28/10/25

RENOVERTY

Rural Energy Efficiency Roadmap (REER) for the energy renovation of family homes in the area of Sveta Nedjelja and Žumberak, Croatia: A step by step renovation guideline

Co-funded by the European Union under project ID 101077272. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.

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Published in 2025 by RENOVERTY.

Editorial team

REGEA

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1. INTRODUCTION

Do you live in a family house that feels too cold in winter or too warm in summer? Do you feel that your monthly energy bills are too high? Have you ever thought about improving the comfort of your home, but stopped because the process seemed complicated or too expensive?

If so, this guide is for you!

This renovation roadmap has been developed within the **RENOVERTY project** [1], as a practical guide for households in the **City of Sveta Nedelja** and the **Municipality of Žumberak** who would like to renovate their homes, save energy and improve their living comfort.

Through simple steps, this guide will help you:

- Understand what an **energy renovation** means and how it can improve your home;
- Learn **which measures** are most effective in reducing energy costs;
- Discover **who can help** you with technical advice and documentation;
- Find out **how to finance** the renovation of your home;
- Get familiar with **potential obstacles** and how to overcome them.

This roadmap builds on real experiences from the two pilot areas, **Sveta Nedelja**, a fast-developing town near Zagreb, and **Žumberak**, a rural municipality with dispersed settlements and older housing stock.

Although the two areas differ in many ways, both show that energy renovation is essential for reducing energy bills, improving living comfort and combating **energy poverty** in rural and peri-urban Croatia.

2. ENERGY RENOVATION OF DWELLINGS

Before starting, it's good to understand what *energy renovation* really means and why it matters for your household.

Energy renovation means improving your home to make it **more energy-efficient, comfortable and environmentally friendly**. It usually includes measures such as:

- **insulating** exterior walls, roofs and floors to prevent heat loss,
- **replacing old windows and doors** with energy-efficient ones,
- **upgrading heating systems** to modern, energy-saving solutions such as **heat pumps or biomass boilers**,
- **installing renewable energy systems**, like **solar panels** for electricity or hot water, and
- improving **lighting and appliances** to reduce unnecessary electricity consumption.

By making these improvements, you can **lower your energy bills**, **reduce your carbon footprint** and enjoy a **warmer, healthier and more comfortable home all year round**.

However, while the benefits of renovation are significant, it's also important to be aware of some challenges. For example, the **initial costs** of works can seem high, and it might take time before you notice savings on your energy bills. Additionally, it can sometimes be difficult to **find reliable professionals**, or to **understand the available grant programmes and financing options**.

But don't worry, this guide will help you through every step of the process and show you **where to look for advice, support and funding**.

In rural and peri-urban areas such as **Sveta Nedelja** and **Žumberak**, energy renovation can make an even bigger difference. Many family houses in these areas were built decades ago, often without insulation and with outdated heating systems. That means higher energy use, lower comfort and higher monthly bills, especially during the cold season. Through renovation, these homes can become **warmer, cheaper to maintain and more resilient** to rising energy prices. While some steps may require expert input or specific permits, most of the process can be managed with the right information and guidance.

In the next chapters, you'll find the **key steps to follow when renovating your home**, from seeking advice and preparing documentation, to financing, implementation and overcoming common obstacles.

3. STEPS TO FOLLOW TO RENOVATE YOUR HOME

Renovating your home can seem complicated at first, as there are documents to collect, professionals to hire and financial decisions to make.

But don't worry! By following a few clear steps, you can make the process much easier and more successful. This chapter walks you through the key stages of energy renovation, explaining what to do, who can help you and what to expect along the way.

3.1. Step 1 – Seek advice

Before starting any work, it's important to get the right information and advice. Start by **checking the documentation for your home**:

- Proof of ownership,
- Building or occupancy permit, or a decision confirming the building's legal status,
- Proof of permanent residence (if required for certain funding schemes).

If you are unsure whether your building is legal or if some documents are missing, you can check through:

- The **Physical Planning Information System (ISPU)** [2] - https://ispu.mgipu.hr,
- The **Joint Information System of Land Registry and Cadastre (ZIS OSS)**[3]- https://gov.hr.

For guidance and support, you can contact:

- Your **local government office** (City of Sveta Nedelja or Municipality of Žumberak),
- The **Local Action Group (LAG Sava or LAG Vallis Colapis)**,
- **North-West Croatia Regional Energy and Climate Agency (REGEA)**,
- The **Environmental Protection and Energy Efficiency Fund (FZOEU)** – www.fzoeu.hr.

