovation Roadmap for Vulnerable Groups (REER)

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TABLE OF CONTENTS

Sommario

1. INTRODUCTION

Do you live in a rural area of your city? Does your home feel too cold in winter or too hot in summer, and despite being careful with your energy use, your bills are still high? Have you considered making improvements to boost your home's energy efficiency and comfort while lowering consumption, but given up because of limited funds?

What if we told you it's all possible?

This practical roadmap is designed for families living in the city of Parma who want to improve their home's energy efficiency, lower utility bills, and increase indoor comfort through renovation. Its purpose is to offer practical guidance on the most effective paths to upgrade your home.

Drawing on real-world experience and analyses of buildings with the specific characteristics of homes from your area, this guide walks you through each stage of planning and carrying out a home renovation. It provides cost estimates for individual activities, explains the expected benefits of each type of energy-efficient renovation, highlights potential challenges that might be encountered along the way, and proposes solutions on how to best overcome these. This will help you decide, with confidence, where to start and which renovation measures best suit your needs.

The guide was developed within the RENOVERTY project, which supports the renovation of vulnerable rural districts and lays the groundwork for energy efficiency that is accessible, inclusive, and socially fair.

2. ENERGY RENOVATION OF DWELLINGS

Before beginning, it's best to understand what an energy renovation implies. Energy renovation means improving your home to make it more energy-efficient, comfortable, and eco-friendly. This can include better insulation, upgrading windows, switching to energy-saving heating systems, or even using renewable energy like solar panels. By making these changes, you can lower your energy bills, reduce your carbon footprint, and enjoy a cozier home all year round.

While energy renovation has great benefits, it can also come with some challenges. The upfront costs can be high, and it may take time to see savings on energy bills, requiring a long-term commitment before they pay themselves off. Finding reliable professionals and understanding available grants or subsidies can also feel complicated. But don't worry - there are financial aid programs and expert advice available to help make the process smoother and more affordable!

In Illustration 1, you can find the general process to follow when renovating your home. However, not all steps can be simple and most of them require an expert's insight. So, if you find yourself lost in the process, don't worry! The steps that you should follow as a citizen, as well as the complexities you may encounter, are detailed in this guide to help you resolve problems before they even begin. Let's take a look at the first step in the next chapter: Contacting experts and seeking advice.

Figure 1:Infographic summary of the energy renovation process
Source: Ecoserveis Association

3. STEPS TO FOLLOW TO RENOVATE YOUR HOME

3.1 Step 1 – Seek advice

When you think about renovating, doubts aren't only about money,they're also practical. If your goal is to save energy and improve comfort, start by talking to experts who can guide you from the first checks to the end of the works.

In the Province of Parma, the free Sportello Energia & Condomini (a one-stop-shop, or OSS) does exactly this. It offers thermal-camera surveys to find heat losses, advice on incentives and financing, and referrals to qualified professionals who handle permits and construction. The help desk is managed by ATES with the support of trusted partners for technical, regulatory and organisational support.

Knowing the key metrics and indicators used in energy upgrades is essential. These benchmarks help track progress and prove that renovations are cutting consumption and CO_2. The main objectives and indicators to monitor results are outlined below.

The use of these indicators allows for the monitoring of progress and outcomes of renovation efforts, ensuring measurable improvements in the energy efficiency of buildings.

Table 1: Objectives of Energy Renovation

Objectives of Energy Renovation	
Reduced Energy Consumption:	• Minimize the energy required for heating, cooling and lighting buildings. • Replace or optimize heating, ventilation, and air conditioning (HVAC) systems.
Reduction of CO_2 Emissions:	• Lower the environmental impact of buildings through improved energy efficiency and integration of renewable energy sources.
Improved Living Comfort:	• Achieve optimal indoor temperatures, enhanced air quality, and better sound insulation. • Reduce heat loss to ensure greater indoor climate stability. • Improve health and well-being by reducing presence of damp and mould.
Increased Share of Renewable Energy:	• Incorporate solar panels, photovoltaic systems, or geothermal systems to decrease reliance on traditional, non-renewable energy sources.
Economic Enhancement of Buildings:	• Elevate the energy class of buildings (e.g., A+, A), and the increasing of the value of the property for the owners. • Reduce long-term energy management costs. • Allow households to become prosumers.
Cost Savings for Users:	• Lower energy expenses through targeted efficiency improvements. • Opportunity for households not to be exposed to the effects of poverty or energy poverty.
Compliance with Energy Regulations:	• Adhere to European, national, and local energy efficiency directives, such as the Energy Performance of Buildings Directive (EPBD).

3.2 Step 2 – Look for professionals

Table 2 shows an example of the stakeholders operating in the Italian city of Parma.

Table 2: Entities and organisations of professionals operating in the city of Parma

Entity	Link
Order of Architects	https://www.archiparma.com/
Order of Engineers	https://ordingparma.it/
LAG	https://galdelducato.it/
Business Directory	https://www.registroimprese.it/web/guest/home
Sportello Energia & Condomini	1. General help desk: https://www.sportelloenergiaparma.eu/ 2. List of professionals: https://www.sportelloenergiaparma.eu/galleria-professionisti/ 3. List of construction companies: https://www.sportelloenergiaparma.eu/galleria-imprese/

Source: Table prepared by AISFOR srl with relevant links from each entity

3.3 Step 3 - Examples of renovation measures you can implement and associated costs

To identify the energy efficiency measures to be implemented in households in Parma and establish priorities for action, a strategy combining two complementary approaches was adopted. Energy audits on a number of houses in Parma were conducted to understand the average household's energy characteristics and needs, and the use of the DREEM (Dynamic high-Resolution dE-mand-sidE Management) model was used to simulate common consumption scenarios and propose optimised energy efficiency interventions based on potential savings and technical-economic feasibility of each measure.

