# Deep REnovation roadmaps to decrease households VulnERability to Energy poveRty

Project No. 101076277

Training Material HandBook

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# About this document

This document presents the training program (definitions, trainees' groups, purpose and proposition of the training program an indicative agenda and training modules). The document sets out a framework for training of the personnel of One Stop Shops (OSSs) and REVERTER Ambassadors (RAs) in the four REVERTER pilots.

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# Executive summary

The EU-funded project REVERTER aims to contribute to the reduction of energy poverty and improvement of quality of life of people in Europe by providing homeowners, tenants and landlords with comprehensive information and realistic building renovation solutions. Eight specific objectives are set in the project description, some of which aim at capacity building and knowledge sharing by developing dedicated training programs and materials for different target groups, i.e., One-stop shop (OSS) personnel, REVERTER Ambassadors (RAs) and vulnerable households.

REVERTER will implement community engagement campaigns, trainings and will advise the identified households on improvement of their levels of comfort or reduction of energy consumption by low-cost measures.

More specifically, the objective of *Task 3.4. Setting up REVERTER Ambassadors and OSS personnel training program* is to establish training programs and related materials for the Energy Ambassadors and the personnel of the pilot OSSs. The training will focus on issues such as:

- social inclusion;
- no- or low-cost measures to cope with EP;
- simple technical issues of energy saving in households;
- energy financing mechanisms and innovative tools, etc.;
- establishment and operation of OSS.

The training program of the REVERTER project is directed to Energy Ambassadors and OSS personnel, who will advise energy-poor and vulnerable households on simple technical issues of energy saving in the home, retrofitting practices, benefits of retrofitting, energy financing mechanisms, and innovative tools, etc.

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# Glossary

| Abbreviation / acronym | Description |
|---|---|
| A2A | Air To Air |
| ASHP | Air Source Heat Pump |
| ASHRAE | American Society of Heating, Refrigerating, and Air-Conditioning Engineers |
| BESS | Battery Energy Storage System |
| BMS | Building Management System |
| BTU | British Thermal Unit |
| COP | Coefficient Of Performance |
| DC | Direct Current |
| DHW | Domestic Hot Water |
| DHW | Domestic Hot Water |
| DHW | Domestic Hot Water |
| EA | Energy Ambassadors |
| EE | Energy Efficiency |
| EE | Energy Efficiency |
| EER | Energy Efficiency Ratio |
| EP | Energy Poverty |
| EPC | Energy Performance Certificate |
| EPC | Energy Performance Certificate |
| EPS | Expanded Polystyrene |
| ESCO | Energy Saving Contract Organisation |
| ESCO | Energy Saving Contract Organisation |
| EU | European Union |
| GDPR | General Data Protection Regulation |

| | |
|---|---|
| GSHP | Ground Source Heat Pump |
| HHs | Households |
| HVAC | Heating, Ventilation, and Air Conditioning |
| IEA | International Energy Agency |
| LED | Light Emitting Diode |
| LPG | Liquified Petroleum Gas |
| MEPS | Moulded Expanded Polystyrene |
| OSS | One-stop shop |
| OSS | One Stop Shop |
| OSS | One Stop Shop |
| PIR | Polyisocyanurate |
| PUR | Polyurethane |
| PV | Photovoltaic |
| PVC | Polyvinyl Chloride |
| R&D | Research and |
| R&D | Research and |
| RES | Renewable Energy Sources |
| RES | Renewable Energy Sources |
| SCOP | Seasonal Coefficient Of Performance |
| SEER | Seasonal Energy Efficiency Ratio |
| SEER | Seasonal Energy Efficiency Ratio |
| XPS | Extruded Polystyrene |

# 1 Recipients of training

## 1.1 OSSs personnel

The OSS personnel will consist of staff members from the project partners, especially those responsible for the pilot implementation of the roadmaps. OSSs providers may be trained on how to operate the OSS. The OSSs providers can be permanent or fixed-term members of the staff. Besides project staff, municipal staff can also be trained by the project.

## 1.2 Energy Ambassadors

The Energy Ambassadors (EAs) could be:

- building managers;
- social workers for the municipalities;
- community members;
- frontline staff of energy suppliers;
- university students;
- staff from organisations assisting vulnerable households;
- elders of multi-family buildings;
- other.

Training material focuses on issues such as: social inclusion, no- or low-cost measures to cope with EP, simple technical issues of energy saving in households, retrofitting practices, benefits of retrofitting, energy financing mechanisms and innovative tools, etc.

# 2 REVERTER training program suggestion

The following table presents the training topics for the three target groups.

*Table 1. Proposed training topics*

| Training topic | Short description/sub-topics | OSS personnel | EAs | HHs |
|---|---|---|---|---|
| **I. National legislation** | National legislation and requirements in terms of minimal energy performances for buildings, thermal comfort conditions, etc. | ✓ | | |
| **II. Energy consumption in households** | 1. Basic energy concepts and units<br>2. Building envelope<br>3. Building installations<br>4. RES in households<br>- Solar systems for DHW<br>- PVs<br>- Geothermal energy | ✓ | ✓ | |
| **III. Step-by-Step Deep Renovation** | 1. Introduction to Deep Renovation<br>2. Building Assessment and Energy Auditing<br>3. Planning and Designing Deep Renovation Projects<br>4. Project Implementation and Management<br>5. Monitoring, Measurement, and Verification<br>6. Certification and Assessment | ✓ | ✓ | |
| **IV. Energy saving in households - best practices** | 1. Low-cost EE measures<br>2. Energy management systems and energy behavior tips - Smart meters, energy monitoring and control<br>- energy behavior change<br>3. Energy labelling<br>4. Benefits of retrofitting<br>5. Energy saving tools | ✓ | ✓ | ✓ leaflets |
| **V. Existing financial schemes and mechanisms at national/local level** | 1. Deep renovation measures<br>2. RES<br>3. Social grants | ✓ | ✓ | ✓ leaflets |

| | | | | |
|---|---|---|---|---|
| **VI. Communication and advising of vulnerable households** | 1. Who is energy poor and energy vulnerable<br>2. How to approach energy vulnerable households<br>3. Communication with energy vulnerable households<br>4. How to advise and support energy vulnerable households | ✔ | ✔ | |
| **VII. Establishment and operation of OSSs** | 1. Design<br>2. Set-up<br>3. Deployment<br>4. Marketing and communication<br>5. Management and monitoring | ✔ | | |

# 3 Training tools

## 3.1 Training tools

The tools to be used during the training of the OSS personnel and the EAs may include:

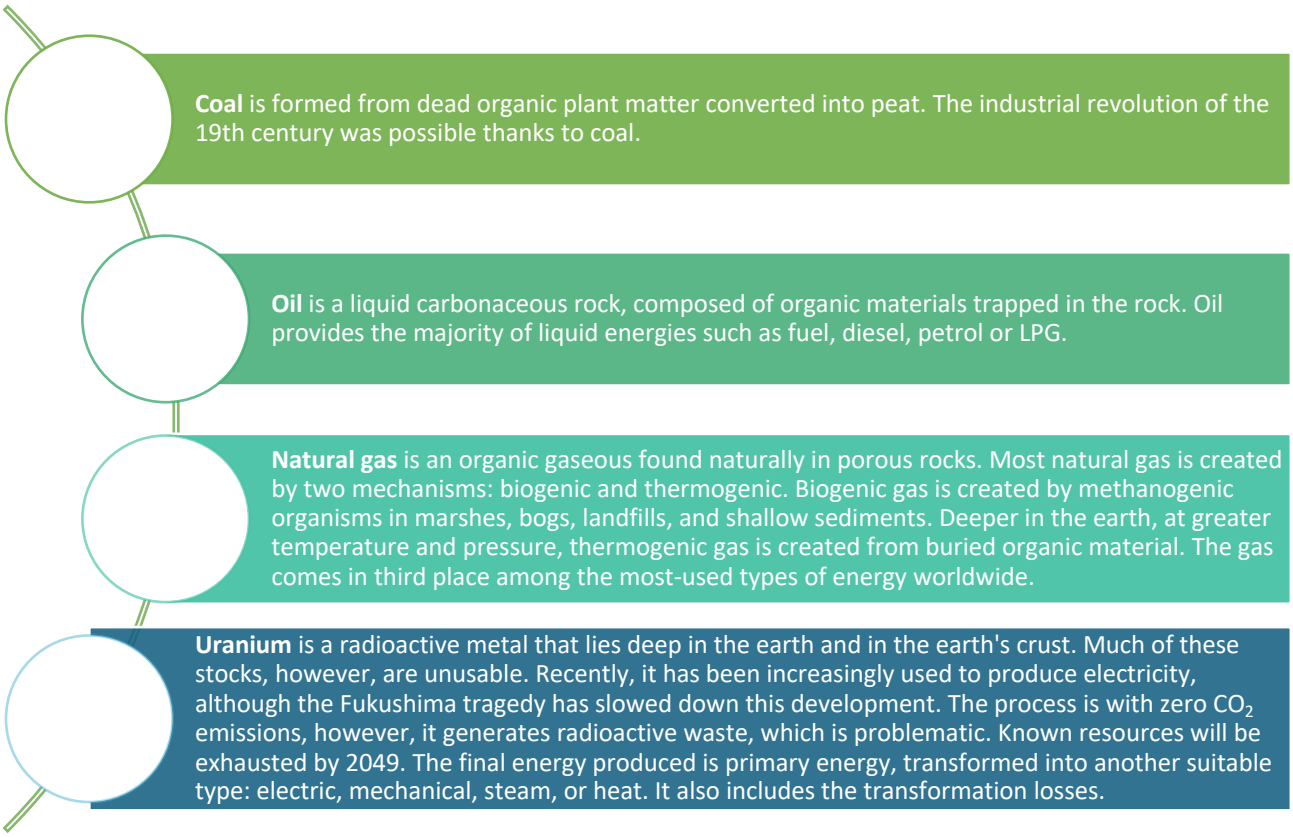
- Training materials as text documents;
- Training materials in ppt;
- Videos;
- Web-based, software tools or applications (if applicable);
- Leaflets;
- Questionnaire;
- Step-by-step guidelines for visits (for the EAs).

# 4 Energy consumption in households

## 4.1 Basic energy concepts and units

### 4.1.1 Primary and final energy

The primary energy consumption encompasses the utilization and losses incurred during energy transformations within the energy industries, such as power generation and refineries. On the other hand, final energy consumption represents the cumulative energy used in various sectors like industry (excluding the energy sector), transport, buildings (residential and services), and agriculture. This excludes the fuels employed by autoproducers for power generation.




Primary energy comprises both renewable and non-renewable forms in their natural state, while final energy consumption quantifies the total energy expended to satisfy the needs of end-use applications. Examples include the electricity consumed by a lightbulb or the fuel burned by a truck. Notably, final energy consumption measurements exclude transmission and distribution losses or inefficiencies, which are considered in the assessment of primary energy demand.

Figure 1 describes the difference between primary and final energy.

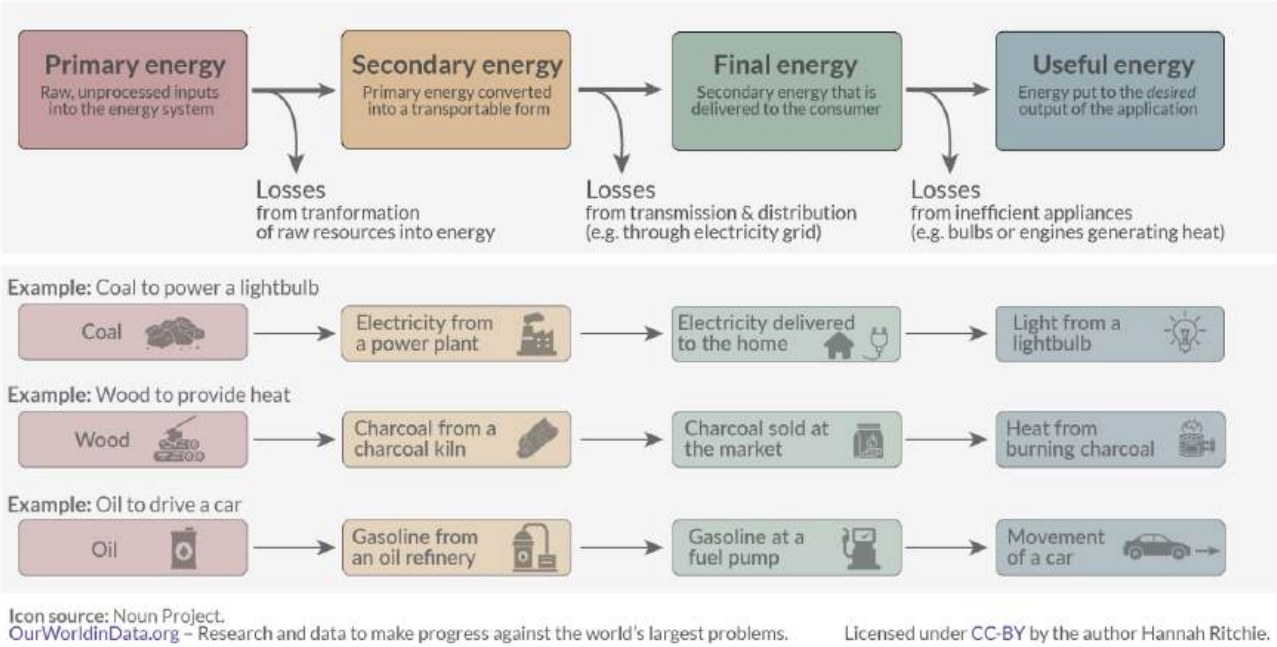



*Figure 1. Different types of energy (Source: OurWorldinData.org)*

## Energy content of different energy sources

Each energy source has a different energy content (calorific value).

*Table 2. Energy content of different types of energy sources*

| **Energy source** | **Energy content (calorific value), Q** |
|---|---|
| Natural gas (kg) | 13,1 kWh/kg |
| Natural gas ($m^3$) | 9,3 kWh/ $m^3$ |
| Liquefied Natural Gas (kg) | 12,55 kWh/kg |
| Liquefied natural gas (l) | 7,3 kWh/l |
| Oil (kg) | 11,75 kWh/kg |
| Oil (l) | 10 kWh/l |
| Wood (kg) | 3,88 kWh/kg |
| Black coal (kg) | 5,83 kWh/kg |
| Anthracite coal (kg) | 8,58 kWh/kg |
| Brown coal (l) | 2,9 kWh/l |

*Example of calculating the energy content in kilowatt hours of natural gas:* 1 000 $m^3$ of natural gas = 1 000 $m^3$ * 9,3 kWh / $m^3$ = 9 300 kWh

## $CO_2$ emissions from different types of energy sources

The environmental impact stemming from energy consumption can be quantified through $CO_2$ emissions, using emissions factors that indicate the amount of carbon dioxide produced per unit of energy from specific fuels. Below are the emission factors for commonly used fuels. In the case of electricity, emission factors vary annually at both national and European levels due to fluctuations in the energy mix used for electricity generation. To ensure precise conversion, it is essential to identify the appropriate emission factor for each country.