These institutions can help you check your building's documentation, prepare for an energy audit and find available financial programmes.

3.2. Step 2 – Look for professionals

Once you know the legal status of your home, the next step is to get a **professional energy audit**. An **energy certifier** will assess your home's condition and issue an **Energy Performance Certificate** [2], showing your home's energy class (from A+ to G) and recommending measures to reduce energy use.

This assessment is important because it helps you:

- understand how much energy your home consumes,
- see where most of the energy is lost (walls, roof, windows, heating),
- get a list of possible measures to improve efficiency.

You can find authorised certifiers in the **Energy Certificate Information System** [4] – https://eenergetskicertifikat.mpgi.hr.

Typical cost of an audit for a family house is **€200–350**, but in most national calls (for example those by FZOEU), the cost is **partly or fully covered**.

Besides the certifier, you might also need:

- **Architects and engineers** to prepare technical documentation,
- **Project managers** to coordinate the works,
- **Certified contractors** to carry out insulation, heating, or solar installation works,
- **Supervisors** to ensure quality control.

Always check references, licences and past experience of the professionals before signing a contract.

3.3. Step 3 - Look for information on costs and savings

I. Sub step 3.1 – Common measure of renovation

Energy renovation can include a range of improvements. The exact combination depends on the condition of your home, your heating system and the resources available.

Table 1: Areas of renovation and corresponding measures

Area of renovation	Types of **measures**	**Purpose**

Building envelope	Insulation of walls, roof and floors; replacement of windows and doors	Reduce heat loss and improve comfort
Heating and hot water	Replacing wood or gas boilers with biomass boilers or heat pumps	Lower heating costs and improve indoor air quality
Electricity and lighting	Replacing old light bulbs with LED lighting and using efficient appliances	Reduce electricity consumption
Renewable energy	Installing solar panels for electricity or domestic hot water	Produce clean energy and reduce dependence on fossil fuels

If you're just beginning, you can start small (for example, improving lighting or sealing windows) and plan a more comprehensive renovation step by step.

II. Sub step 3.2

When planning your renovation, make sure you receive advice on how to achieve the following key **objectives**:

- **Reduce energy consumption** through insulation and efficient heating systems
- **Improve living comfort** by ensuring stable indoor temperatures all year round
- **Protect your health** by preventing moisture, mould and drafts
- **Lower monthly energy bills** and make your home more affordable to maintain
- **Increase property value** through higher energy performance and better comfort
- **Contribute to a cleaner environment** by using renewable energy and reducing emissions

Every home is different, so the best combination of measures depends on your home's type, heating system and location.

III. Sub step 3.3

As part of the **RENOVERTY project**, detailed simulations were carried out for typical family houses in **Sveta Nedelja** and **Žumberak** using the **DREEM model** (Dynamic high-Resolution dEmand-sidE Management model).

Table 2: Assessment of the feasibility of individual implementation of various energy renovation measures for family houses using firewood

	Investment Cost (€)	Lifespan (years)	Reduction of energy consumption (kWh/year)	Energy savings (%)	Payback period (year)
Exterior wall insulation	4,847	30	**5,814**	**10.1**	20.7
Double-glazed windows	3,584	30	**1,100**	**1.9**	>Lifespan
Roof insulation	4,788	30	**14,311**	**24.9**	6.4
Boiler upgrade to biomass	3,657	20	**9,724**	**16.9**	8.2
Boiler upgrade to heat pump	10,000	20	**43,280**	**75.3**	13.7
LED lighting	45	23	**579**	**1.0**	0.7

The results show the potential energy savings, investment costs and payback periods for key renovation measures.

What do these results mean for your home?

- **The most effective measures** are those that combine **thermal insulation and efficient heating systems** as they bring the largest energy savings and improve comfort.
- **Heat pumps** show the highest energy savings (up to 75%), but they also require higher investment; grants and co-financing can make them affordable.
- **Insulation of the roof and walls** provides stable long-term benefits and improves living comfort, even if the financial return takes longer.
- **LED lighting** is the simplest and cheapest measure with an immediate effect on electricity bills.
- **Replacing old windows and doors** is best planned together with insulation to avoid heat loss and improve comfort.

Recommended approach:

1. **Start with low-cost actions** - LED lighting, sealing gaps, basic repairs.
2. **Plan insulation and heating upgrades together** - this ensures the best comfort and energy savings.
3. **Add renewable energy sources**, such as solar panels, to further reduce costs and dependence on fossil fuels.