Seven Energy Efficiency Measures (EEMs) were identified for the application of the DREEM model, applicable to all pilots:

- EEM1 - Insulation of External Walls: External insulation of the main walls of the building (typically solid walls without cavities).
- EEM2 - Double-Glazed Windows: Replacement of single-glazed windows with energy-efficient double-glazed windows to reduce heat loss.
- EEM3 - Roof Insulation: Insulation between and beneath roof beams to reduce the overall heat transfer coefficient, utilising materials with low thermal conductivity (applicable only to single-family buildings).
- EEM4 – Energy-Efficient Heating System (Gas Boiler): Replacement of an outdated heating system with a high-efficiency gas boiler.
- EEM5 – Energy-Efficient Heating System (Biomass Boiler): Replacement of an outdated heating system with a high-efficiency biomass boiler.
- EEM6 - Energy-Efficient Heating System (Heat Pump): Replacement of an outdated heating system with the installation of a high-efficiency heat pump.
- EEM7 - Energy-Efficient Lighting: Replacement of traditional lamps (fluorescent lamps) with highly efficient LED systems.

Effects of Selected Energy Efficiency Measures

For single-family homes, the best way to save energy is by switching the heating system to a heat pump. This cuts energy use by about 64%. Adding roof insulation is the next best option, saving around 39%. Insulating the outside walls also helps, saving about 17%.

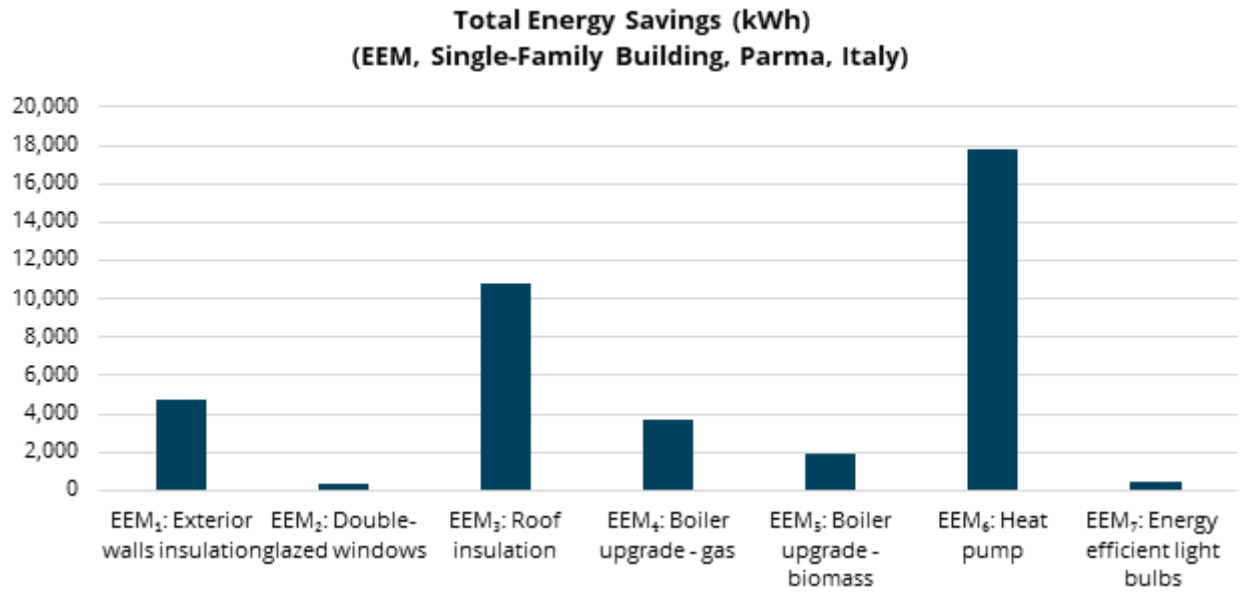

Figure 2: Total Energy Savings in Parma for Single-family buildings and each energy efficiency measure

In apartment buildings (multi-family homes), the best way to save energy is by changing the old heating system to a heat pump. This can cut energy use by around 61%, which means much lower energy bills.

The second-best option is putting insulation on the outside walls. This helps keep heat inside the building, reducing energy use by about 33%.

Another way to save is by installing a more efficient gas boiler. This doesn't save as much as the other options, but it still lowers energy use by about 14%.