*Table 3. Ecological equivalence of the different energy sources*

| **Type of energy source** | **Ecological equivalence factor fi*** |
|---|---|
| | $gCO_2/kWh$ |
| Natural Gas | 220 |
| LPG | 290 |
| Biogas | 100 |
| Liquid biofuel | 70 |
| Hetiang oil | 290 |
| Coal | 360 |
| Anthracite | 360 |
| Woods | 40 |
| Pellets | 40 |
| Electricity | 486 |
| Heat from district heating | 290 |
| Renewable energy supplied by a carrier in place and nearby | 0 |

* The values are at national level. The source of the presented values is Bulgarian National methodology for calculating the energy performance of buildings.

## Units of Energy

*Table 4: Basic units of energy*

| **Unit** | **Description** |
|---|---|
| **Joule (J)** | The SI unit of energy is the **joule (J)** or **newton-meter (N * m)**. The joule is also the SI unit of work. Joule (J) - energy for mass lifting 1 kg per 1 m |

| | |
|---|---|
| **Calorie (Cal)** | Equivalent to 4 180 J - energy to raise the temperature of 1 g of water from 14°C to 15°C at a pressure of 1 atm. |
| **kilowatt hour (kWh)** | Equivalent to 3.6 x 106 J or 1 GJ = 277.777 kWh energy produced or consumed in kilowatt hours. |
| **Tonne of oil equivalent (toe)** | The equivalent quantity of energy produced during the burning of 1 tonne of oil 41 868 kJ, which is approximately 42 GJ. This unit is useful if different fuels are compared. 1 toe = 11.63 MWh = 41.868 GJ |
| **BTU** | The British thermal unit (BTU or Btu) is a measure of heat, which is a form of energy. It was originally defined as the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit. The SI unit for energy is the joule (J); one BTU equals about 1,055 J |

### 4.1.2 Heat exchange and material properties

Heat exchange is a process whereby heat transfers from a higher to a lower temperature body. Heat exchange takes place through:

- Thermal conductivity (solids);
- Convection (for fluids);
- Heat radiation

**Thermal conductivity: heat transfer by direct contact between two physical materials**

*Some materials transfer heat better than others. Example: If the panhandle on the stove is made of copper, it will be warm to the touch, because copper is a conductor of heat. If the handle is made of plastic, we won't feel the heat because plastic is a poor conductor of heat.*

**Convection:** Convective heat transfer, commonly known as convection, is the **process of transferring heat from one location to another** through the movement of fluids.

*In liquids and gases, convection typically stands as the primary mode of heat transfer. Despite being discussed separately, convective heat transfer encompasses the combined mechanisms of conduction (heat diffusion) and advection (heat transfer through bulk fluid flow).*

*Example: if you hold your hand above a flame, you feel warmth because the air is heated by the flames.*

**Radiation:** Transfer of heat by electromagnetic waves.

*Materials reflect more or less the thermal radiation they receive. Wood, for example, reflects more radiation than marble. This is why a wooden interior is warmer than a marble interior Example: The sun emits heat radiation. So, when the sun is shining, you feel the heat on the surface of the skin, but when a cloud hides the sun, you no longer feel the heat.*

**Heat transmittance:** The heat transmittance λ (lambda) expresses the amount of heat that passes through a material – 1 m² area, 1 second, 1 m thick, 1K (one degree) difference between the temperatures on both sides of the material under consideration.

*This feature characterizes the ability of each material to transfer thermal energy in the form of heat. Specific heat conductivity is a constant for all types of materials, except heat insulations. The lower the value of λ, the better thermo-insulation properties the corresponding material has. Very often the packaging of building materials is indicated by their thermal conductivity - λ.*

### 4.1.3 Energy consumption in households

According to *Eurostat* in 2021, households accounted for 27 % of final energy consumption in the EU. Most of the EU's final energy consumption in households was covered by natural gas (33.5%) and electricity (24.6%). Renewables accounted for 21.2%, followed by oil and petroleum products (9.5%) and derived heat (8.6%). A small proportion (2.5%) was still covered by coal products (solid fossil fuels).

- In 2021, households represented 27% of final energy consumption, or 18.6% of gross inland energy consumption, in the EU.
- In 2021, natural gas accounted for 33.5% of the EU final energy consumption in households, electricity for 24.6%, renewables and wastes for 21.2% and oil & petroleum products for 9.5%.
- The main use of energy by households in the EU in 2021 was for heating their homes (64.4% of final energy consumption in the residential sector), with renewables accounting for more than a quarter (27%) of EU households' space heating consumption.
- The biggest share of the household`s energy consumption relies on space heating, especially in the continental climate zone. Therefore, heating is the share of consumption that has the greatest reduction potential.

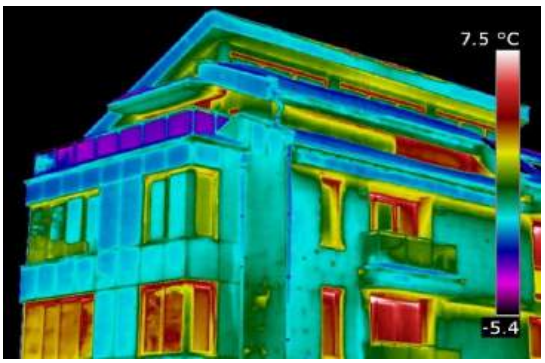
## 4.2 Building envelope

The building envelope acts as the physical barrier that separates the exterior and interior environments enclosing a structure. Typically, it consists of a combination of components and systems designed to shield the interior space from external environmental factors such as precipitation, wind, temperature, humidity, and ultraviolet radiation. The internal environment encompasses occupants, furnishings, building materials, lighting, machinery, equipment, and the HVAC (heating, ventilation, and air conditioning) system.

The building envelope performs various functions, which can be categorized into three main areas:

| Support | Control | Finish |
|---|---|---|
| • it ensures strength and rigidity, providing structural support against both internal and external loads and forces | • it controls the exchange of water, air, condensation, and heat between the interior and exterior of the building. | • it serves aesthetic purposes, enhancing the visual appeal of the structure while still fulfilling its support and control functions. |

### 4.2.1 Heat losses through building envelope




Heat losses in residential buildings are the result of heat exchange through the external enclosing elements, depending on their thermal conductivity and the difference between external and internal temperatures. Heat transfer takes place from the area with higher to the area with lower temperature.

Reducing heat loss through the building envelope depends on the local climate and the local energy needs - certain architectural principles guarantee high energy efficiency and a high standard of visuals, warmth and health comfort in the spaces where different activities are realized.

- Most of the heat losses are through the roof (more than 30%) and through the walls (more than 20%).
- The most effective energy-saving measure is optimizing the thermal insulation of the external walls.
- The combination of insulation solutions on external walls and roofs can lead to a reduction of up to 50% of heat losses.

Thermal insulation materials have the following important features:

- **Thermal conductivity (λ)** - characterizes the quality of a material as a conductor of heat. The thermal conductivity coefficient is W/mK and indicates how much heat (W) conducts a 1 m thick element at a temperature difference of 1 Kelvin (K). The lower the thermal conductivity of a material, the better the insulator is.
- **Thermal resistance** is the reciprocal of thermal conductivity (1/K) and is measured in mK/W. This is the temperature resistance for a unit thickness (per meter). Thus determined, this magnitude depends on the nature and thickness of the material, so the value is specific.
- **Heat transmittance** (U-value) - The quantity of thermal losses through the element is determined by the heat transfer coefficient U (U-value). It describes the amount of heat flowing through 1m² of an element when the temperature difference between the inner and outer surfaces is 1K. The unit is W/m²K.

*Table 5 Heat transmittance coefficient of different types of external walls*

| Types of multilayer elements | Total wall thickness | Heat transmittance coefficient, U W/(m²K) |
|---|---|---|
| **External wall - concrete, without insulation** | 25 cm. | 3,30 |
| **External wall - brick, without insulation** | 25 cm. | 1,26 |
| **External wall - brick with 5 cm EPS** | 30 cm. | 0,49 |
| **External wall – concrete with 5 cm EPS** | 30 cm. | 0,65 |
| **External wall - brick with 8 cm EPS** | 33 cm. | 0,33 |
| **External wall - brick with 10 cm EPS** | 35 cm. | 0,28 |
| **Wooden frame construction with 22 cm insulation** | 25 cm. | 0,19 |
| **Low energy wall with 46 cm insulation** | 49 cm. | 0,09 |

Major sources of losses in non-insulated buildings (although it depends on the specific conditions):

- Roof: about 25 to 30% of heat losses;
- Walls: about 20 to 25% of heat losses;
- Ventilation and infiltration: about 20 to 25% of heat losses;
- Windows: about 10 to 15% of heat losses;
- Thermal bridges: about 5 to 10% of heat losses

The most intensive heat losses within a building are through the roof (more than 30%) and through the walls (more than 20%).

Reducing heat loss through the building envelope, depending on the local climate and the local energy, needs certain architectural principles:

- external or internal insulation;
- roof insulation
- change of windows and doors
- improving air-tightness.

By implementing them we can achieve high energy efficiency, as well as a high standard of visual, warm and healthy comfort.

### 4.2.2 Infiltration and thermal bridges

The presence of a thermal bridge in the building leads to a greater heat transfer from the warmer to the colder surface of the building, therefore thermal bridges can significantly reduce the quality of the insulation. A classic thermal bridge is a balcony slab that passes through an insulated exterior

wall. Typical effects of thermal bridging are reduction of internal surface temperature; in the worst case, this can lead to an increase in humidity in parts of the structure. The percentages of heat losses are indicative and depend on the areas of the enclosing elements and their ratios to the total enclosing area of the building, as well as their thermal conductivity.

In the enclosing structure of each building, there are elements with higher thermal conductivity. They are set at the project level or appear in the construction process.

- Thermal bridges occur at: corners and edges, ceiling-to-wall connection, two-wall connection, or wall-to-floor connection;
- Thermostats increase heating costs as well as harmful emissions in the atmosphere;
- increase the risk of condensation, mould and fungi; damage to the structure; aesthetic problems;
- Thermal losses: about 5 to 10% of heat losses. Thermal bridges are formed when materials that are bad insulators are in contact with air and allow the airflow to pass through the created air "Path".

Thermal bridges should be removed by reduced profile cross-section, with materials having better insulating properties or by inserting an additional insulating element.

Infiltration air refers to the inadvertent and uncontrolled entry of outdoor air into an enclosed space. This occurrence results from cracks in the building envelope caused by pressure differentials between the interior and exterior environments. Even when doors or windows are intentionally opened for ventilation, the air entering through them is still considered infiltration. This phenomenon is more prevalent in winter when outside air is colder and denser than the air inside, influenced by factors such as wind velocity, wind direction, and the airtightness of the building envelope.

### 4.2.3 Different types of insulation

External wall insulation systems are materials that form the thermal envelope of a building. The primary objective of these insulation materials is to diminish heat transfer through walls, thereby reducing heat losses and, consequently, lowering the energy demand for heating. Thermal insulation, characterized by low thermal conductivity, typically below 0.1 W/mK, plays a crucial role in minimizing energy consumption in buildings by preventing heat loss through the building envelope.

An external wall insulation system involves the use of materials such as expanded polystyrene (extruded - XPS and expanded - EPS), mineral wool, polyurethane foam, or phenolic foam, combined with a reinforced cement-based, mineral, or synthetic plaster. Commonly used insulation materials include EPS, XPS, and mineral wool. Improving insulation, especially in existing buildings, can significantly reduce energy losses in both external walls and roofs. Insulation acts as a barrier against heat loss and gain, with its importance extending to protecting against summer heat in addition to winter cold in various climate zones.

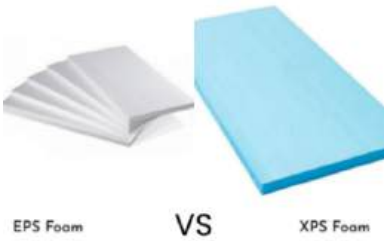
*Table 6. Market available insulation materials*

| Material | Thermal conductivity coefficients (typical values), λ, W/(m*K) |
|---|---|
| ***Fiberglass*** | • **0.046** W/(m*K) |
| ***Mineral wool*** | • **from 0.037 to 0.045** W/(m*K) |
| ***Cellulose insulation*** | • **0.040** W/(m*K) |
| ***Polyurethane foam / Polyisocyanurate*** | • **0.022** W/(m*K) |
| ***Polyisocyanurate*** | • **0.023** W/(m*K) |
| ***Expanded polystyrene (EPS)*** | • **from 0.031 to 0.037** W/(m*K) |
| ***Extruded polystyrene (XPS)*** | • **from 0.031 to 0.037** W/(m*K) |

A crucial characteristic of insulation materials is their ability to maintain R-value over time and continue providing insulation even when exposed to water for extended periods. Given that water is an efficient conductor of heat, water-soaked insulation loses its R-value. Additionally, if absorbed water undergoes freezing and thawing cycles, the insulation structure may deteriorate over time, compromising its structural integrity.

*Table 7. Different types of insulation materials*

| Type of insulation material | Description |
|---|---|
|  | **Fiberglass** is a commonly used insulation material in recent times. Fiberglass is a non-flammable insulating material. Moreover, it is an inexpensive insulation and is therefore a recommended option. |
|  | **Mineral wool** refers to several different types of insulation. It can refer to glass wool (made from natural sand and/or recycled glass), rock wool (made from basalt) or slag wool (made from the slag that is generated in steel foundries). Mineral wool can be purchased in the form of plates or rolls. Most forms of mineral wool do not have additives to make them fire-resistant, but it is not flammable by itself. |

| | |
|---|---|
|  | **Cellulose insulation** is undoubtedly one of the most environmentally friendly insulations. It is produced from recycled cardboard, paper and other similar materials, and is supplied in bulk form. Some recent research on cellulose has shown that it can be an excellent product for preventing fire damage. |
|  | **Polyisocyanurate** (PIR) is a thermoset type of plastic, a closed-cell foam that contains a low-conductivity gas without hydrochlorofluorocarbon in its cells. Polyisocyanurate insulation is available as a liquid, as a spray foam, and as rigid foam boards. It can also be produced as laminated insulation panels with a variety of surface finishes. |
|  | **Polystyrene** is commonly used to make foam, insulation boards, concrete insulation blocks or loose insulation from small balls. Moulded expanded polystyrene (MEPS) is often used as thermal insulation boards but is also available in bulk. Other polystyrene insulation material similar to MEPS is expanded polystyrene (EPS), graphite polystyrene (graphite EPS) and extruded polystyrene (XPS). |
|  | **Polyurethane** is an insulating material in the form of foam, which contains a gas with low thermal conductivity in its cells. Polyurethane foam for insulation is available in closed and<br>open-cell forms. In closed cell forms, the high-density cells are closed and filled with gas, which helps the foam to expand and fill the spaces around them. Open cell forms are not as dense and filled with air, giving this form of insulation a spongy structure and a lower R-value. |

Source: ComAct (2021). Inventory of energy efficiency technical measures for energy-poor households. Available at: https://www.oneplanetnetwork.org/sites/default/files/from-crm/d4.1-identification-and-analysis-of-technical-measures-.pdf

The selection of materials for building construction is influenced by a diverse range of factors. Here are three examples:

1. XPS (Extruded Polystyrene):
    - XPS is produced through a continuous extrusion process, resulting in a consistent closed-cell cross-section.