By combining these measures, you can achieve up to **60–70% overall energy savings** and qualify for the **highest co-financing rates** under national programmes such as those of the Environmental Protection and Energy Efficiency Fund (FZOEU).

3.4. Step 4 - How to finance energy renovations

The financial aspect is often the biggest obstacle to starting an energy renovation, but there are several **national, local and community-level programmes** that can make your renovation affordable.

This section will help you understand where to look for financial support and how to combine different options.

⇒ **National funding schemes**

The main national programme that supports the energy renovation of family houses in Croatia is managed by the **Environmental Protection and Energy Efficiency Fund (FZOEU)**. The Fund regularly publishes **public calls** for co-financing energy renovation measures. These calls are open to homeowners who live in their homes permanently and have proof of building legality.

Typical support includes:

- **Grants covering up to 60–100% of total costs**, depending on the household's financial status.
- Eligible costs include: energy audits, project documentation, insulation works, heating system replacement, installation of solar systems and supervision.
- For households at risk of energy poverty, **100% financing** is often available.

You can check active and upcoming calls on the FZOEU website [5]: https://www.fzoeu.hr

Tip: Even if a call is not open at the moment, you can prepare in advance (e.g. collect your documentation, conduct an energy audit and contact professionals) so you're ready when the next call is announced.

⇒ **Local support and rural development**

Local self-government units, such as the **City of Sveta Nedelja** and the **Municipality of Žumberak**, can also provide support in the form of:

- Local subsidies for energy efficiency or renewable energy installations,
- Exemptions or reductions in local taxes and construction fees for households that renovate,

- Help with administrative procedures and tender applications.

In rural areas, **Local Action Groups (LAGs)** play a very important role in providing advice and coordinating local calls through rural development programmes.

Contact your local LAGs:

- **LAG Sava** – www.lagsava.hr
- **LAG Vallis Colapis** – leader.vallis-colapis.hr

They can connect you with experts, help you understand which funds are currently open and even assist you in preparing applications.

⇒ **Innovative and community-based models**

In addition to grants, there are **innovative ways to finance renovations** through cooperation with other households or organisations:

Table 3: Financing energy renovation

Model	Description	Where to learn more
Energy communities	Several households or public buildings jointly invest in renewable energy production (e.g. solar PV) and share the benefits.	www.energetske-zajednice.hr [6]
ESCO model	An Energy Service Company (ESCO) finances the works upfront and you gradually repay the investment through achieved energy savings.	https://www.enu.hr/ee-u-hrvatskoj/tko-je-tko-ee-rh/pruzatelji-energetske-usluge/ [7]
Bank loans or green financing	Some Croatian banks offer "green loans" or housing renovation loans with favourable interest rates.	Contact your local bank
EU programmes	Rural households and local authorities can apply for support via EU funds such as the European Regional Development Fund or LIFE Programme.	https://strukturnifondovi.hr [8]

Tip: Even if you are not eligible for full grants, combining **partial co-financing** with **ESCO services** or **community initiatives** can make renovation accessible with very little or no initial investment.

⇒ **Preparing your financing plan**

Before applying for any financial support, make sure you:

1. **Have your building documentation ready** (proof of ownership and legality).
2. **Conduct an energy audit** – most programmes require it.
3. **Get offers from certified professionals** for the planned works.
4. **Calculate your own contribution**, if needed, and explore possibilities for co-financing.
5. **Follow application deadlines** and keep copies of all submitted documents.

Remember, energy renovation is a long-term investment. With available support and careful planning, your renovation can pay off quickly through **lower monthly bills**, **increased comfort** and **higher property value**.

3.5. Step 5 - Possible complexities you may encounter

Starting an energy renovation project can be exciting, but it can also come with some unexpected challenges, from administrative procedures to financial or technical issues. The good news is that most of these can be solved with good preparation, clear information and the support of the right people.

Below are the most common **obstacles** that households in **Sveta Nedelja** and **Žumberak** may face, together with **practical solutions** and **who to contact for help**.