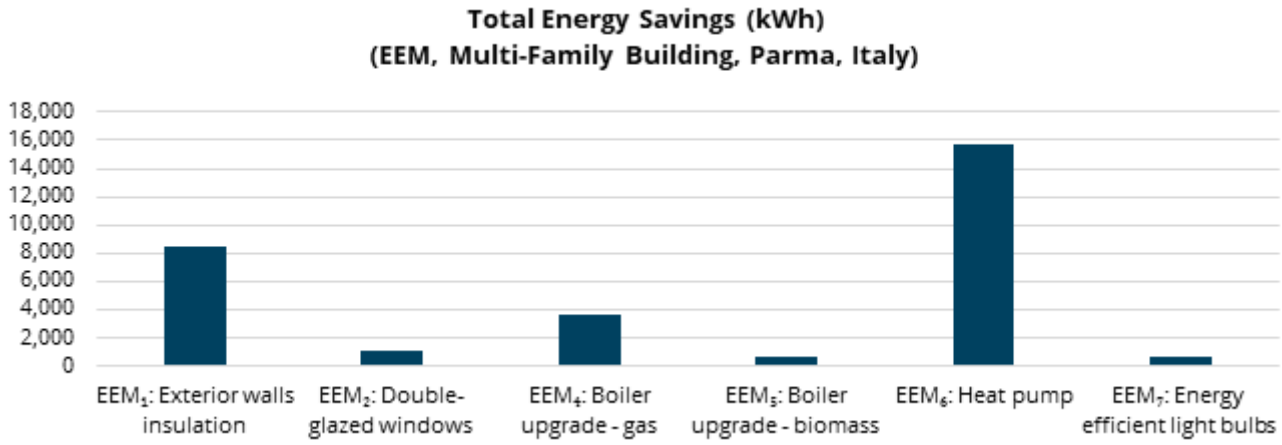

Figure 3:Total Energy Savings in Parma for Multi-family buildings and each energy efficiency measures

Economic Benefits and Return on Investment

This section outlines the indicators used to highlight the economic benefits of each energy efficiency measure. The key indicators considered are:

1. **Investment Costs (€):** Represents the total expenditure required to implement a specific project or intervention, including initial costs for materials, labour, installation, and other related expenses.
2. **Useful Life (Years):** Estimates the period during which the investment or installation (e.g., heating or thermal insulation system) remains effective and functional before requiring significant repairs or replacements.
3. **Discount Rate (%):** The percentage used to discount future cash flows, calculating the present value of anticipated savings or earnings while accounting for inflation and the cost of capital or expected return rate.
4. **Net Present Value (NPV) (€):** The difference between the present value of future cash flows generated by the investment and its initial cost. A positive NPV indicates a profitable investment, serving as a critical indicator for evaluating a project's cost-effectiveness.
5. **Payback Period (Years):** The time required to recover the initial investment through the savings or benefits generated. This reflects the number of years it takes for economic returns to offset costs.
6. **Levelized Cost of Energy Saved (LCSE):** Measures the cost per kWh of energy saved, calculated by dividing the total investment cost by the energy saved over the useful life of the intervention. This facilitates comparison of the economic efficiency of different measures.

Single-Family Buildings

According to the DREEM model, developed by the University of Piraeus Research Centre (UPRC), it is shown that the best money-saving upgrades are roof insulation and switching to a biomass boiler. These give the highest financial return over time.

On the other hand, adding insulation to outside walls or changing windows to double-glazed ones actually lose money unless there's financial help, like government subsidies. The cheapest upgrades for each unit of energy saved are using energy-saving light bulbs and adding roof insulation. These also pay for themselves the fastest - light bulbs in less than half a year, and roof insulation in about 2.5 years.

The table below outlines investment costs, useful life, discount rate, NPV, payback period and levelized cost of energy saved (LCSE) for single-family buildings, in the absence of subsidies.

Table 3: Table reporting energy efficiency measure and respective Investment Costs, Useful Life, Discount Rate, NPV, Payback Period, Levelized Cosy of Energy Saved for Single-family buildings

Energy Efre	Investment Costs (€)	Useful Life (Years)	Discount Rate (%)	NPV (€)	Payback Period (Years)	Levelized Cost of Energy Saved (€/kWh)
EEM1: Insulation of External Walls	22,013	30	4.00%	-13,072.3	>Lifetime	0.270
EEM2: Double-Glazed Windows	4,313	30	4.00%	-3,615.0	>Lifetime	0.679
EEM3: Roof Insulation	2,762	30	4.00%	17,765.9	2.5	0.015
EEM4: Gas Boiler Upgrade	735	20	4.00%	3,364.8	2.6	0.044
EEM5: Biomass Boiler Upgrade	3,500	20	4.00%	7,568.6	4.8	0.233
EEM6: Heat Pump	6,000	20	4.00%	3,078.9	11.4	0.036
EEM7: Energy-Efficient Light Bulbs	60	23	4.00%	1,871.6	0.4	0.009

Multi-Family Buildings

In apartment buildings, the upgrades that bring the most overall profit are upgrading the biomass boiler (net present value, or NPV, €6,777.5) and installing a heat pump (NPV €4,836.3). Looking at the cost of the energy you get after the upgrade (LCSE), the best options are energy-efficient light bulbs at €0.007/kWh and heat pumps at €0.041/kWh. These choices also pay back quickly: light bulbs recover their cost in about 0.4 years (around five months) and gas boiler upgrades in about 2.5 years. By contrast, external wall insulation and swapping old windows for double-glazing don't pay for themselves without subsidies, because their NPVs are negative (the savings don't cover the total cost).
The table below outlines investment costs, useful life, discount rate, NPV, payback period and LCSE for multi-family buildings, in the absence of subsidies.