- The homogeneous structure of XPS contributes to its thermal and mechanical properties.

2. EPS (Expanded Polystyrene):
    - EPS is manufactured by expanding spherical beads in a mold, using heat and pressure to fuse the beads where they touch. Open spaces between the beads remain.
    - This method creates a structure with both closed and open cells, influencing its insulation characteristics.
3. Composite Insulated Panels (Sandwich Panels) with PIR/PUR Core:
    - Composite insulated panels consist of two rigid metal facings (typically steel or aluminum) with a core made of PIR/PUR foam insulation.
    - Rigid polyurethane (PUR) and polyisocyanurate (PIR) insulation products offer high effectiveness, low weight, excellent thermal conductivity, and a strong strength-to-weight ratio.
    - The closed-cell structure of the foam, with trapped gas having low thermal conductivity, contributes to excellent insulation.
    - During manufacturing, the PIR/PUR core expands, creating a robust semi-structural unit by bonding and laminating with the metal facings.
    - These panels provide superior thermal performance, ensuring continuous insulation and factory-engineered airtight joints.

In summary, the choice of building materials involves considering manufacturing processes, structural characteristics, and insulation properties. Each material, whether XPS, EPS, or composite insulated panels with a PIR/PUR core, has specific attributes that make it suitable for different applications in construction.

## ADVANTAGES:

- Efficient Heat Conservation: Substantially decrease heat loss and reduce the energy demand for heating, leading to a decrease in $CO_2$ emissions.
- Common and Effective Solution: External wall insulation is a widely adopted solution, delivering notable energy savings, particularly in colder climates, with an impressive payback period.
- No Reduction in Floor Area: Implementation of external wall insulation does not diminish the floor area of the building.
- Enhanced Sound Resistance: Improves the building's resistance to sound transmission.
- Extended Wall Longevity: Increases the lifespan of external walls.
- Non-disruptive Application: Application can be carried out without disrupting the household.
- Aesthetic Renewal: Revitalizes the appearance of external walls.

- Diverse Design Options: Offers a broad range of renders and decorative finishes, providing nearly limitless options for textures and colors..

**ENERGY SAVINGS:**

The percentage of energy savings is a function from:

- The thickness of the thermal insulation and the respective U–value;
- The climate zone;
- The size, type and gross floor area of surrounding external walls;
- Other energy-saving measures implemented.

**COSTS:**

The cost associated with wall insulation can fluctuate based on several factors, including the insulation type and thickness, facade intricacies and finish, labour costs, insulation manufacturer, and the country of origin. Notably, the overall cost is influenced by the building's height due to the expenses related to scaffolding. Typically, insulation costs are computed per square meter of the facade surface. Consequently, providing a comprehensive assessment of the payback period proves challenging, as it hinges on both the initial investment and the resulting savings.

### 4.2.4 Glazing

Glazing refers to a sealed construction comprising two or more windows separated by variously sized spacers, creating double (single) or triple glazing (two-chamber) glass configurations. Insulated glass units are produced with glass thickness ranging from 10 mm to 16 mm.

The primary purpose of glazing is to facilitate optimal natural light entry into a room while offering visibility to the outside. It plays a crucial role in preventing bidirectional heat transfer between the interior and exterior of a building, with a focus on retaining heat during winter and excluding heat in summer.

The area of the windows typically reaches about 25% of the area of the dwelling. If these 25% are covered with energy-efficient windows, the average winter temperature in the dwelling can rise by 4-5°C. Thus, windows have a great influence on the heat loss in the dwelling.

The glass area within a window typically ranges between 70% and 90%, significantly impacting the overall thermo-technical parameters of windows. Achieving excellent thermal insulation is a key objective in residential buildings, aiming to substantially reduce energy needs, heating losses, and associated costs.

Various types of double and triple glazing windows with distinctive features and U-values include:

- **White Float Glass**: Widely used in combination with other types, available in varying thicknesses (3 mm up to 10 mm).
- **Low-Emission Glass (K-Glass)**: Enhances overall energy efficiency with a high solar heat gain coefficient and visible transmittance, reducing the U-factor significantly.
- **All-Season Glass**: Offers optimal thermal insulation, sunlight control, and insulation capabilities for a comfortable environment throughout the year without a "greenhouse" effect. Characterized by high selectivity and a low coefficient of thermal conductivity.

- **Laminated Glass**: A multi-layered glass type joined by high-tension film, providing high soundproofing and safety as it does not break into pieces when damaged.
- **Reflective Glass**: Suitable for walls or roofs, increases solar control, and exhibits high resistance to scratching and staining.
- **Tinted Glass**: Available in blue, green, brown, and grey tints, suitable for windows and doors.
- **Argon Gas Windows**: Feature windows filled with argon gas between panes to enhance overall energy efficiency. Argon, being heavier than air, prevents frost at the window's bottom and improves soundproofing. Three-paneled argon-filled windows provide dual insulation layers.

These varied glass options offer solutions tailored to specific needs, combining functionality, energy efficiency, and aesthetic considerations. The heat that passes through 1 $m^2$ of the window surface is characterized by the U value, while the amount of solar energy that passes through 1 $m^2$ is represented by "g" (solar energy transmittance). The lower the value of U, the more solar energy passes through it.

*Table 8. Characteristics of different glazing types*

| | **Number of spacers** | **Transmission coefficient W/$m^2$K** | **Transmittance %** | **Solar factor** |
|---|---|---|---|---|
| Double glazing with white float glass – 24 mm | 1x16mm | 2.6 | 81.1 | 77.1 |
| Double glazing with white float glass and K-glass – 24 mm | 1x16mm | 1.1 | 79.3 | 61.3 |
| Double glazing with white float and high energy glass– 24 mm | 1x16mm | 1.1 | 66.2 | 42.5 |
| Triple glazing with three white float glasses – 36 mm | 2x12mm | 1.7 | 73.6 | 69.4 |
| Triple glazing with high-energy and two white glasses – 36 mm | 2x12mm | 0.7 | 58.9 | 37.9 |

**Types of glazing based on their efficiency:**

- **Inefficient glazing** - single glazing (U-values up to 5.8 W / $m^2$K) is considered very inefficient for windows glazing.
- **The energy-efficient glazing consists** of two or three layers of glasses separated by an air layer. (U-values from 1,20 W/$m^2$K to 1,70 W/$m^2$K))
- **The triple glazing** is considered high-efficiency (U-values from 0,4 to 1,1 W/$m^2$K)

*Table 9. Different types of joinery*

| Type | Description |
|---|---|
| **Wooden windows** | Excellent insulation characteristics; among the best materials for preserving the comfort of the home; the cheapest option - joinery of coniferous trees (white pine or spruce). Of the broad-leaved woods, the most used are oak and ash |
| **Double-glazed wooden windows** | Providing twice as good sound and heat insulation compared to traditional woodwork, and with no danger of condensation. It is produced from three-layer lamellas, and this prevents it from rolling, shrinking, and cracking |
| **Aluminium joinery** | Ensures durability and security, maintenance is easy and inexpensive, and does not require periodic painting. As a material, aluminium is an excellent conductor of heat and therefore heat loss in this type of window is greater. Quality aluminium windows require thermal insulating bridges in the profiles, which leads to their cost increase; |
| **PVC (PVC) joinery** | Very good heat and sound insulation properties. Maintenance is easy. The material is resistant to cold, heat, and chemicals. Greater and better energy performance is achieved with joinery with more internal chambers |
| **Combined joinery** | The most expensive option is joinery combining aluminium with wood. The wood is protected from atmospheric influences with an external aluminium lining on the profile. The best qualities of the two materials combine in aesthetic and functional terms |

## Important!

Regarding windows:

The "g"-values of windows exert a more significant impact on decreasing cooling demand than their U-values.

- For insulation:
  - There is a possibility that insulation may elevate cooling demand due to retained heat gains in the building.
  - The additional benefit of insulation in reducing cooling demand is most prominent in climates where heat reserves are minimized, achieved through external sunshades, efficient applications, and effective ventilation.
- In temperate climates, apart from the roof or top floor, the extra impact of insulation in reducing cooling demand is generally negligible.

## 4.3 Building installations

### 4.3.1 Heating devices and installations

Different means of heating are used to heat dwellings and buildings. Such systems could be centralized or decentralized, as well as individual or common (a common system for the whole building).

- Individual heating could be a heating stove, an electric heater, an air conditioner, another type of heat pump, or an individual boiler. Those heating solutions can be based on solid fuels, natural gas, oil, or electricity.
- Common heating systems could be a boiler that can run on biomass, oil, natural gas, or a heat pump.
- Centralised heating systems connected to district heating that runs on natural gas, solid, or liquid fuels. The decentralized heating systems could be grouped into two different types, depending on the location of the heat source, direct and indirect heating.

#### *4.3.1.1 Direct heating*

When the heat source is in the room that is being heated, the heating unit belongs to the group of direct heating devices. There are different types of direct heating devices:

- fireplaces;
- stoves;
- cast iron heaters;
- combined stoves;
- Electrical heaters;
- individual air-to-air heat pumps (air conditioners).

In this group of heating devices, part of the heat is transmitted directly to the air or water so as to heat the room. The heating source for this type of heating is mainly wood, wooden pellets, and coal or electricity.

- Systems (boilers, stoves, burners) with efficiency greater than 88-90 % are considered very efficient.
- Systems with efficiency lower than 88% are considered inefficient.
- Systems with efficiency between up to 70% are considered very inefficient.
- Electrical radiators or other electrical systems with an efficiency of 100 % are also considered inefficient (high-energy-consuming means of heating).

#### *4.3.1.2 Indirect heating*

The second group of heating systems includes different types of indirect heating. The heat source is outside the heated rooms. Most of the heat is transferred to a heat carrier (water or air) that is transported to the rooms to be heated by pipelines or ducts and heating units such as radiators, convectors/ fan coils. In the premises, the heat transfer medium indirectly or directly transfers part of the heat it transmits and returns it to the heat source. These are the systems with heating boilers, heat pumps, centralized heating.

- **Pellet boilers**

One of the most popular options for heating in houses is the use of wood pellets as a source of heat. They are small granules made from sawdust, agricultural or plant residues. These boilers are the most environmentally friendly appliances for solid fuel heating. Their burning efficiency reaches 90 % or more. In terms of convenience and cleanliness, they are easier to maintain and operate than traditional fireplaces. At the same time, the use of pellets leads to a reduction in greenhouse gas emissions. Their only disadvantage is the higher initial investment.

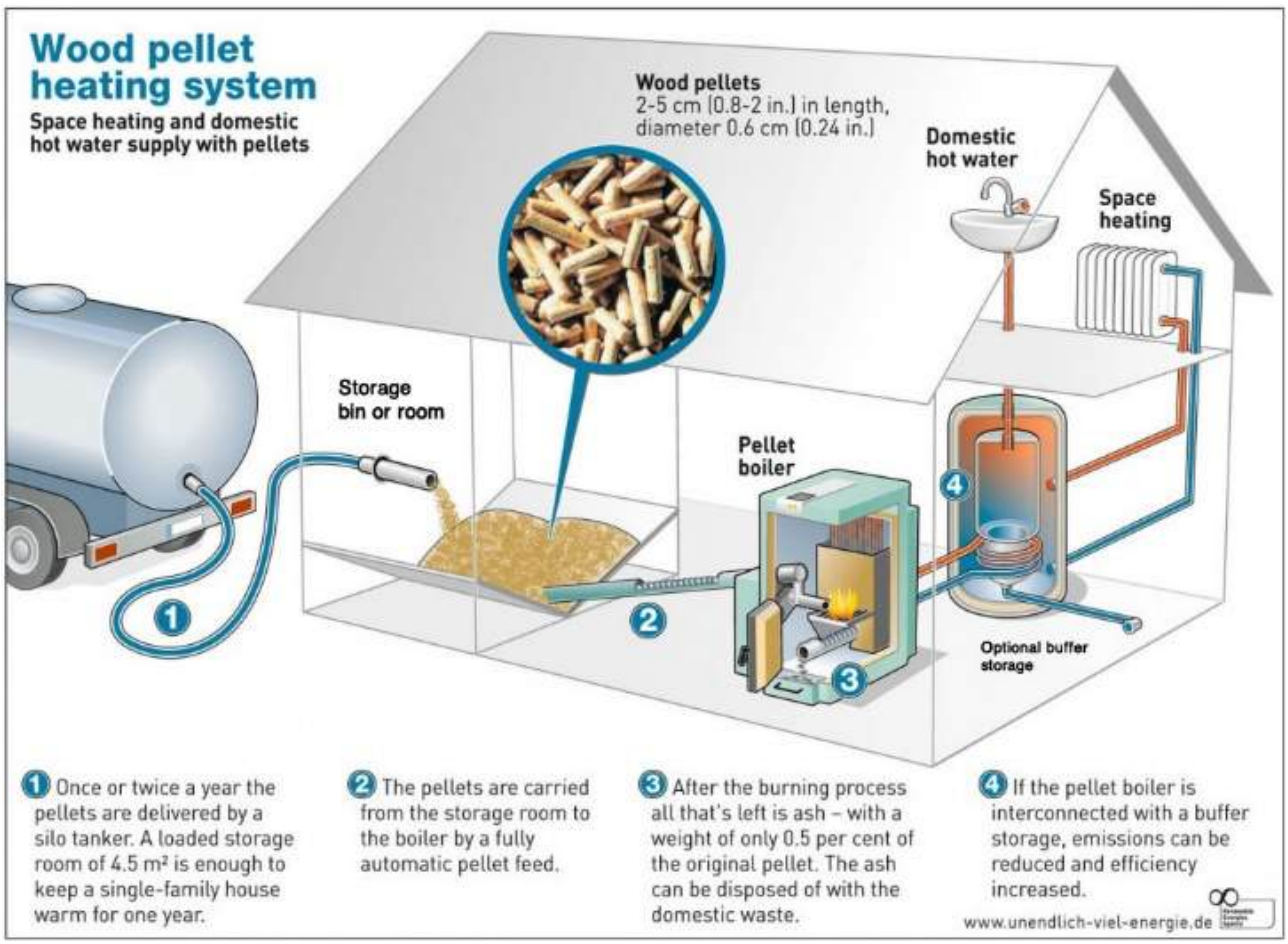



*Figure 2. Wood pellet heating system (Source: Biomass Magazine)*

As of 1 January 2022, reference Regulation (EC) 2015/1185, specific eco-design requirements are imposed for heating local solid fuel heating sources, namely: the seasonal energy efficiency of heating of local heating hot-fuel sources with a closed combustion chamber using pellets must be at least 79%. Seasonal energy efficiency means the relationship between the heating load covered

by a local heating fuel source and the annual energy consumption required to cover this load, expressed as a percentage.

- **Condensing gas boilers**

Condensing boilers, powered by gas or oil, function as water heaters with high efficiency, typically exceeding 90% of the higher heating value. Their efficiency is achieved by condensing water vapor in the exhaust gases, recovering the latent heat of vaporization that would otherwise be wasted. The condensed vapor exits the system as liquid water through a drain.