Table 4: Analysis of possible risks associated with energy renovation (from co-creation process)

Type of barrier	Risk / Challenge	How to overcome it	Who can help
Technical	The house may need additional works before energy renovation (e.g. old roof, damaged walls).	Ask a qualified engineer or architect to inspect the building before starting renovation. They can help you decide which works to do first and avoid later problems. Through RENOVERTY activities such as local advisory support and REGEA's expertise through PV Max project support, citizens can receive simple technical advice usually	Licensed designers or engineers, energy agency, LAG Sava or Vallis Colapis

		reserved for commercial clients, now adapted for households.	
Legal/ administrative	You're not sure which permits or documents you need for your renovation	Ask for assistance from a local authority responsible for building and energy matters and collect the necessary documents (e.g. proof of ownership, building permit, residence certificate) early. Use the online portals ISPU and ZIS OSS.	Local authorities, LAG Sava or Vallis Colapis
Financial / Community	You don't have enough funds to start renovation or are unsure how to apply for grants. Moreover, you are afraid you may face unexpected expenses once the renovation starts	Check the latest public calls by FZOEU which can cover up to 100% for vulnerable households covering the costs of energy renovation measures. You can also ask your LAG for advice on current financial support. Consider phased renovation or ESCO or energy community models. In addition, consider joining or learning from local renewable energy communities, such as the Energy community Sava established through RENOVERTY project, which provides practical example of joint investment in solar energy and benefit from shared resources. Moreover, keep a small financial reserve of around 10-15% in your budget to cover any unforeseen expenses during the renovation (e.g. due to hidden damage or additional repairs that were not planned).	Environmental Protection and Energy Efficiency Fund (FZOEU), local authorities, LAG, Energy community Sava, energy agency
Community/ Social	You don't know who to trust or where to start when finding reliable professionals.	Use official registries of certified experts (energy certifiers, contractors) and always request references and written offers. You can also ask your neighbours or LAG for recommendations or seek for advice from trusted experts (energy agency).	Ministry of Physical Planning, Construction and State Assets (MPGI), Croatian Chamber of Economy

			(HGK), LAG, energy agency
Behavioural / Awareness	Renovation seems complicated or you're not convinced it will pay off.	Contact your local LAG or city office before applying. They can explain the forms, deadlines and help you prepare the paperwork. Attend local info sessions and online trainings for households developed through RENOVERTY (available at: https://renoverty.aisforacademy.eu/?lang=en&utm) which offer simple guidance and practical tips for planning and carrying out your renovation.	LAGs, local authorities, energy agency

Practical advice:

- Before you start, create a simple **timeline** of your renovation with the expected duration of each phase.
- Keep a **record of all communications and offers** - this makes later steps smoother.
- Don't hesitate to ask questions - every programme and every home is a bit different!

The **Local Action Groups** (LAG Sava and LAG Vallis Colapis) and the **energy agencies (REGEA)** are here to support households during this process.

They can help you interpret tender rules, find experts and even assist in preparing funding applications.

Remember: *Most barriers are not technical, they are procedural and can be solved through communication and coordination. With the right partners and planning, your renovation will go smoothly from start to finish.*

3.6. Step 6 – Phased planning: Plan your renovation

Once you have decided which measures to implement and secured financing, it's time to plan your renovation in detail.

A well-organised plan helps avoid delays, reduce costs and make the process as smooth as possible.

Energy renovation can be carried out **all at once** or **in several phases**, depending on your budget and priorities.

Phased renovation is often the best option for rural and peri-urban areas like **Sveta Nedelja** and **Žumberak**, allowing households to start with smaller, most cost-effective measures and expand later.

Table 5: Recommended renovation phases and timing

Phase	What to do	Suggested timing	Who can help
1. Preparation and advice	Gather documents, conduct an energy audit, and contact municipality or LAG for guidance.	1–2 months	LAG Sava, LAG Vallis Colapis, REGEA
2. Planning and design	Choose measures, obtain technical documentation and cost estimates.	2–3 months	Certified designers and engineers
3. Financing and application	Apply for available grants, secure co-financing.	1–3 months (depending on call deadlines)	Environmental Protection and Energy Efficiency Fund (FZOEU), municipality, LAG
4. Implementation	Carry out the works: insulation, heating system, renewables, supervision.	3–6 months	Contractors, project manager
5. After renovation	Inspection, submission of final documents, learning to use new systems.	1 month	Contractor, energy agency, energy advisor

Tip: Try to schedule major works such as facade insulation or roof replacement during spring or early autumn to avoid extreme temperatures and delays.