Table 4:Table reporting energy efficiency measures and respective Investment Costs, Useful Life, Discount Rate, NPV, Payback Period, Levelized Cost of Energy Saved for Multi-family buildings

Energy Efficiency Measure	Investment Costs (€)	Useful Life (Years)	Discount Rate (%)	NPV (€)	Payback Period (Years)	Levelized Cost of Energy Saved (€/kWh)
EEM1: Insulation of External Walls	18,943	30	4.00%	-2,177.8	>Lifetime	0.130
EEM2: Double-Glazed Windows	2,200	30	4.00%	-552.2	>Lifetime	0.151
EEM4: Gas Boiler Upgrade	735	20	4.00%	3,789.5	2.5	0.044
EEM5: Biomass Boiler Upgrade	3,500	20	4.00%	6,777.5	5.2	0.621
EEM6: Heat Pump	6,000	20	4.00%	4,836.3	9.1	0.041
EEM7: Energy-Efficient Light Bulbs	75	23	4.00%	2,643.9	0.4	0.007

To better understand how and where a building uses and wastes energy, we carry out energy audits and issue an Energy Performance Certificate (EPC). A qualified technician reviews documents and systems, visits the property (walls, windows, insulation, heating/cooling), and uses certified software to calculate performance, assign an energy class, estimate consumption and CO_2 emissions, and suggest improvements.

To reflect local building diversity, we analyzed a range of homes (single- and multi-family, condominiums from different periods) with both individual and central heating. In total, 24 apartments in rural municipalities were inspected, collecting data on climate, the building envelope (walls, floors, windows), and HVAC systems to build a reliable building-system model.The result was 24 EPCs plus streamlined “expeditious audits” that combine audit findings with EPC insights. These documents describe the current condition and point to the most cost-effective upgrades - such as insulation upgrades, window replacement, plant/system tuning or replacement, and control improvements - that reduce energy costs and emissions.

Expeditious Audit Results

Based on the energy audits described above, on typical rural Valtaro homes - including quick

checks that identified the best efficiency upgrades - we set out the following practical, ready-to-use intervention guidelines:

- Insulation of Vertical Opaque Envelopes (Walls): These interventions are often challenging due to high costs, long payback periods, and the aesthetic characteristics of many rural buildings, such as exposed stone walls. In such cases, less invasive and more cost-effective solutions are recommended, such as insulating floors adjoining attics (using insulating mats) or cellars, after verifying regulatory height requirements. These measures, while requiring lower investments, can reduce heat loss and achieve energy savings of 10-20%. For condominium buildings constructed between the 1960s and 1980s, characterised by poor thermal insulation, reinforced concrete frames, perforated or semi-solid brick walls, brick and concrete floors, and single-glazed aluminium or wooden windows, external insulation is a preferable solution. These buildings typically have high energy consumption (>180 kWh/m^2) and are generally not subject to landscape or technical constraints. In such cases, external wall insulation can be more cost-effective, as fixed costs (e.g., scaffolding and design) can be divided among multiple owners.
- Replacement of Windows and Doors: While this intervention involves significant initial costs and long payback periods, it offers benefits in terms of energy savings (5-10%) and improvements in safety and living comfort.
- Installation of Renewable Energy Sources and Efficient Heating Systems: The adoption of renewable energy sources, such as heat pumps combined with photovoltaic systems, is encouraged under the Energy Performance of Buildings Directive (EPBD, called “Green Homes”), approved in March 2024. These solutions are applicable even in rural settings but involve significant investments and are most efficient in well-insulated buildings (insulated envelope). Otherwise, hybrid systems, such as gas or LPG condensing boilers integrated with, or entirely replaced by, new-generation biomass systems, are more advantageous. Biomass systems can achieve savings of 15-30% and shorter payback times, especially when combined with local supply chains and incentives such as the Thermal Account (“Conto Termico”) or regional subsidies in Emilia-Romagna.
- Building Automation Systems: Advanced technologies can transform buildings into "smart buildings" through the use of sensors, platforms, and integrated control systems. Smart control systems automatically adjust heating and cooling to outdoor temperatures, switch lights and appliances on and off based on actual use, regulate air quality, and open or close blinds or shutters in response to natural light. They also boost safety by monitoring for fires and alarms. Costs are relatively low, payback is quick, and advanced setups can cut energy use by up to 30%.

3.4 Step 4 - How to finance energy renovations

Another important factor to consider when discussing energy renovation is the economic aspect. As is well known, the possibility of renovating a building is not only linked to the ability to organise the work or the various stages of the process, but also to the financial resources of those wishing to undertake such renovation. For this reason, it is good to know that you are not alone in this situation and that financial assistance is available, which each of us can apply for independently and autonomously, based on the specific circumstances of our own situation.

Funding Currently Available

At the time of writing, the main financing options available for energy renovation projects are tax deductions, including:

- **Ecobonus**: 50% deduction for the 1st house, depending on the type of intervention (e.g., thermal insulation, replacement of fixtures), valid until December 31, 2025.
- **Renovation Bonus**: 50% deduction for the 1st house on a maximum of €96,000, valid until December 31, 2025.
- **Furniture and Appliances Bonus**: 50% deduction on the purchase of furniture and large appliances up to €5,000, valid until 2025.
- **Bonus for the Removal of Architectural Barriers**: 75% deduction for installing lifts, stairlifts and ramps, valid until December 31, 2025.