In a conventional boiler, fuel combustion produces hot gases that pass through a heat exchanger, transferring much of their heat to water and raising its temperature. Water vapor (steam) is a byproduct of burning the hydrogen content of the fuel. A condensing boiler enhances efficiency by extracting additional heat from waste gases through condensation of water vapor to liquid form, recovering its latent heat of vaporization. This process can result in a typical efficiency increase of 10-12%. The effectiveness of condensation varies based on the temperature of the water returning to the boiler but is always at least as efficient as a non-condensing boiler.

Manufacturers of condensing boilers claim potential thermal efficiency of up to 98%, in contrast to 70%-80% with conventional designs (based on the higher heating value of fuels). Typical models achieve efficiencies of about 90%, placing most brands of condensing gas boilers in the highest available categories for energy efficiency

In terms of economy and environmental friendliness, gas heating is one of the most practical solutions for the home. Despite the economy and environmental friendliness, natural gas heating remained a less popular solution due to the poorly developed gas distribution network. The modern market offers a wide range of gas heaters with automatic (using a sensor) and manual control.

**Condensing boilers - general characteristics**

The condensing gas boiler uses not only the heat from the combustion of the gas, but also the heat released when the water vapor in the fuel condenses

- Burner modulates: in the range from 12.5 to 100 % of the maximum power, which means high efficiency even at lower load
- Automatically adapts to required heat.

**Single circuit boilers**

- works only in heating mode.
- They have the option of connecting to an external boiler with a coil for heating hot water for DHW

**Double-circuit boilers with direct heating of domestic hot water**

- hot water is heated according to current consumption
- no heat loss
- water does not stagnate in the boiler.

**Double-circuit boilers with built-in water tank**

- with larger dimensions, but provide higher comfort of hot water without an additional boiler

- eliminate the need to wait for the water to heat up and provide a sufficient amount of hot water at the moment.
- Oil boilers

A boiler serves two primary functions: heating the air inside a home and providing hot water. In the case of an oil boiler, the combustion of oil in the combustion chamber warms up cold water through a heat exchanger. The process is similar to that of a gas boiler, and oil boilers can approach the efficiency levels of gas boilers. Building regulations mandate that new oil boilers must have an energy rating of at least 86%, or A+, and a condensing oil-fired boiler typically achieves an efficiency of 90% or higher. Oil is considered a more efficient fuel than gas because oil boilers utilize nearly all the heat generated from burning fuel, minimizing wastage.

The primary distinction between a gas and an oil boiler lies in how they store their fuel. A gas boiler, connected to the mains, has a continuous fuel supply and doesn't require fuel storage. Conversely, an oil boiler necessitates a tank to store oil until needed. Despite their efficiency, oil boilers are often considered less environmentally friendly compared to gas or electric alternatives.

In new buildings, oil heating systems are increasingly rare due to their overall inefficiency and higher annual heating costs, especially when compared to more efficient alternatives like heat pumps. A new condensing oil-fired boiler typically achieves an efficiency rating of 92% to 93%, surpassing non-condensing boilers at 85%, and older systems at 60% to 70%. Replacing an old heating system with a high-tech heat pump can lead to significant savings, with a potential 30% reduction in annual heating costs when utilizing outdoor reset control and proper heat loss calculation, and over 270% compared to a modern heat pump.

#### *4.3.1.3 Heat pumps*

Heat pumps offer exceptional energy efficiency, operating similarly to refrigerators or air conditioners. They extract heat from sources such as the surrounding air, geothermal energy from the ground, water sources, or waste heat from industrial processes, amplifying and transferring the heat to the desired location. This method of transferring heat is more efficient than generating it, making heat pumps more cost-effective than traditional heating technologies like boilers or electric heaters. The coefficient of performance (COP) for a typical household heat pump is around 4, indicating that the energy output is four times greater than the electrical energy used to run it. This makes current models 3-5 times more energy efficient than gas boilers. Heat pumps can also be combined with other heating systems, commonly gas, in hybrid configurations.

There are various types of heat pumps, each with its unique characteristics:

1. **Air-to-Air Heat Pump:**
    - Transfers heat from the outside air to the air inside the home, increasing room temperatures.
    - Efficiency varies with outside temperatures, being less effective at lower temperatures.
    - Quick to install and does not require complex installations.
    - Does not heat water, requiring an alternative method for domestic hot water (DHW).
    - Requires a heat pump for each room needing heating or cooling.

2. **Air Source Heat Pump:**
    - Transfers heat from the outside air to water, which heats rooms through radiators or underfloor heating.
    - Can also heat water stored in a hot water cylinder.
    - Absorbs heat into a fluid that passes through a heat exchanger, raising the temperature and transferring heat to water.
3. **Water Source Heat Pump:**
    - Uses heat energy from water for heating and hot water.
    - Two main designs: closed loop systems (lakes, lochs, or large ponds) and open loop systems (boreholes near rivers or suitable geological conditions).
4. **Ground Source Heat Pump (Geothermal):**
    - Transfers heat from the ground to heat the home and hot water.
    - Uses a loop of pipe buried in outdoor space, absorbing heat from the ground into a fluid that is then transferred to water.
    - Retains high efficiency even at low outside temperatures and is not affected by external factors.
5. **Hybrid Heat Pump:**
    - Combines a heat pump with another heat source, often a fossil fuel (gas, oil, or LPG) boiler.
6. **Cascaded Heat Pump System:**
    - Allows multiple heat pump units to work together to meet heating and hot water requirements.
7. **Exhaust Air Heat Pump:**
    - Transfers heat from a ventilation system to warm air that heats the home.
    - Can be used to heat water stored in a hot water cylinder, reducing the need for a wet central heating system.

Each type of heat pump has its advantages and is suitable for specific applications, offering environmentally friendly and energy-efficient solutions for heating and hot water needs.

Choosing a heat pump involves considering various factors, including costs, efficiencies, installation practicality, and available space. Here are key considerations.

**Cost of heat pumps**

- The installation cost varies between air source and ground source heat pumps.
- Common cost factors include the size of the dwelling, whether it's a new or existing building, preparation work needed for conversion, and potential radiator upgrades for improved efficiency.
- New builds with fulfilled efficiency standards can help keep costs down.

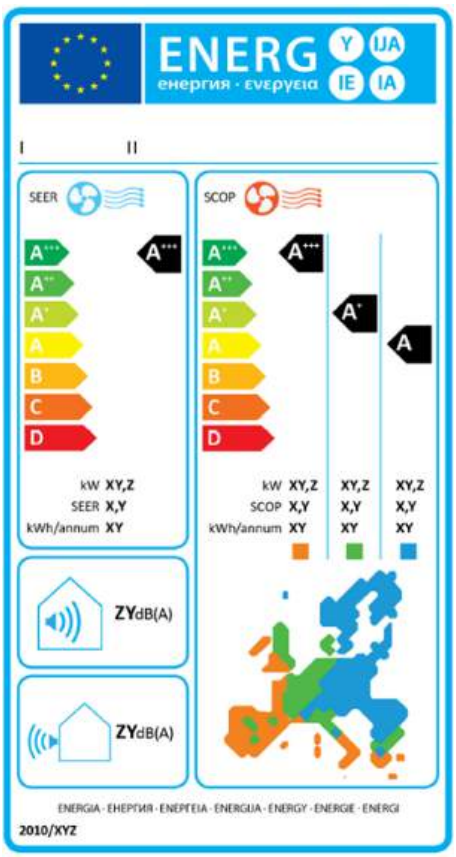
**Efficiency**

- Heat pump efficiency is influenced by the 'source' temperature (air, water, or ground).

- Air source heat pumps work with air temperatures ranging from -5°C to 25°C for most of the year.
- Ground source heat pumps extract heat from the soil, where temperatures don't reach as high but generally stay above 5°C throughout the year.
- Air source heat pumps can be more efficient in certain periods, but ground source heat pumps tend to be more efficient over the entire year.
- Ground source heat pumps are more efficient during extremely cold temperatures, making them a better option in colder climates.

**Climate zones for heating mode**

- Climatic conditions and external temperatures significantly impact the coefficient of performance (COP) of heat pumps.
- SCOP (Seasonal Coefficient of Performance), which was launched in 2013, measures energy efficiency throughout winter (heating) and summer (cooling).
- Heat pumps are labeled based on performance in three climate zones: cold, moderate, and warm.
- SCOP is evaluated at different temperatures (-7°C, 2°C, 7°C, and 12°C).
- Unlike air conditioning units, climate zones on heat pump labels are coded in shades of blue.




| | | |
|---|---|---|
| A+++ | SCOP ≥ 5,10 | SEER ≥ 8,50 |
| A++ | 4,60 ≤ SCOP < 5,10 | 6,10 ≤ SEER < 8,50 |
| A+ | 4,00 ≤ SCOP < 4,60 | 5,60 ≤ SEER < 6,10 |
| A | 3,40 ≤ SCOP < 4,00 | 5,10 ≤ SEER < 5,60 |
| B | 3,10 ≤ SCOP < 3,40 | 4,60 ≤ SEER < 5,10 |
| C | 2,80 ≤ SCOP < 3,10 | 4,10 ≤ SEER < 4,60 |
| D | 2,50 ≤ SCOP < 2,80 | 3,60 ≤ SEER < 4,10 |
| E | 2,20 ≤ SCOP < 2,50 | 3,10 ≤ SEER < 3,60 |
| F | 1,90 ≤ SCOP < 2,20 | 2,60 ≤ SEER < 3,10 |
| G | SCOP < 1,90 | SEER < 2,60 |

*Figure 4 Scale for energy labelling of air-to-air heat pumps*

| | | |
|---|---|---|
| A+++ | SCOP > 3,75 | $\eta_s$ > 150 % |
| A++ | 3,13 ≤ SCOP < 3,75 | 125 % ≤ $\eta_s$ < 150 % |
| A+ | 2,45 ≤ SCOP < 3,13 | 98 % ≤ $\eta_s$ < 125 % |
| A | 2,25 ≤ SCOP < 2,45 | 90 % ≤ $\eta_s$ < 98 % |
| B | 2,05 ≤ SCOP < 2,25 | 82 % ≤ $\eta_s$ < 90 % |
| C | 1,88 ≤ SCOP < 2,05 | 75 % ≤ $\eta_s$ < 82 % |
| D | 0,93 ≤ SCOP < 1,88 | 37 % ≤ $\eta_s$ < 75 % |
| E | 0,85 ≤ SCOP < 0,93 | 34 % ≤ $\eta_s$ < 37 % |
| F | 0,75 ≤ SCOP < 0,85 | 30 % ≤ $\eta_s$ < 34 % |
| G | SCOP < 0,75 | $\eta_s$ < 30% |

*Figure 3. Energy labels for air-to-air heat pumps*

*Figure 5. Scales for energy labelling of air-to-water heat pumps for 55 ˚C*

#### *4.3.1.4 Individual electric heaters*

Traditional electric heating appliances are typically: fan coils; electric radiators: oil, water, dry (air); accumulating stoves; air conditioners. The air conditioners are modern heating systems that consume 3 to 4 times less electricity than the energy they bring into the heated / cooled room. In contrast, electric heaters, accumulator electric heaters, convectors and fan coils consume as much electrical energy as heating energy they provide.

The typical installed power of the electric heaters is shown in the following table.

*Table 10 Typical installed power of the most prevalent electric heating appliances*

| **Electric heating appliances** | **Installed power, Watt** |
|---|---|
| Calorifier | 2000 |
| Fan coil | 2400 |
| Electric heater | 2000 |
| Accumulating electric heater | 3000 |
| Air conditioner 9000 BTU | 950 |
| Air conditioner 12000 BTU | 1250 |
| Air conditioner 18000 BTU | 1750 |
| Air conditioner 24000 BTU | 2600 |

#### *4.3.1.5 State of the art energy efficiency level of different devices*

Different types of individual heating devices considered to be efficient include:

*Table 11. Efficiency and power of different types of individual heating devices*

| **DIRECT HEATING DEVICES** | **EFFICIENCY** | **INSTALLED POWER** |
|---|---|---|
| **PELLET HEATING DEVICES** | | |
| • **Hot air pellet fireplace** | 88-92 % | 6 / 8 / 10 / 12 kW |
| • **Pellet fireplace with water jacket** | 88-92 % | 12 / 18 / 25 kW |
| • **Pellet boiler** | 88-92 % | 15 / 25 / 35 kW |
| **NATURAL GAS HEATING DEVICES** | | |
| **Natural gas condensing boilers** | | |

| | | |
|---|---|---|
| • **Single-circuit natural gas condensing boiler** | 90-95 % | 16 / 24 / 28/ 35 kW |
| • **Two-circuit natural gas condensing boiler** | 90-95 % | 24 / 35 kW |
| • **Condensing gas boiler with built-in water heater** | 90-95 % | 24 / 35 kW |
| **Gas convectors** | | |
| • **Gas convector** | 90-95 % | 3 / 5 kW |
| **ELECTRIC HEATING DEVICES** | | |
| • **Air Conditioners (A2A heatpump)** | 350 to 470 % | 9000 / 12 000 / 15 000 / 24 000 / 30 000 BTU |

The most important feature of how individual units are characterised is their overall and seasonal efficiency. Nevertheless, the price efficiency is also a function of the price of the energy carrier

#### *4.3.1.6 Centralized district heating*

District heating is a system for producing and distributing heat energy, generated in a centralized location (power plant) through a system of insulated pipes for residential and commercial heating needs, such as space heating and domestic hot water. Many fossil-fuel-fired power plants, especially those in settlements, are actually cogeneration power plants. Cogeneration is a technology for centralized simultaneous generation of electricity and heat. In traditional methods of electricity production, a large amount of useful heat is discharged into the environment in the form of condensed heat from the steam. In contrast, cogeneration technology uses this "waste" heat and produces both heat and electricity in a combined process with higher efficiency. The combined production of electric and thermal energy has proven qualities and, in combination with modern best available techniques, is the most efficient and environmentally friendly method.

The facilities that connect the heat transmission network to the domestic installations of residential, administrative and industrial buildings are called substations.

Heating installations with horizontal risers have entered the market during the last twenty-five years after the introduction of polyethylene pipes with metal inserts. This type of installation has its unquestionable advantages: more aesthetic and practical - there are no vertical pipes in the rooms, the bills are simpler - according to the indications of the central and apartment heat meters, and the difference forms the energies for the building installation and for the heating of water. A great advantage is the possibility of interruption of heating individually in case of overdue bills. For horizontal heating installations, residents have the ability to regulate their own heat consumption by themselves.