Minimising risks and disturbances during renovation

Renovation can temporarily disrupt everyday life, but good planning helps you minimise these inconveniences:

Table 6: Minimising risks and disturbances during renovation

Potential disturbance or risk	How to mitigate it
Noise and dust	Plan noisy works during daytime; close doors and windows; use protective covers.
Temporary loss of heating or water	Schedule replacements during warmer months; arrange temporary heating or water supply if needed.
Restricted access or safety risks	Keep work areas clearly marked; avoid storage of heavy materials in living areas; inform neighbours in advance.
Delays due to weather or supply issues	Build a small-time buffer (2-4 weeks) into your plan and confirm delivery dates early.
Unexpected additional costs	Keep a 10–15% contingency reserve and request all change in writing from the contractor.

Clear communication between the homeowner, contractor and project manager is key. Regular updates and on-site checks ensure that problems are detected early and resolved quickly.

Monitoring the success of your renovation

After works are completed, it's important to monitor how successful your renovation was - both in energy and comfort terms. The following table presents a set of key indicators that can be used to monitor and evaluate the success of your home renovation. Each indicator corresponds to one of the areas of renovation listed in Table 1, ensuring that all types of measures can be tracked over time.

Here are simple **indicators** you can use:

Table 7: Monitoring the success of your renovation

Indicator	How to measure it	Expected improvement
Energy consumption	Compare energy bills before and after renovation (kWh/year).	40–70% reduction in total energy use.
Indoor temperature stability	Measure temperature differences in summer and winter (°C).	More stable temperatures, fewer drafts.

Heating system efficiency	Check energy class of new system and average operating hours.	Up to 50% lower fuel use and better comfort.
Electricity and lightning efficiency	Compare annual electricity consumption from lightning and appliances before and after renovation (kWh/year).	20-40% reduction in electricity use for lightning and appliances.
Renewable energy generation	Measure annual electricity of heat produced by installed solar systems (kWh/year) and share of self-consumption.	Increased share of renewable energy use (up to 30-50% of household needs).
Comfort and satisfaction	Collect feedback from household members (simple survey).	Higher comfort, wellbeing and satisfaction.
Building value	Compare property valuation before and after works.	10–20% increase in property value.

Tip: Keep your energy bills, receipts and certificates as they can help you track results and can be used for future grant applications.

By planning your renovation carefully, monitoring progress and staying in touch with professionals, you can ensure that your investment pays off in comfort, savings and quality of life.

And remember - your local partners (**LAG Sava** and **LAG Vallis Colapis**) are always available to support you during every phase of the process.

3.7. Summary

Renovating your home is a big step, but also one of the most rewarding investments you can make for your comfort, finances and the environment.

This guide has shown that with the right information and support, every household, whether in **Sveta Nedelja**, **Žumberak**, or elsewhere, can successfully complete the process of energy renovation.

Below is a short summary of the main steps you should follow and who can support you along the way.

Table 8: Energy Renovation Journey: Step by Step

Step	What to do	Key goal	Who can help you

1. Seek advice	Check your building documentation, ask for expert help and learn about renovation options.	Understand what your home needs.	Local authorities, LAG Sava, LAG Vallis Colapis, REGEA
2. Look for professionals	Contact certified designers, engineers and contractors.	Ensure quality design and implementation.	Croatian Chamber of Economy, Ministry of Physical Planning, Construction and State Assets' register
3. Check costs and savings	Review energy audit results, identify key measures and estimate costs and benefits.	Plan your renovation efficiently and realistically.	Energy auditor, energy agency
4. Secure financing	Apply for national or local grants (FZOEU, LAG) or explore ESCO/energy community models.	Make renovation affordable.	Environmental Protection and Energy Efficiency Fund (FZOEU), LAGs, municipality
5. Manage risks and challenges	Anticipate administrative, financial, or technical issues and plan ahead.	Keep your renovation on track and avoid stress.	LAGs, local authorities, energy agency
6. Plan and monitor renovation	Set a realistic timeline, track bills and comfort after renovation and maintain your new systems.	Ensure lasting results and comfort for your family.	Contractor, project manager, energy agency

Final message

Energy renovation is not only about saving money, it's about **living better**. A renovated home means:

- Lower energy bills and greater financial security,
- A warmer, healthier and more comfortable living space,
- A higher-quality home for your family, and

- A meaningful contribution to protecting our environment.

You don’t have to do it alone, **local partners** such as **LAGs, local authorities and energy agencies** are here to guide you step by step, from the first idea to the completed renovation.

Now it’s your turn: start planning your renovation today and build a more efficient, comfortable and sustainable home for the future.

4. REFERENCES AND LINKS

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