There are three main ways to use tax incentives for energy upgrades. First, direct deductions reduce your personal taxes by part of the costs. Second, credit assignment lets you transfer the tax credit to a bank or company to get cash or an immediate discount. Third, the invoice discount gives you a price cut right on the bill, with the supplier later claiming the credit. These options, however, can be hard to access for low-income households or families in energy poverty due to a lack of initial capital. Looking ahead, it remains unclear what financing options will be available in 2025/2026. National plans - PNRR with the RePowerEU chapter, and the PNIEC[1] - set goals to fight energy poverty, cut emissions, and upgrade buildings, and new support measures are expected. Right now, EU cohesion funds do not finance renovations of private homes in the region. However, many Italian banks offer dedicated loans and mortgages on favourable terms to help pay for works like installing solar panels, adding insulation, replacing windows, and upgrading to more efficient heating systems.

[1] PNRR, REPowerEU, PNIEC: The *Piano Nazionale di Ripresa e Resilienza* (PNRR) is Italy's Recovery and Resilience Plan under NextGenerationEU. It was later amended to include a dedicated REPowerEU chapter, which redirects EU funds to speed up renewables deployment, reinforce energy infrastructure, and reduce dependence on imported fossil fuels after the 2022 energy crisis. This REPowerEU chapter is meant to deliver fast, measurable actions by 2026, including support for skills and technical capacity at local level. The *Piano Nazionale Integrato Energia e Clima* (PNIEC), which Italy notified in updated form to the European Commission in 2024, is the national energy and climate plan to 2030. It defines how much renewable capacity Italy intends to install, how much it plans to cut energy consumption, and how it will ensure energy security while phasing down fossil fuels. The updated version raises 2030 targets to above 130 GW of renewables and roughly 40% renewables in final energy use, and estimates over €170 billion in additional investments by 2030.

3.4 Step 4 - Possible complexities you may encounter

Identify and Overcome Barriers and Challenges

The energy renovation of buildings in Italy faces numerous barriers that require targeted strategies to address them. Among the primary obstacles that we found at the local level there are:

Economic Barriers:

High upfront costs - for insulation, new windows, or efficient heating - can put energy upgrades out of reach, especially for families with limited budgets. Public incentives (tax deductions and "building bonuses") help, but they can be hard for low-income households to access. Spreading costs over time with dedicated loans or subsidized mortgages is often more practical, and many banks now offer products tailored to energy renovations.

A key option is the State Guarantee Fund for the Purchase and Renovation of a First Home. It can guarantee up to 50% of a mortgage (up to €250,000) for all applicants, with better rates for specific groups: young couples (at least one under 35), people under 35 with non-standard contracts, single parents with minors, and tenants of public housing (IACPs). Applications are filed at participating banks using the official forms available from CONSAP S.p.A., the Department of the Treasury, and the banks themselves.

For households experiencing energy poverty, additional support may be available from third-sector organizations, such as RICREDITI, which offer a microcredit line for energy renovation. Another solution could be to guide RECs to stipulate in their statutes that a percentage of their revenues be used to finance the renovation of homes for people experiencing energy poverty. Energy Service Companies (ESCOs) are another route: they can finance and carry out the works, and homeowners repay them over time from the energy savings achieved, reducing or eliminating upfront costs.

Information Barriers:

Many owners simply don't know which energy-saving options, technologies, or tax incentives exist. Clear awareness campaigns are essential: they show the economic and environmental benefits and point people to help. A key reference is the ENEA website, which offers practical guides, tools, and up-to-date information on technologies and incentives. Free training - such as RENOVERTY courses - and low-cost energy advice or audits can further support owners in making smart, informed upgrades. In addition, you can search for websites offering articles, news and

in-depth information, such as the Sportello Energia Web, with which we have collaborated on the creation of a special section.

Administrative Barriers:

Bureaucratic procedures for obtaining permits, particularly for historic buildings or buildings subject to preservation constraints, are a significant deterrent. Simplifying regulations and establishing one-stop shops for permit management can streamline the authorisation process. At present, only one OSS is available in the Parma area, the Sportello Energia&Condomini, which offers free services to citizens, such as inspections with a thermal imaging camera to check heat dispersion and support to find out how to finance energy renovation.

Disagreements in Condominiums:

Conflicts among residents and a lack of interest often slow down the decision-making process for initiating renovation projects in apartment buildings. Generally, the majority required for the approval of works is 50% plus one of the votes of the condominiums present at the meeting. In some cases, a qualified majority of 66% or 75% may be required. Informational meetings with experts can help clarify the economic and living benefits of these interventions, fostering consensus.

Return on Investment:

Long payback times discourage many owners. Flexible financing that lets upgrades be repaid through future energy savings, or incentives that shorten payback, can boost uptake. Another option is to team up: join or create energy communities to pool resources, cut installation and maintenance costs, and make projects more affordable.

Shortage of Technical Skills:

A shortage of up-to-date skills can lower the quality of upgrades. Ongoing training for professionals is essential to apply new technologies correctly and follow current rules. To find reliable companies, beyond word of mouth, consult the Sportello Energia & Condomini directory.

Workshops held for the project confirmed the main obstacles: high costs, complex paperwork, and limited understanding of long-term benefits. Owners who joined audits shared both positives and negatives; many, especially older owners or where children are uninterested, focus only on immediate costs and delay action.

To address this, the pilot area will: run awareness campaigns at local events and through newsletters; promote Renewable Energy Communities (RECs) that state in their statutes that a percentage of their revenues will be used to finance the renovation so residents and small businesses can produce, share, and manage local clean energy; and partner with third-sector groups to support households experiencing energy poverty, also advising on microcredit.