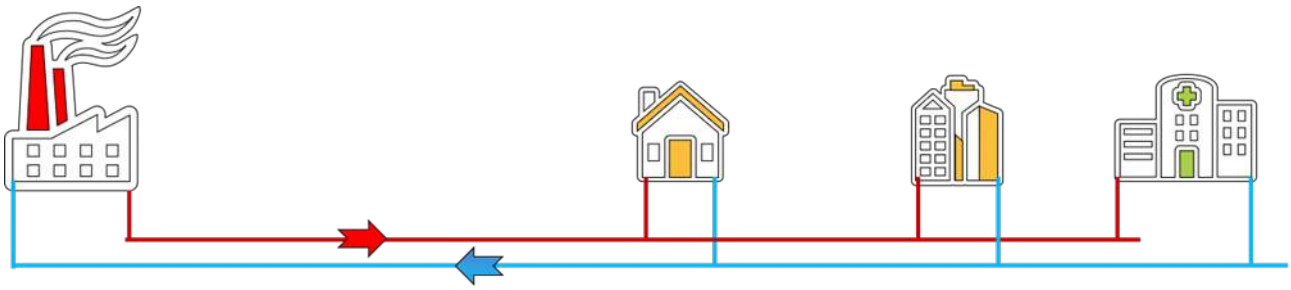


*Figure 6. Scheme of centralized heating (Source: community.esri.com)*

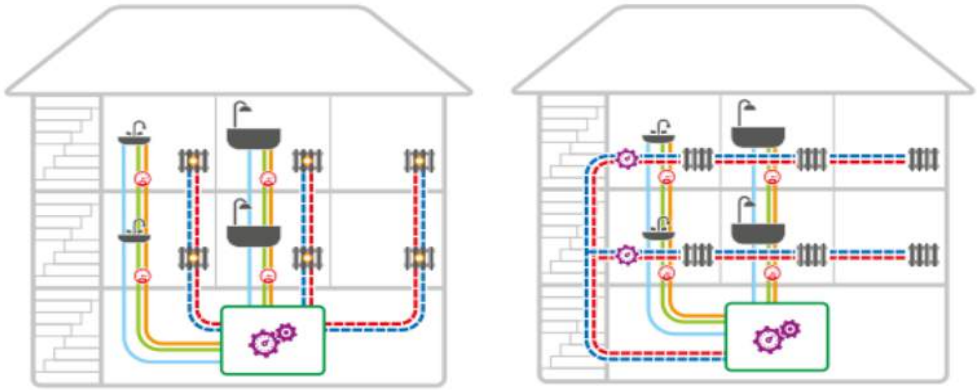


*Figure 7. Example of old vertical and new horizontal internal heating building installation (source: EVN Bulgaria)*

### 4.3.2 Electricity usage within households

#### *4.3.2.1 General information*

The distribution of electricity use can vary significantly based on individual habits, energy efficiency measures, and regional climate differences.

Household`s electricity consumption depends on:

- The number of people in a household
- Whether the household uses electricity as a heating means and the number of heating appliances;
- Whether the water is heated by an electric boiler;
- What type of food preparation is used;
- the energy efficiency of the lighting fixtures;
- Efficiency of appliances.

The distribution of electricity consumption in households depends mainly on the way of heating. As it was already presented above, the highest share of the final energy consumption in households takes the space heating (64,4%), followed by water heating (14,5%) and lighting and appliances (13,5%).

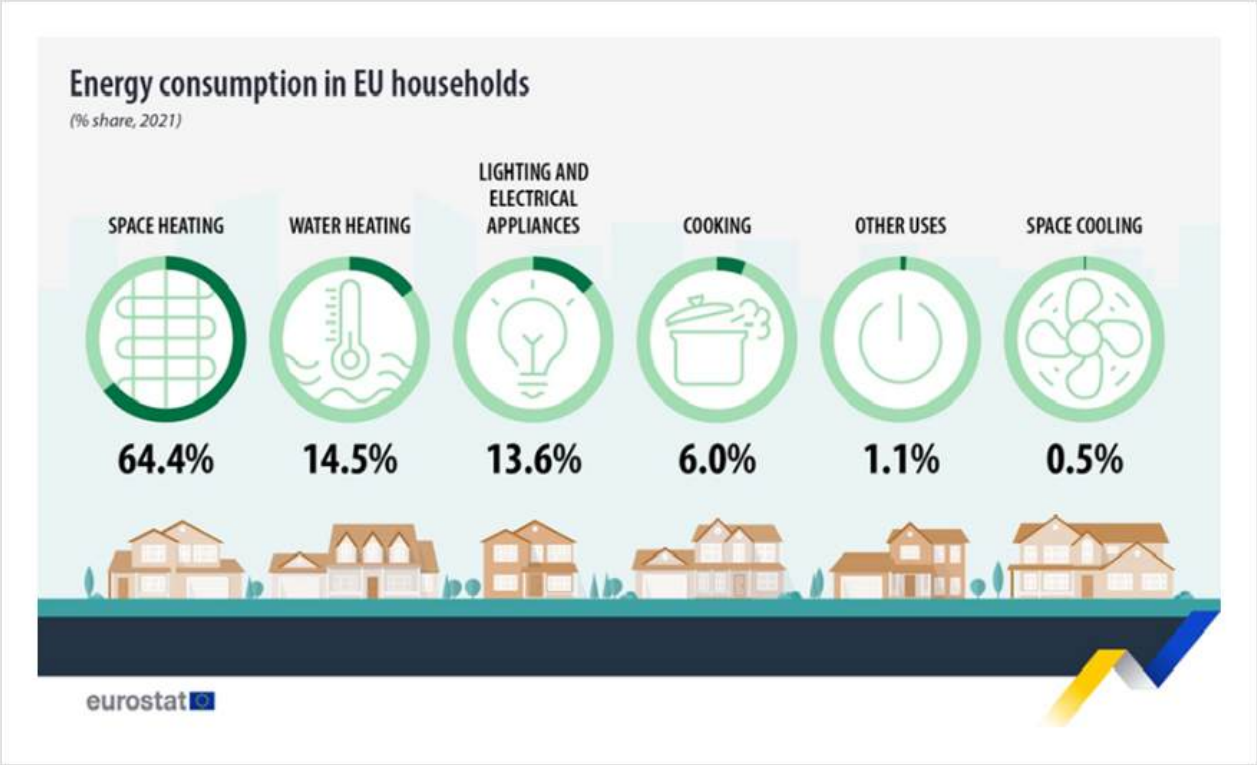



*Figure 8. Distribution of energy consumption in EU households*

Certainly, in some EU countries with warmer climates, cooling can be a significant portion of electricity use in households.

As it can be seen the fields with the highest potential for energy saving are domestic hot water, cooling, lighting and refrigeration appliances.

# 5 Step-by-Step Deep Renovation in Households

Renovating a building can pose challenges in terms of complexity, cost, and time investment. In Europe, the majority of residential building renovations are executed incrementally over several years, introducing the risk of being "locked in" where current renovation decisions may constrain future possibilities. For homeowners, the lack of clarity on which renovation measures to undertake and their sequencing presents a significant hurdle to enhancing energy efficiency and the overall condition of their property. Compounding these challenges is the unique nature of each situation, as buildings differ in construction characteristics, renovation history, current use, and other factors. Homeowners themselves have diverse needs, preferences, and available resources. [1]

Building renovation not only has the potential to enhance energy performance but can also address other objectives, such as reconfiguring spaces or upgrading the facade. These various changes can be unified within a cohesive roadmap, optimizing the combination of interventions and encompassing the numerous benefits that a well-planned renovation can deliver, including enhanced thermal comfort, indoor air quality, sound insulation, and more.

Deep renovation denotes a thorough and comprehensive process aimed at enhancing the energy efficiency, sustainability, and overall performance of a building or structure. It entails significant modifications to the building's systems, components, and materials, bringing it in line with modern standards and reducing its environmental impact.

Key features of deep renovation typically include (*Figure 9*):

[1] iBRoad. My path towards an energy efficient home. December 2020. Available at: https://ibroad-project.eu/

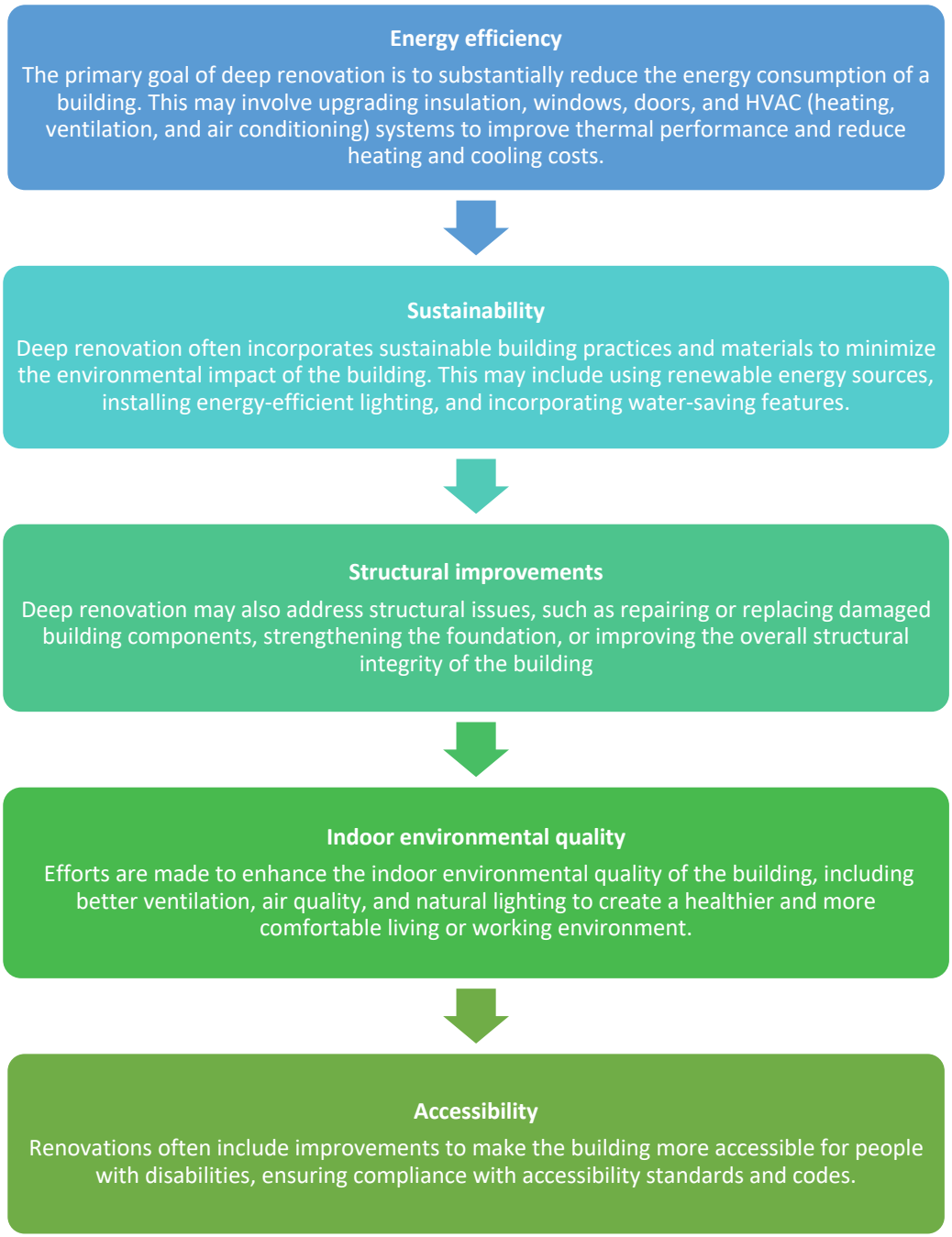



*Figure 9. Key features of deep renovation*

Deep renovation involves making significant and comprehensive renovations to the building to boost energy efficiency and sustainability. This means going beyond simple renovation and cosmetic changes and focusing on improving the building's performance, which can lead to substantial cost savings and a greener, more comfortable living space.

**Deep renovation according to the European Commission refers to those building renovations that achieve more than a 60% reduction in primary energy consumption.**

A huge potential for energy savings lies in the renovation of the existing building stock. The deep renovation of these buildings is a necessary condition for the construction sector to be able to reduce its greenhouse gas emissions and meet the targets for reducing energy consumption. The new Target 55-ready package aims to put the EU on the path to climate neutrality. Energy accounts for 75% of greenhouse gas emissions, and the building stock of EU member states - about 43% of energy consumption.

A major renovation can be defined as such renovation that meets the national standard and regulations of a specific country; a major renovation can also be defined as a minimum percentage of energy savings; Energy savings from non-renewable sources over 60%. Other definitions are related to standards for near-zero consumption buildings.

It is important to know that if the goal is to save energy above 60% (primary energy savings), this can be achieved by renovating the entire building, and this can mean a large investment out of reach for most European families.

It is possible a step-by-step basic energy renovation, for example, every 3-4 years, one investment for:

1. Replacement of windows;

2. Wall insulation;

3. Replacement of heating and cooling systems.

A road map with recommendations for reducing the energy consumption of the building or household can be developed with an estimated budget for each step and achieving standards approaching those of a near-zero consumption building in a few years

## 5.1 Deep renovation barriers and benefits

Deep renovation, the comprehensive transformation of existing buildings to significantly improve their energy efficiency and sustainability, plays a pivotal role in addressing the ever-increasing global energy consumption and reducing carbon emissions. While its benefits are undeniable, the journey towards deep renovation is fraught with several significant challenges and barriers. These obstacles extend beyond mere technical complexities, encompassing financial, regulatory, and behavioural hurdles that hinder the widespread adoption of deep renovation practices.

### 5.1.1 Deep renovation barriers

Energy renovation barriers refer to the obstacles, challenges, or factors that hinder the adoption, implementation, or success of energy retrofit projects in buildings. These barriers can exist at various levels, e.g., individual, organisational, societal, financial, etc., and may vary depending on the specific context, such as the country, region, or type of building (Figure 2).

Understanding and addressing these barriers is essential for overcoming resistance, unlocking the full potential of energy retrofits, and facilitating their widespread adoption to achieve energy efficiency goals in the built environment.