Addressing complexities in the retrofitting process

Starting an energy renovation project involves various complexities, ranging from financial and technical difficulties to adapting to regulations, administrative complexity, and resistance to change. The **Sportello Energia & Condomini (OSS)** is the main point of reference that will inform, guide, advise and accompany you in your energy retrofitting processes, offering solutions to the difficulties that may be encountered and unblocking the possible obstacles across the different stages of the project. Thanks to the co-creation process, table 7 offers an analysis of potential risks that may emerge during an energy renovation project.

Table 5: Analysis of possible risks associated with energy renovation (from the co-creation process)

	RISK	SOLUTION	WHO	HOW
ENVIRONMENT DAMAGES	**Improper waste management or the presence of hazardous materials such as asbestos can pose significant challenges.**	To mitigate those risks, it's better to conduct an environmental assessment before starting works, hire certified removal specialists if required, and follow strict containment and disposal protocols.	Certified removal specialists	**- Preliminary site screening:** review the building's history and past reports; identify known or suspected asbestos, lead-based paints, PCBs, mineral wool, and decommissioned tanks. Inspection and sampling by certified technicians. **- Risk assessment and prioritization:** risk impact evaluation, areas to be contained, critical phases, and interactions with occupants/third parties. **- Engagement with the competent authorities** **- Site planning:** remove/remediate hazardous materials before energy-efficiency works. Removal, encapsulation, containment, transport, and disposal of waste. Air and environmental monitoring of the area under

				renovation. - **Post-remediation verification:** end-of-works environmental dossier, including technical reports, disposal certificates, monitoring results, waste traceability, and updates to the register of residual materials (if any) and to the drawings/plans.
ADMINISTRATIVE COMPLEXITY	**Complex and lengthy bureaucratic processes.**	Identify the most significant administrative barriers and propose policy changes to overcome them. Legislators at the national, regional and local levels should simplify bureaucratic procedures and regulations, avoiding conflicts with higher-level regulations.	Legislators at the national, regional and local levels	- National, regional and local stakeholders/actors should simplify bureaucratic procedures and regulations, avoiding conflicts with higher-level regulations.

SOCIAL CHALLENGES	**The renovation works can also cause physical and psychological discomfort for residents and neighbours: noise is one of the most common disturbances.**	It can be mitigated by scheduling noisier tasks during specific hours, avoiding early mornings or evenings, and temporarily isolating in quieter areas. Earplugs or noise-cancelling headphones can also help.	Construction workers, construction companies, households	- Develop co-creative solutions that balance individual needs while with renovation goals. Set a noise window in the site plan (e.g., 9:00–13:00, 15:00–18:00). - Notify residents weekly; provide quiet rooms/zones during peak works; offer earplugs on request.
	Dust and dirt generated by the work	It can be minimised by sealing affected areas with plastic sheeting or panels, using air purifiers to keep adjacent areas clean, and scheduling regular cleaning.	Construction workers, construction companies, households	- Seal work zones with plastic barriers and zipper doors; maintain negative pressure where feasible. - Use wet methods and HEPA vacuums; schedule daily cleaning of common areas. - Provide protective masks for those who visit the building
	Chemicals from materials used may emit strong smells or toxic fumes	They can be managed through proper ventilation and the use of eco-friendly, solvent-free materials.	Construction workers, construction companies	- Specify low-VOC, solvent-free products in the procurement specs. Ensure cross-ventilation (fans/extractors) and 24–48h curing periods before re-occupation.

	Reduction of living space	Reorganizing living spaces and using temporary storage for bulky items or planning the work in phases: this can ensure that not all areas are inaccessible at the same time, while temporary solutions, such as makeshift kitchens or emergency bathrooms, can reduce inconvenience.	Construction workers, construction companies, house holds	- Develop co-creative solutions that balance individual needs while with renovation goals. - Phase the works room-by-room; never block all key rooms at once. - Provide temporary setups (mini-kitchen, portable wardrobes); arrange off-site storage for bulky items.
	Interruptions to essential services such as electricity, water, or gas	These can be mitigated by planning for outages, conserving water, preparing meals in advance, or renting equipment like electric generators or water tanks if necessary.	Construction workers, construction companies, house holds	- Define clear roles and responsibilities to negotiate with all group members. - Engage local and reliable authorities or organizations to promote collaborations among households. - Appoint a trusted "community leader" or similar figure. In such cases, condominium administrators should mobilise to find impartial third parties who can facilitate dialogue among tenants and/or owners. - Prepare contingencies: power banks/generator, water tanks, and pre-cooked meals; keep one emergency bathroom available

	Renovation projects may also strain family or neighbourly relationships: Noise and prolonged inconveniences can create tensions.	Transparent communication with neighbours, including advance notice about the work and agreeing on suitable schedules, can help maintain good relations. Listening to complaints and finding shared solutions is essential to avoid conflicts.	Construction workers, construction companies, households	- Define clear roles and responsibilities to negotiate with all group members. - Engage local and reliable authorities or organizations to “pressure” families. - Appoint a trusted "community leader" or similar figure.

ECONOMIC	**Unexpected costs can arise during the works.**	To mitigate this risk, it's better to include a contingency budget of at least 10-15% in financial planning.	Households, banks (provision of advantageous green loans)	- Draft a document that allocates a budget for known-but-uncertain risks. If the project is poorly defined (preliminary stage), set the contingency at 15%; if it is detailed/mature (executive stage), you can reduce it to 10%. - When preparing an estimate, include a dedicated contingency line in the cost breakdown (do not spread it across individual items). - Maintain a Contingency Register updated weekly and iInclude variation clauses covering procedures, timing, pricing, and percentage limits. - Implement cost control using a cost baseline (budget at the start of works) and a monthly forecast. - Carry out additional investigations (surveys, systems tests) where uncertainty is high: better to spend a little now than a lot later.

	Impossibility of accessing loans, mortgages and incentives	To mitigate these risks, it is possible to seek out third sector organisations that offer support in finding funding or microcredit. It is also possible to search for RECs that dedicate part of their revenues to renovating buildings inhabited by people experiencing energy poverty or finance part of the work for those who will become part of the REC.	Households, banks, third sector entities	- Be precise about what you need. - Map actors that already touch vulnerable households . - Co-design a "micro line" that is realistic or find an entity which already provides microcredit. In Parma you can contact RICREDITI, which has a dedicated microcredits line for renovation.
TECHNICAL	**Inadequate initial energy analyses, which may result in interventions that fail to address the actual needs of the building, rendering them ineffective**	To mitigate this risk, you must have a comprehensive energy audit conducted by certified professionals, including thermal imaging, blower door testing, and detailed energy simulations. You can also improve your knowledge through the RENOVERTY training available on the Moodle platform for free. In addition, you can visit the Sportello Energia Web, where	Certified professionals	- Engage certified professionals with a clear scope: thermography, blower-door testing, measurements on building systems and envelope, and collection of actual consumption data (12–24 months). - Run energy simulations (a model calibrated to historical consumption) with scenario and sensitivity analyses; output: a prioritised list of measures with costs and benefits. - Arrange an external technical peer review of the report and the reference baseline.

		you will find articles and in-depth information on energy efficiency upgrades.		
	Incompatibility between the interventions and the building structure	To mitigate this risk, you may take in consideration the possibility to conduct a structural assessment and material analysis before finalizing the design. Opt for tailored solutions such as breathable insulation for historical buildings or lightweight panels for fragile structures.	Restorers and technicians trained in addressing challenges for those affected by energy poverty.	- Preliminary investigations (probes, non-destructive testing, materials analysis, moisture/salts; verification of loads and anchor points). - Tailored solutions: breathable insulation for historic buildings, lightweight panels for fragile structures, low-thickness systems. - Construction details validated before large-scale installation; approval by a structural engineer and, where required, heritage authorities.
	The use of poor-quality materials or insufficient integration of energy systems may also reduce the overall effectiveness of the interventions.	To mitigate all those risks it's better to engage experienced, certified contractors and require detailed execution plans, and specify high-quality, certified materials in contracts, and request product warranties.	Experienced, certified contractors	Important things to check: - Performance specifications: minimum ratings, certifications, technical datasheets, and required warranties. - Qualified suppliers with verifiable references; mandatory batch traceability.

	Lack of tools to carry out small DIY renovation works	To mitigate this risk, you can search for information on shops, chains and third sector organisations that offer the possibility of borrowing tools for free or at a low cost.	Households, shops, chains and third sector organisations	- In the town of Borgo Val di Taro, you can contact Emporio Solidale, which currently has a toolbox and a drill that it lends out free of charge.
EFFECTS	**Stress caused by delays, unforeseen expenses, or challenges in managing timelines**	Detailed planning, a realistic budget, a clear schedule, and regular communication with professionals can help minimise project-related anxiety.	Households and certified professionals	- Kick-off with objectives, constraints, and priorities (quality–cost–time). - Work Breakdown Structure: break the project into phases/activities with durations, dependencies, and owners. - Schedule: milestones, critical path, noisy/interruptive windows; update weekly. - Baseline budget with clear line items and a separate 10–15% contingency Updates: a 30-minute weekly call + a concise report (progress, risks, decisions).
		Engaging a general contractor to supervise the work is another effective strategy.	Households and certified professionals	- Define scope, responsibilities, and penalties. - Verifiable references on similar projects, PM team, insurance, and safety management. - Regular site meetings (weekly/biweekly) with minutes capturing actions, deadlines, and owners.

		Including financial and time buffers can help address unexpected issues	Households	- Dedicated 10–15% line in the cost plan, with usage rules and a movement log. - Best/base/worst scenarios to validate buffer sizing. - Alert thresholds: for example, if you use >50% of the contingency before 50% of the physical progress, trigger corrective actions.
		Monitoring expenses regularly and maintaining open communication with suppliers can prevent surprises and ensure effective budget control.	Households, workers, companies.	- Cost control: monthly comparison of budget (baseline), actuals, and forecast. - KPI dashboard: cost variance, percentage contingency committed, milestones on/off track. - Orders and contracts: fixed prices where possible; order confirmations with timelines, penalties, and payment terms.

Source: AISFOR srl

3.5 Step 5 – Phased planning: Plan your renovation

Below are our final - though by no means less important - considerations on timelines and work monitoring. Drawing on field audits and on-site research, we outline practical benchmarks you can reuse to plan efficient, well-coordinated energy renovations.