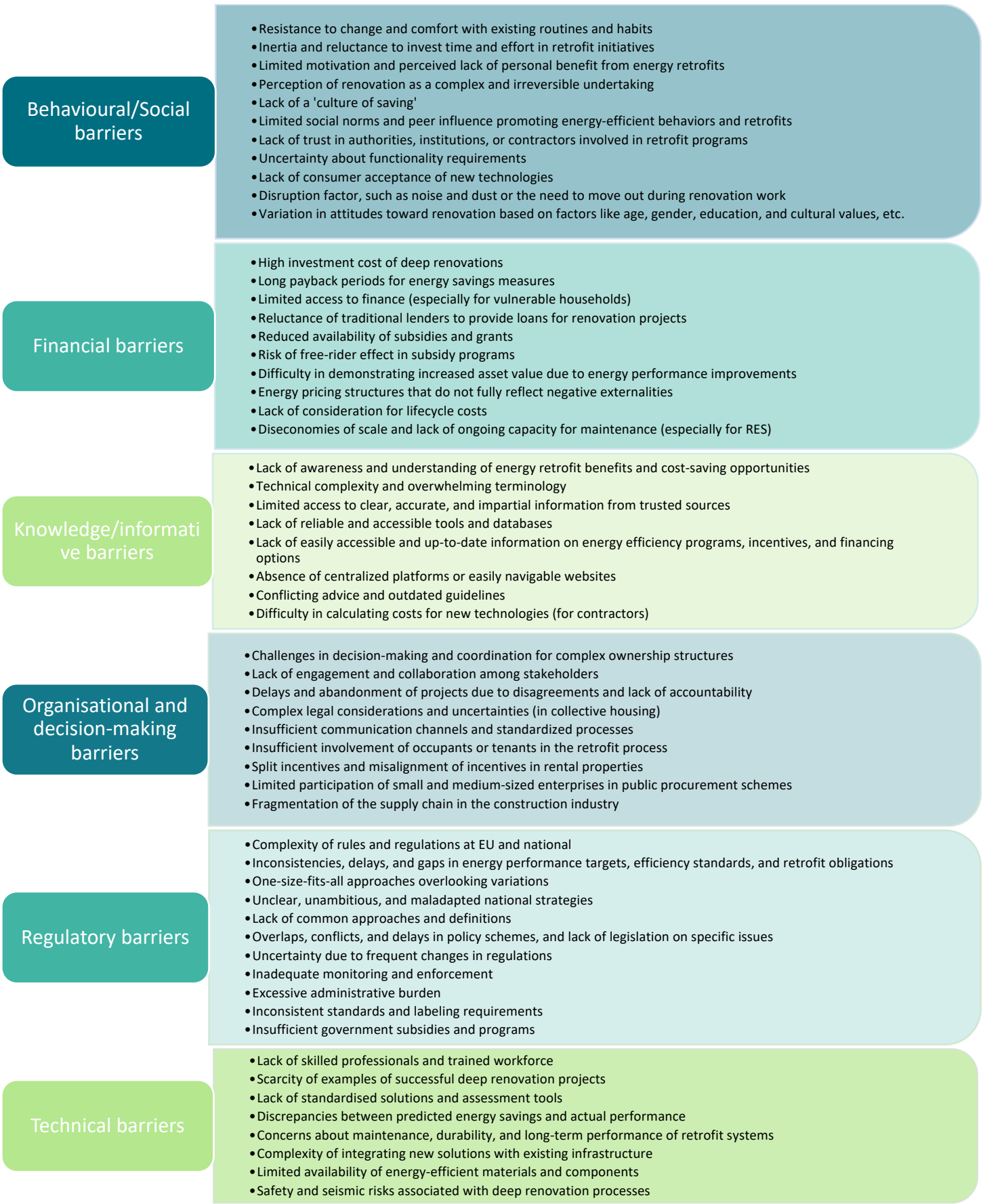



*Figure 10. Energy renovation barriers*

### 5.1.2 Benefits of deep renovation

The main benefits of deep renovation for the households and the community are summarised in the following Figures 3 and 4.


*Figure 11. Deep renovation benefits for the households*

**Environmental benefits**

By upgrading insulation, replacing windows and doors, installing energy-efficient heating and cooling systems, and domestic hot water systems, households can reduce their energy consumption. By decreasing the demand for electricity and heating fuels, building energy renovations contribute to reducing the emission of $CO_2$ and other greenhouse gases and help to mitigate global warming. For instance, energy efficiency measures are expected to contribute 44% of the carbon abatement needed by 2035, and deep renovation, in particular, can lead to a 75% reduction in final energy consumption by 2050, compared to 2010.

**Competitiveness**

The development of technologies related to energy efficiency has a positive effect on the economy and its competitiveness. The assessment of the impact of energy efficiency is made for individual products or branches of the industry by comparing the export and import of this product or branch with the total export and import of the country, and if the result is positive, increased competitiveness is reported.

**New jobs in the region**

There are two main factors that determine the effect on employment: investments in energy efficiency create jobs in the industry that produces the relevant products and services, and the energy savings achieved reduce in the long term the consumption of energy products. In turn, a reduction in consumption has an effect on the added value produced, and a change in the added value leads to an effect on employment in the relevant sector.

*Figure 12. Deep renovation benefits for the communities*

## 5.2 Types of building renovation measures

Exemplary energy-saving measures in buildings are recommended by institutions, administrative bodies, offices and agencies of the European Union, including recommendations of the EC to establish requirements for building installations. An example list of measures is presented in the following table.

*Table 12. Examples of deep renovation measures*

| Measures on building envelope | Measures on building systems | Measures for utilization of energy from renewable sources and utilization of waste heat |
|---|---|---|
| Complete laying or upgrading of existing thermal insulation on the walls of existing buildings | Installation or improvement/modernization of a heating installation (based on fossil fuels and/or renewable energy, with a boiler for cooling the flue gases below the dew point — condensing boiler, heat pumps, etc.) in all buildings | Air-to-air heat pumps |
| Complete laying or upgrading of existing thermal insulation on the roofs of existing buildings | Modernization of an existing vertical heating installation by building a horizontal heating system | Air-to-water heat pumps |

| | | |
|---|---|---|
| Thermal insulation of the same roof elements in existing building roofs | Control and measuring devices for regulating the temperature of the internal air and water | Ground-connected heat pumps for utilizing the heat of the ground |
| Thermal insulation of an existing ground floor in an existing building | Installation or improvement of a ventilation installation (forced ventilation with heat recovery, forced suction-discharge ventilation, suction ventilation) | Solar systems for DHW |
| Increasing the thermal inertia of the building structure by using massive building materials exposed to radiant energy in the building space (Note: it can only be applied in certain types of climate conditions). | Improving the use of daylight. Energy-efficient lighting | Heating systems utilizing geothermal energy |
| Installation of windows and doors with good thermal insulation properties for the winter period | Installation or improvement of photovoltaic systems | Photovoltaic systems for the production of electrical energy for own consumption |
| Better shading against sunlight | Changing the energy carrier for a given installation | Heat recovery from exhaust air |
| Better sealing against air infiltration (the maximum sealing possible with the relevant state of the art). | Replacing pumps and fans | |
| Changing the ratio between transparent and opaque surfaces (optimization of glazing percentage) | Thermal insulation of pipes | |
| Openings for night ventilation (cross or chimney ventilation | Direct-fired boilers or boilers with an intermediate heat carrier, and accompanied by hot water tanks, can be combined with thermal solar installations<br>Installations for the utilization of solar energy for heating or cooling, and for DHW of different power-intensive night ventilation | |
| | Installation of energy-efficient office and household appliances | |

### 5.2.1 Building Assessment and Energy Auditing

The initial assessment of eligibility, needs, benefits and necessary financial resources for implementation, which, depending on the specifics of the investment intention, includes:

Building Assessment and Energy Auditing are critical processes in evaluating and improving the energy performance and overall sustainability of buildings. These assessments help identify areas of inefficiency, recommend energy-saving measures, and contribute to more environmentally friendly and cost-effective building operations.

It is also the stage in which it is determined whether the building is eligible for application under a specific financing procedure. Determining the eligibility of the residential building according to the "mechanical resistance and stability" requirement - based on visible signs.

#### *5.2.1.1 Building Assessment*

Building assessment is a comprehensive evaluation of a building's physical condition, performance, and overall sustainability. It involves a detailed examination of various building systems, components, and their interactions.

The building assessment is the process of developing a technical passport of the building.

Initial assessment of eligibility, needs, benefits and necessary financial resources for implementation, which, according to the specifics of the investment intention, includes:

- Determining the eligibility of the residential building according to the requirement of "mechanical resistance and resistance".
- Determining the necessary renovation activities related to:

Development of project documentation/investment project

a) Presents in graphic and textual form, according to the applicable regulations, the technical, economic, technological, functional and planning-compositional requirements for the object;

b) Details the requirements for the technology of implementation and the materials used, containing drawings and working details, as well as detailed technical specifications of the intended construction materials;

c) Serves for the implementation of construction and repair activities, as well as for conducting procedures for selecting their implementation.

**Compliance assessment of investment projects:**

a) Gives confidence to the Employer/Owner that the investment project meets the regulatory requirements and that its implementation will be achieved in advance

the set goals and indicators;

b) Facilitates/accelerates the process of approval by the municipal administration and issuance of a building permit.

**Construction permit:**

a) Guarantees legality in the implementation of SMP.

#### *5.2.1.2 Commencement, execution and completion of construction*

**Monitoring and evaluation of achieved savings**

a) Implementation of construction and assembly activities in accordance with the issued construction documents;

b) Insertion of materials according to the design technical specifications;

c) Carrying out control during implementation according to the regulations and the specifics of the residential buildings.

**Assessment of achieved energy savings after implementation of EE measures**

a) The proof of energy savings achieved as a result of implemented EE measures by means of a subsequent energy audit.

**Monitoring the behaviour of the residential building after the renovation**

a) Exercising real control by means of control measurements and taking corrective actions. Changes in the behavioural model of the owners when using energy in the renovated residential building:

- Increasing the energy efficiency of the building.
- Possibility of applying alternative measures incl. providing energy from renewable sources.
- Improvement of operational characteristics related to
- increasing the safety and comfort of living.
- Estimated benefit assessment - savings, etc.
- Estimated financial resources necessary for the implementation of
- the investment project for EE with all costs included - energy survey, investment design and assessment of compliance with essential requirements, construction
- supervision, investor control, and administrative costs related to construction authorisation and commissioning, including VAT, when applicable.

The initial assessment of eligibility, needs, benefits and the necessary financial resources for implementation can be prepared by one or more technical experts with experience in surveys, design of new buildings or renovation of existing buildings, implementation of EE measures incl. construction of new buildings.

#### *5.2.1.3 Technical inspection*

The assessment of needs is carried out according to the specifics of the residential building and the applicable regulations and/or the requirements of specific EE programs providing co-financing. The financial resource is determined on the basis of market prices for labour and materials, as well as prices of individual measures/operations/building activities in the implementation of similar investment projects.

The technical inspection goals are presented in *Figure 13*.

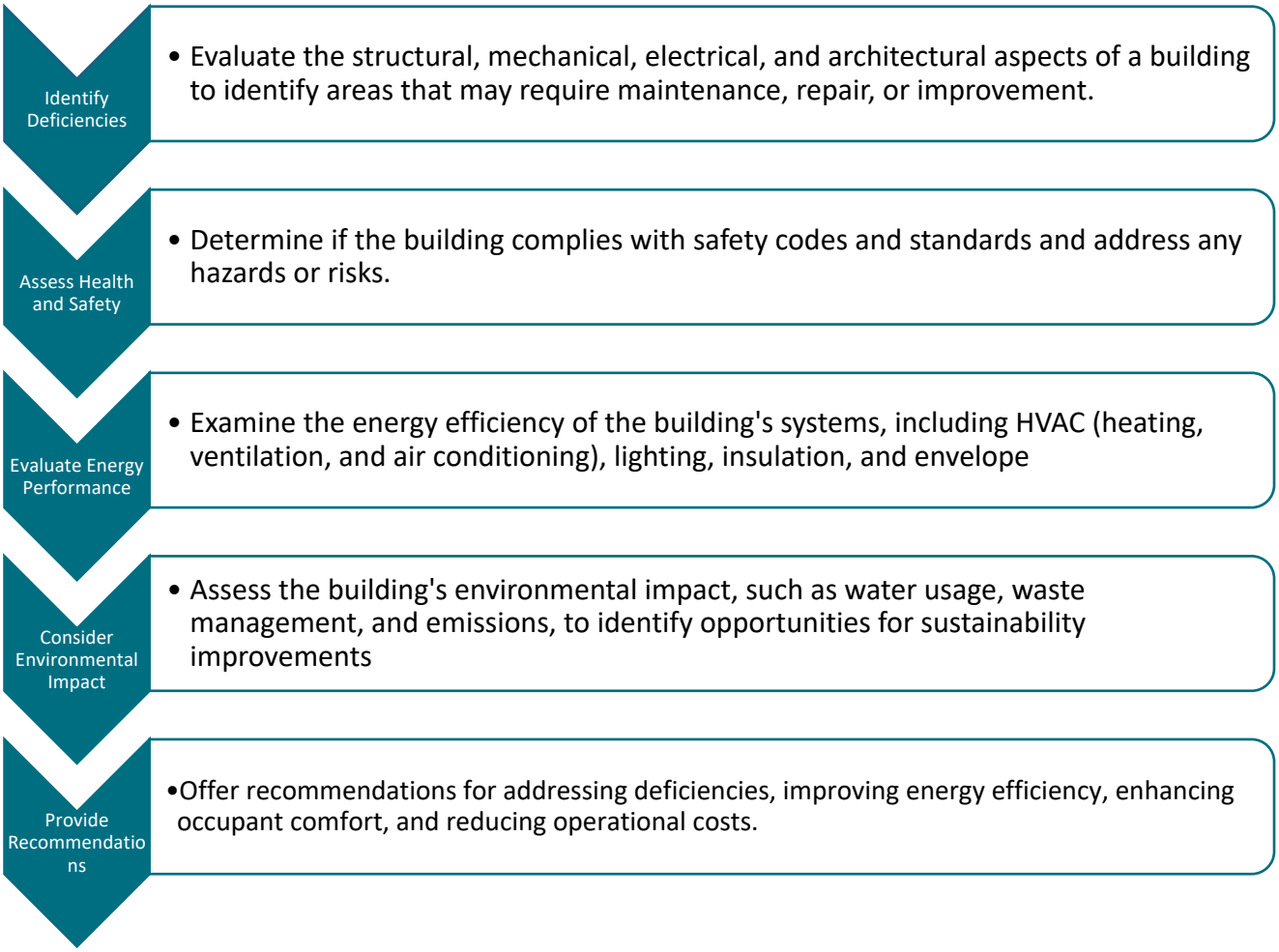



*Figure 13. Technical inspection goals*

#### *5.2.1.4 Energy auditing*

Energy auditing is a specialised form of building assessment focused primarily on evaluating and optimizing energy use within a building. The goals of an energy audit are shown in Figure 6.