The time required to complete energy renovation interventions and achieve one or more energy class upgrades depends on the complexity of the work, bureaucratic processes, and the availability of contractors. General timelines are as follows:

- Design and Inspection (*1-3 months*): A qualified technician conducts an inspection to perform the energy diagnosis and develop the renovation project.
- Obtaining Permits and Funding (*1-6 months*): The duration depends on securing the necessary permits (e.g., SCIA or CILA) and, if applicable, on the approval of incentives and financing.
- Execution of the Works (*3-12 months*): Timing varies based on the complexity of the interventions. Simple measures, such as replacing fixtures or installing photovoltaic systems, can be completed in a few months, whereas more extensive projects, such as wall insulation or heating system replacement, may take longer.
- Final Energy Certification (*1-2 weeks*): Once the work is completed, a qualified technician drafts a new Energy Performance Certificate (EPC) to certify the building's improved energy class.

In total, the process may take 6 months to 1.5 years, with potential delays due to bureaucracy, material shortages, and/or labour availability. Based on the audits conducted, the average cost of the efficiency measures included in the certificates is approximately €29,500 per property unit, with a range between €13,000 and €52,000, depending on the size of the property and the interventions required. At the same time, when carrying out and overseeing the works, it's crucial to have a clear picture of how works should progress, and to know which indicators are best for tracking that progress. The table below therefore offers an interesting overview of all those possible indicators.

Table 6: Indicators to Monitor the Success of Energy Renovation

Indicators to Monitor the Success of Energy Renovation	
Energy Class:	• Measures the improvement in the building's energy classification (e.g., A+, A, B, C, etc.). • Reflects the overall efficiency of the building in terms of primary energy consumption. **An ideal improvement corresponds to a jump of at least two energy classes (e.g., from G to E).**
Energy Consumption per Square Meter (kWh/m²/year):	• Indicates the annual energy consumption for heating, cooling, domestic hot water, and lighting per $m^{2.}$ **Optimal values range between 50 and 90 kWh/m²/year.**
Reduction of CO_2 Emissions ($kgCO_2$/year):	• Quantifies the decrease in CO_2 emissions achieved through renovations. **An optimal reduction falls between 30% and 50%.**
Thermal Insulation (Thermal Transmittance U - W/m²K):	• Assesses the quality of thermal insulation in walls, roofs and windows. Lower values indicate greater efficiency in reducing heat loss. **Optimal values for thermal transmittance range between 0.20 and 0.30 W/m²K for walls and roofs.**
Share of Renewable Energy (%):	• Monitors the proportion of renewable energy in the building's total energy needs. **The goal is to achieve a renewable energy share of 30% to 50%.**
Efficiency of Heating and Cooling Systems (COP/EER):	• The Coefficient of Performance (COP) for heating and the Energy Efficiency Ratio (EER) for cooling measure system efficiency. Higher values represent greater efficiency.

	Recommended benchmarks are COP ≥ 4.0 and EER ≥ 3.5.
Return on Investment (ROI):	• Evaluates the time required to recoup renovation costs through energy savings. **An ideal ROI ranges between 5 and 10 years, <u>depending on the energy-saving measure implemented</u>.**
Economic Savings on Energy Bills (%):	• Compares pre- and post-renovation energy expenses to quantify actual savings. **The goal is a 20% to 50% reduction in energy bills.**
Living Comfort Indices (PMV, PPD):	• The Predicted Mean Vote (**PMV**) and the Predicted Percentage of Dissatisfied (**PPD**) measure thermal comfort as perceived by occupants. **Optimal ranges for PMV are between -0.5 and +0.5, while PPD should be below 10%.**

Congratulations, you have arrived at the end of this guide. Please bear in mind that once you decide to undertake an energy renovation in your home, it is necessary to understand your household's financial capacity to complete the project, taking into account applicable grants and subsidies. At an economic level, although the subsidies in this guide are received in full at the end of the process, the financing methods mentioned in previous sections allow the funds to be advanced and can make your renovations more feasible. In parallel, you can contact professionals which can generate a complete renovation offer (audit, advice on feasibility and all the different solutions, cost optimisation, project completion, construction management) and construction companies that perform the work. The works require licenses to be processed at the municipality's town hall and the payment of the related fees. Finally, assessing the general complexities and drawbacks the process may entail is crucial to implementing mitigation measures and ensuring a smooth, satisfying renovation experience.

Don't forget! As written throughout this guide, **the Sportello Energia & Condomini (OSS)** households like yours during this process and help you address the possible complexities that may arise during the different stages of energy renovation**.**

Now, it is your turn to plan your renovation! As a reminder, here are some useful steps to keep in mind while planning!

1. Seek advice	What day do I plan a visit or contact the Sportello Energia & Condomini (OSS)?	1. General help desk: https://www.sportelloenergiaparma.eu/ 2. List of professionals: https://www.sportelloenergiaparma.eu/galleria-professionisti/ 3. List of construction companies: https://www.sportelloenergiaparma.eu/galleria-imprese/
2. Look for professionals and budgets	How many professionals and budgets will you contact and when? Can the professionals apply for grants, or will you do it with the Sportello Energia & Condomini (OSS)?	Look for professionals: 1. Order of Architects: https://www.archiparma 2. Order of Engineers: https://ordingparma.it/ 3. List of construction companies: https://www.sportelloenergiaparma.eu/galleria-imprese/
3. Select the most appropriate measures	Do you know which measures might work best for you? What measures suit you better in terms of energy savings and economic viability?	Check sections 3.3 Examples of renovation measures you can implement and associated costs, and 3.4 How to finance the energy renovation of your dwelling.
4. Check the main complexities the process may have	What inconveniences can you find in the process?	Check section 3.5 Possible complexities you may encounter and keep yourself prepared!


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