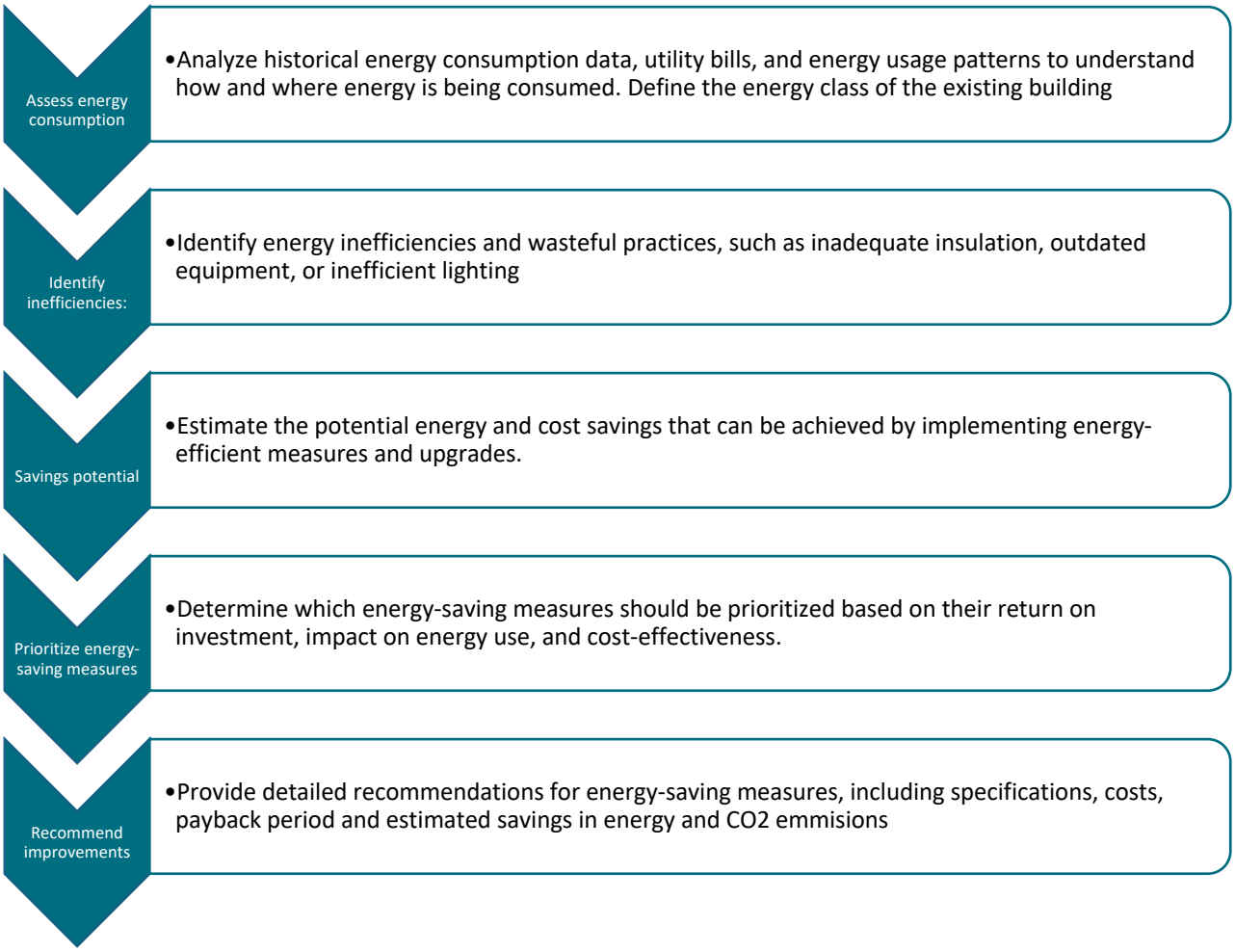



*Figure 14. Energy auditing goals*

Energy audits can range from basic assessments, such as walk-through audits or preliminary energy audits, to more comprehensive audits under the official EPC body and involve detailed data analysis, engineering calculations, and performance modelling.

Both building assessments and energy audits are valuable tools for building owners, facility managers, and OSS personnel to make informed decisions about improving energy efficiency, reducing operational costs, enhancing occupant comfort, and contributing to environmental sustainability. These processes are essential steps toward creating more energy-efficient and environmentally responsible buildings.

### 5.2.2 Preparation of project documentation for the implementation of an energy-efficient investment project

#### *5.2.2.1 Development of a Technical Specification/design assignment*

Technical specification/design assignment is an extremely important element of the investment project. The high-quality technical specification is a guarantee/necessary condition for the preparation of a high-quality investment project in the required scope and volume.

The technical specification is made on the basis of:

- Survey for EE and Certificate for energy characteristics;
- Technical inspection by parts and Technical Passport;
- Applicable regulations.

The selected package of priority energy-saving measures, proposed with the energy survey and containing technical parameters of the energy consumption indicators, essentially represents part of the technical-economic task for awarding and developing the investment project. A mandatory part of the assignment is the construction activities and operations that do not affect the consumption and saving of energy but are mandatory in connection with the recommendations of

the examination of the technical parameters reflected in the technical passport.

The technical specification sets the requirements regarding:

- Design phase;
- Design parts that the documentation must contain, incl. calculations;
- Implementation materials;
- Applicable quality norms and standards;

#### *5.2.2.2 Development of project documentation/investment project*

The investment project for EE of residential buildings is drawn up in accordance with, Ordinance 4 on the scope and content of investment projects. The regulation defines the scope and content of investment projects, as well as related preliminary (pre-investment) studies and design tasks. The Ordinance applies to all sites for which an approved investment project is required when a building permit is issued.

The specifics of the renovation for EE of residential buildings (objects that are not particularly complex in terms of functionality, technology and/or installation and the availability of photographs and surveys) predominantly imply a single-phase design - in the technical design or working design phase.

The renovation investment project for EE includes the following project parts:

1) parts for architecture and structures:

- architectural;
- constructive;

2) parts for installations and networks of the technical infrastructure:

- water supply and sewage;
- electrical (electrical supply, electrical equipment, and electrical installations);
- heat supply, heating, ventilation, and air conditioning;
- energy efficiency;
- gas supply (if applicable).

3) Fire safety

4) Safety and health plan

5) plan for construction waste management

6) part Project-accounting documentation

*The process of preparing technical documentation is preceded by*

*providing a sketch of the property and a design visa. These documents should be*

*provided in advance by the owner of the site for intervention/SS.*

#### *5.2.2.3 Compliance assessment of investment projects*

The conformity assessment according to acceptance by an expert council of the approving administration, for residential and mixed low-rise buildings and cottage buildings (according to Territorial Planning Law), their reconstructions, alterations, major repairs, and change of purpose, or at the request of the contracting authority

### 5.2.3 Project Implementation and Management

#### *5.2.3.1 Construction permit*

Constructions can only be carried out if they are permitted in accordance with the Spatial Planning Act. The building permit is necessarily issued at the initiative of the contracting authority/owner within the meaning of the Territorial Planning Act and necessarily in his name. The issuance of a construction permit under the general rules of the Territorial Planning Act is carried out on the basis of approved technical or work investment projects, which are an integral part of it, by the chief architect of the relevant municipality in the location of the property in which it will be built. The building permit loses legal effect when construction has not started within three years of its entry into force.

#### *5.2.3.2 Commencement, implementation and completion of construction/implementation of renovation measures for EE*

The provisions of the Territorial Planning Act regulate the relationships and the interactions between the participants in the construction process and the administration during the initiation, implementation and completion of the construction, with the limits of responsibility of each of them defined. Participants in the construction process are the client, the builder, the designer, the consultant, the individual exercising technical control for the "Construction" part, the technical manager and the supplier of machinery, facilities and technological equipment.

### 5.2.4 Monitoring, Measurement, and Verification

The proof of the achieved energy savings as a result of implemented EE measures is regulated in the EE and is carried out no earlier than one year after the introduction of the measures to increase the energy efficiency of the end users of energy through an energy efficiency survey. The survey to

prove the achieved energy savings is carried out by a company registered in the register under Art. 44, para. 1 and paragraph 2 of the EE Law (available on the SEDA website).

The evaluation for the proof of the achieved energy savings is prepared for all implemented effective measures and their corresponding terms of action. For the purposes of evaluating the achieved energy savings, the owner of the building shall provide available reports from inspections of the building and the certificates issued based on them, including documents proving the implementation of the measures and their technical characteristics in accordance with the recommendations of previous inspections and the investment project.

# 6 Energy saving in households

## 6.1 Energy efficiency measures in households

Nowadays, where environmental sustainability and cost-saving measures are of paramount importance, finding ways to save energy in our households is not just a wise choice, but a responsible one. Energy conservation not only helps reduce our carbon footprint but also translates into lower utility bills, leaving more money in our pockets. Fortunately, there are numerous practical steps and strategies that can be implemented in homes of all sizes and types to achieve significant energy savings. In this guide, we will explore a comprehensive list of general tips that will empower you to make informed choices and transform your household into an energy-efficient haven. From simple changes in lighting to more complex upgrades in appliances and insulation, these tips will not only benefit the household‘s wallet but also contribute to a more sustainable and environmentally conscious way of living.

Energy efficiency measures in households refer to various actions, technologies, and practices adopted by homeowners to reduce the amount of energy consumed in their homes while maintaining or even improving comfort and functionality. These measures are implemented with the goal of reducing energy bills, lowering environmental impact, and conserving energy resources. Some general tips are given in the following box.

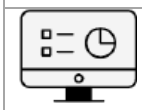
**General tips for saving energy in households:**

- Keep track of your consumption. Check your consumption and your bills regularly: it will ease the planning of your family budget. Witness how changes in your behaviour may affect energy bills.
- Buying a more energy-efficient appliance could save you money over time when compared with similar products.
- Switch off all electrical appliances at the plug instead of using the "standby" mode. Appliances are still using electricity when on "standby" mode, and account for 6% of all electricity usage in the home.
- Remember to ventilate - Ventilation is needed to get fresh air in and let moisture and smells out. Open the windows daily. Please remember, the shorter, the better: 10 minutes is generally enough! In winter do that during the least-cold hours and turn the heating on only when ventilation is finished.

Source: http://www.fiesta-audit.eu/en/

The following table (*Table 13*) presents some common energy efficiency measures in households, which will be discussed in more detail in the next chapters.

*Table 13. Energy efficiency measures and related benefits for households*

| | Energy saving measure | Benefits for the households |
|---|---|---|
|  | **Improved insulation** | Proper insulation in walls, ceilings, and floors helps prevent heat loss in the winter and keeps the home cooler in the summer, reducing the need for heating and cooling. |
|  | **Energy-efficient windows** | Replacing old, single-pane windows with energy-efficient double- or triple-pane windows with low-emissivity coatings can improve insulation and reduce heat transfer |
|  | **Energy-efficient appliances** | Replacing old, energy-guzzling appliances with energy-efficient models can significantly reduce energy consumption. This includes appliances like refrigerators, washing machines, and dishwashers. |
|  | **Led lighting** | Replacing traditional incandescent bulbs with energy-efficient LED (Light Emitting Diode) lighting can save a substantial amount of electricity and have a longer lifespan. |
|  | **Sealing air leaks** | Identifying and sealing gaps, cracks, and leaks around windows, doors, and ducts can prevent drafts and heat loss, making the home more comfortable and energy-efficient. |
|  | **Programmable thermostats** | Installing programmable thermostats allows homeowners to set temperature schedules, ensuring the heating or cooling system operates efficiently when needed. |
|  | **High-efficiency HVAC systems** | Upgrading heating, ventilation, and air conditioning (HVAC) systems to high-efficiency models can reduce energy consumption for heating and cooling. |
|  | **Smart home technology** | Using smart thermostats, lighting controls, and appliances that can be remotely controlled and programmed for optimal efficiency. |
|  | **Water saving** | Installing low-flow faucets, showerheads, and toilets can reduce water heating costs and overall water consumption. |
|  | **Behavioural changes** | Encouraging household members to adopt energy-saving habits like turning off lights when not in use, unplugging electronics, and using appliances efficiently |

To achieve balancing of energy consumption in a household, it is necessary to perform the steps illustrated in *Figure 15*.

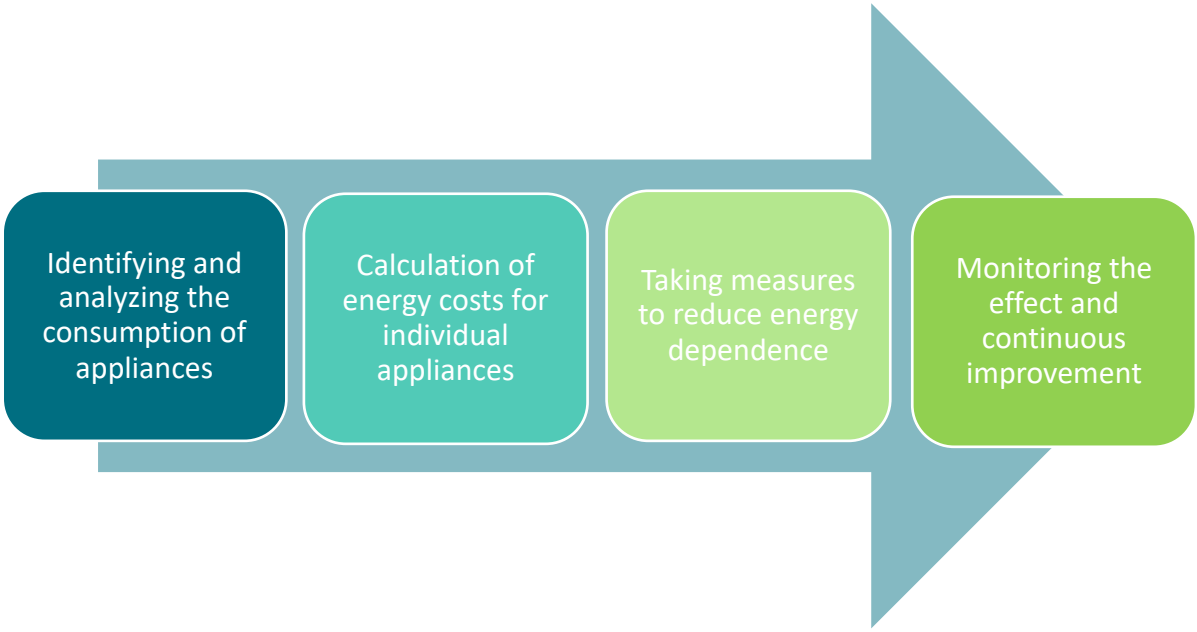



*Figure 15. Steps in balancing energy consumption*

## 6.2 Energy saving tips for heating and cooling

Energy consumption for heating and cooling accounts for a significant portion of a household's energy expenses. Therefore, implementing energy-saving tips in this area can have a substantial impact on both your comfort and your utility bills. Here are some energy-saving tips specifically tailored to heating and cooling.

The measures categorised as “Relatively Easy” are simple changes or practices that most homeowners can implement without much difficulty or cost. "Moderate" measures may require a bit more effort or investment but are still manageable for many households. The “More Involved” measures often involve larger investments, such as home improvements or appliance replacements, and may require professional assistance in some cases. Remember that the easiness of implementation can vary depending on individual circumstances, such as the age and condition of your home, your budget, and your DIY skills. It's a good idea to prioritise the measures that make the most sense for every specific situation and gradually work toward more involved upgrades as household’s budget and resources allow.

Tables 2 and 3 provide some recommended energy efficiency measures for heating and cooling, respectively.

*Table 14. Energy efficiency measures for heating*

| EE measures for heating | Description | Level of applicability |
|---|---|---|
| **Set your thermostat wisely** | The most straightforward method to conserve energy for heating is to adhere to the recommended indoor temperatures. During winter, maintaining a daytime temperature of 21°C and a nighttime range | Relatively Easy |

| | | |
|---|---|---|
| | of 15 - 18°C should provide ample comfort at home. A simple adjustment, such as lowering your thermostat by just 1 degree centigrade, has the potential to yield significant savings—up to 10% on your annual fuel bill | |
| **Seal leaks** | Inspect doors, windows, and other openings for drafts. Seal any gaps and use weather-stripping to prevent heat from escaping | Moderate |
| **Use curtains or blinds** | In winter, close curtains or blinds at night to trap heat inside. During the day, open them to let in natural sunlight and warmth. | Relatively Easy |
| **Regular furnace maintenance** | Have your furnace serviced annually to ensure it's running efficiently. Clean or replace air filters regularly as well | Moderate |
| **Use space heaters efficiently** | If you're using space heaters, only heat the rooms you're occupying and turn them off when you leave. Electric blankets can also be energy-efficient alternatives for staying warm | Moderate |
| **Upgrade insulation** | Insulate your attic, walls, and basement to keep heat from escaping. Adequate insulation can make a significant difference in your heating costs | More Involved |
| **Maintain your radiators properly** | Furniture in front of a radiator will block or absorb the heat | Relatively Easy |
| **Reflective radiator panels** | Reflective radiator panels behind the radiators could reduce your heating bill by up to 20%. When radiators are installed on a poorly insulated wall, most of the heat will dissipate through the wall and to the outside. To avoid heat losses, a thin reflective panel between the wall and the radiator can be installed (they are easily available at stores) | Moderate |
| **Drying your clothes** | Drying your clothes on the radiator makes your boiler work harder than it needs to and costs more. | Relatively Easy |
| **Keep heat where you need it.** | Effectively manage heated spaces by closing doors to retain warmth, or, conversely, open them to allow heat to disperse into adjoining rooms. Leaving a door ajar in a room you intend to heat can result in unnecessary energy and financial losses. By conscientiously controlling the flow of heat within your living space, you not only enhance energy efficiency but also contribute to cost savings | Relatively Easy |

| | | |
|---|---|---|
| **Don’t switch off the heating during the night** | In the colder days, it is recommended not to switch off the heating during the hours when you are away from home, only to reduce it. When it is turned off, your home will cool down too quickly, which will lead to overheating to reach a favourable temperature | Relatively Easy |
| **Reduce the heating temperature during the working day, but not below 15 degrees** | If you are away from home during the day or for a longer time, reduce the temperature, but not below 15 degrees, otherwise, the air in the room becomes too humid and the risk of mould increases. You should know that the lower the temperature in a room, the more often you need to ventilate the room to reduce the humidity | |

*Table 15. Energy efficiency measures for cooling*

| EE measures for cooling | Description | Level of applicability |
|---|---|---|
| **Use ceiling fans** | Ceiling fans help distribute cool air more evenly and can allow you to set your thermostat a few degrees higher without sacrificing comfort | Relatively Easy |
| **Maintain your air conditioner** | Schedule regular maintenance for your air conditioning system to ensure it runs efficiently. Clean or replace filters as recommended | Relatively Easy |
| **Programmable thermostat** | Install a programmable thermostat to automatically adjust your cooling settings when you're not at home or when you're sleeping | Relatively Easy |
| **Seal leaks** | Just like in heating, seal any gaps around doors, windows, and ductwork to prevent cool air from escaping | Relatively Easy |
| **Shade and ventilate** | Use shades, blinds, or curtains to block out direct sunlight during the hottest part of the day. Use exhaust fans in bathrooms and kitchens to remove heat and humidity. | Relatively Easy |
| **Upgrade to energy-efficient cooling** | If your air conditioner is old and inefficient, consider upgrading to a newer, energy-efficient model. Look for the ENERGY STAR label | More Involved |
| **Plant shade trees** | Planting trees strategically around your home can provide natural shade, reducing the need for cooling | Relatively Easy |

| | | |
|---|---|---|
| **Keep the recommended indoor temperatures** | he most straightforward approach to reduce energy consumption from cooling devices is to adhere to recommended indoor temperatures. During summer, maintaining a temperature of 26°C should provide sufficient comfort. Elevating the thermostat by just two degrees not only allows you to enjoy a full day of cost-free cooling but also helps prevent unnecessary colds | Relatively Easy |
| **Take advantage on natural ventilation** | Optimize natural ventilation by opening windows on the north and south sides of your home when the outside temperature is cooler. This facilitates cross ventilation, promoting a refreshing airflow and further reducing the need for artificial cooling | Relatively Easy |

## 6.3 Energy saving tips for the building envelope

Improving the energy efficiency of the building envelope, which consists of the walls, roof, windows, doors, and foundation, is crucial for reducing energy consumption in a building. Enhancing the energy efficiency of the building envelope not only reduces energy consumption but also improves comfort and indoor air quality. Depending on the age and condition of your building, you may need to prioritize different measures to achieve the best results.

Some energy-saving tips for enhancing the building envelope, described and categorised by ease of implementation are given in the following table.

*Table 16. Energy saving measures for the building envelope*

| EE measures for building envelope | Description | Level of applicability |
|---|---|---|
| **Insulate your facade and roof** | Adequate insulation in walls, floors, and attics helps maintain a stable indoor temperature. Consider adding or upgrading insulation to meet or exceed recommended U-values | More involved |
| **Seal air leaks** | Identify and seal gaps, cracks, and holes in the building envelope. Use weather-stripping, caulk, and foam insulation to seal leaks around doors, windows, pipes, and electrical outlets | Relatively Easy |
| **Install energy-efficient windows and doors** | If replacing windows and doors is not an option, consider adding storm windows and doors to improve insulation and reduce drafts | Moderate |

| | | |
|---|---|---|
| **Use insulated window coverings** | Install insulated curtains or blinds to reduce heat transfer through windows during hot summers and cold winters | Relatively Easy |
| **Reflective roofing** | Choose reflective or cool roofing materials to reduce heat absorption and keep the building cooler in hot weather | Moderate |
| **Seal and insulate the attic** | Properly seal and insulate the attic to prevent heat loss in winter and heat gain in summer | Relatively Easy |
| **Upgrade siding and exterior finishes** | Consider adding insulated siding or exterior finishes to improve the thermal performance of the walls | Moderate |
| **Manage solar gain** | Use shading devices such as awnings, pergolas, or planting deciduous trees strategically to block direct sunlight during the hottest parts of the day | Relatively Easy |
| **Optimize foundation insulation** | Ensure the foundation is properly insulated to prevent heat loss from below ground | More involved |
| **Inspect and maintain** | Regularly inspect the building envelope for damage, wear, or water leaks, and promptly address any issues to maintain its integrity | Relatively Easy |
| **Energy audits** | Consider getting a professional energy audit to identify specific areas of improvement in your building envelope and prioritize upgrades | More involved |

The measures categorised as “Relatively Easy” are relatively simple changes or projects that most homeowners can tackle with moderate effort and budget. “Moderate” measures may require a bit more effort or investment but are still manageable for many households. The “More Involved” measures often involve more extensive renovations or design considerations and may require professional assistance.

## 6.4 Energy saving tips for lighting

Energy-saving tips for lighting in households can significantly reduce electricity consumption and lower your utility bills. Here are some tips for more efficient lighting, with average price in the EU.

**Switch to led bulbs**: Replace incandescent and CFL bulbs with energy-efficient LED bulbs. LEDs use significantly less energy and last much longer. The cost of LED bulbs can vary depending on the

brand and type (e.g., standard, dimmable, smart). On average, you can expect to pay between €2 to €10 per bulb.

**Dimmer switches:** Install dimmer switches in rooms where adjustable lighting is desirable. Dimming lights can save energy when full brightness is not needed Dimmer switches typically range from €15 to €30 each, not including installation costs.

**Motion sensors**: Use motion-activated lights for outdoor areas, closets, and hallways. They ensure that lights are on only when needed. The cost of motion sensors for indoor use is usually between €10 to €30 per sensor. Outdoor motion sensors can range from €20 to €50 each.

**Smart lighting systems and timers**: Use timers and smart lighting systems to automate when lights turn on and off, particularly when you're away from home. Smart lighting systems can vary widely in price. Basic smart bulbs start at around €10 to €20 per bulb, while more advanced systems with hubs and colour-changing capabilities can cost €50 or more per bulb. Simple plug-in timers can cost as little as €5 to €15 each.

**Task lighting** (Desk Lamps, Under-Cabinet Lights): Use task-specific lighting, such as desk lamps or under-cabinet lights, for activities like reading, cooking, or working. This allows you to illuminate only the area where it's needed. Prices for task lighting fixtures vary widely, ranging from €20 to €50 or more per fixture.

**Solar-powered lights:** For outdoor lighting needs like pathway or garden lighting, consider solar-powered options that charge during the day and provide illumination at night. Solar-powered outdoor lights are relatively affordable, with prices typically ranging from €10 to €50.

**Energy-efficient fixtures**: Dust and dirt on light fixtures can reduce their brightness. Regularly clean bulbs, lamps, and fixtures to ensure optimal light output.

Also, energy savings can be achieved by **changing energy behaviour**, e.g.:

- Choose light paint colours: Light-coloured walls and ceilings can reflect more light, reducing the need for higher-wattage bulbs.
- Educate family members: Teach everyone in your household about the importance of energy-efficient lighting and encourage them to turn off lights when leaving a room.
- Consider lighting zones: Install multiple light switches in rooms with different lighting zones to allow you to control specific areas independently.
- Regular maintenance: Check for flickering or malfunctioning bulbs and fixtures and replace them promptly. Faulty lighting can waste energy.
- By implementing these energy-saving tips for lighting, you can reduce your electricity consumption, lower your energy bills, and contribute to a more sustainable and environmentally friendly household.

### 6.4.1 Energy saving tips for household equipment

The importance of energy efficiency in household equipment is of importance, when talking about cost reduction and higher life standards. From kitchen appliances to electronic devices, our daily lives are intertwined with different types of equipment that, when used inefficiently, can lead to energy waste and higher energy and water bills. However, with the right knowledge and practices, it is possible to experience the convenience of modern appliances and devices while reducing energy consumption and the associated environmental impact.

Below simple energy-saving tips are presented, categorised by type of appliance. These are measures that households could easily implement. Average costs and range of implementation are also provided.

## A. Refrigerators and Freezers

**Set temperature wisely**: Keep your fridge at around 6-8°C and the freezer at -18°C (0°F) for optimal efficiency. Avoid colder settings, as they increase energy usage without significant benefits.

Cost: Free

Ease: Relatively Easy

**Clean coils and seals**: Dusty coils and damaged seals can reduce efficiency. Clean coils annually and replace damaged seals.

Cost: A coil brush costs around €5-€10.

Ease: Relatively Easy

**Upgrade to energy-efficient models**: Energy-efficient refrigerators and freezers with the ENERGY STAR/ or ECO LABEL can save you money over time.

Cost: €300-€1,500+ (varies by size and features).

Ease: Moderate

**Keep the refrigerator full**: A well-stocked fridge retains cold better than an empty one. However, avoid overfilling to allow for proper air circulation.

Cost: Free

Ease: Relatively Easy

**Cover and store food properly**: Use airtight containers or covers to prevent moisture loss and odors from spreading inside the fridge. This reduces the workload on the compressor.

Cost: Free

Ease: Relatively Easy

**More energy-saving tips for refrigerators and freezers:**

- Regularly Defrost Manual Defrost Freezers: If you have a manual defrost freezer, make sure to defrost it regularly (when frost reaches about 1/4 inch) to maintain its efficiency.
- Position the Fridge Wisely: Place your refrigerator in a cool, well-ventilated area, away from direct sunlight, heat sources, and the stove. Ensure there is adequate space behind and on top for heat dissipation.
- Clean the Coils: Dust and dirt can accumulate on the refrigerator's condenser coils, hindering heat exchange. Vacuum or brush the coils at least once a year to keep them clean.
- Check the Door Seals: Ensure that the refrigerator and freezer doors sealed tightly. Replace damaged or worn-out gaskets to prevent cold air leaks.
- Use Energy-Saving Mode: Some newer refrigerators have an energy-saving mode that reduces power consumption during periods of low activity, like when you're away.

- Avoid Excessive Opening: Limit the number of times you open the refrigerator door, and avoid keeping it open for extended periods. This reduces the need for the compressor to work harder.
- Organize for Efficiency: Keep frequently used items toward the front of the refrigerator for quick access. Store less-frequently used items toward the back.
- Allow Hot Foods to Cool: Let hot foods cool down to room temperature before placing them in the fridge to reduce the energy required to lower their temperature.
- Use the Crisper Drawers: Store fruits and vegetables in the designated crisper drawers. Adjust the humidity settings as needed to keep produce fresh longer.
- Consider a Newer, Energy-Efficient Model: If your refrigerator is old and inefficient, upgrading to an Energy Star-rated model can lead to significant energy savings over time.
- Turn off Ice Makers and Water Dispensers: If your refrigerator has ice makers and water dispensers, consider turning them off if you don't use them regularly, as they can increase energy consumption.
- Plan Your Shopping: Minimize food waste by planning your grocery shopping and meals to use up perishable items before they go bad.

## B. Washing Machines and dryers

**Use cold water**: Washing with cold water reduces energy consumption by avoiding the need to heat water.

Cost: Free

Ease: Relatively Easy

**Run full loads**: Maximizing the load size reduces the number of cycles and saves energy.

Cost: Free

Ease: Relatively Easy

**Choose high spin speeds**: High spin speeds remove more water, reducing drying time and energy use.

Cost: Free

Ease: Relatively Easy

**Option for energy-efficient models**: Look at the energy label when buying appliances. ENERGY STAR-rated washing machines are designed to be more efficient.

Cost: €300-€1,000+ (varies by capacity and features).

Ease: Moderate

**More energy-saving tips for washing machines and dryers:**

- Pre-treat stains: pre-treat stains or heavily soiled areas to avoid running the wash cycle again, which saves energy and water.
- Front-load vs. Top-load: front-load washing machines are generally more energy-efficient than top-load machines. Consider this when shopping for a new washer.

- use delay start: some washing machines have a delay start feature, which allows you to run cycles during off-peak hours when energy rates may be lower.
- Maintain the machine: regularly clean the lint filter and check for blockages in the drain pump or hoses. Keeping the machine in good working condition ensures it operates efficiently.
- Drying your clothes outside on the terrace is free. If you use a dryer, consider its energy efficiency characteristics.
- Drying the same fabrics together speeds up the drying process.
- Drying clothes in the tumble dryer is expensive and makes them harder to iron
- Clean the lint filter: after each load, clean the lint filter to maintain proper airflow, which allows the dryer to work more efficiently.
- Use moisture sensors: if your dryer has a moisture sensor setting, use it. These sensors detect when clothes are dry and automatically shut off the machine, preventing over-drying.
- Dry full loads: just like with washing machines, dry full loads whenever possible to make the most efficient use of the appliance.
- Separate heavy and lightweight fabrics: when drying mixed loads, separate heavier items (like towels and jeans) from lighter fabrics (like shirts and delicates) to optimize drying times.
- Dry towels and heavier cotton in a separate load from lighter-weight clothes.
- If your dryer has a "cooling cycle", it allows the clothes to finish drying with the residual heat in the dryer.

## C. Dishwashers

**Run full loads**: Like washing machines, running full dishwasher loads conserves energy. Dishwashers are most energy-efficient when they run full loads. Wait until you have enough dishes to fill the dishwasher before running it.

Cost: Free

Ease: Relatively Easy

**Use efficient settings**: Select shorter or eco-friendly cycles when possible. Many dishwashers offer an energy-saving or eco-friendly cycle. Use this setting to reduce water and energy consumption during the wash.

Cost: Free

Ease: Relatively Easy

**Air dry dishes**: Some dishwashers have a heated dry option. Skip the heated drying cycle and allow dishes to air dry. Turning this off and allowing dishes to air dry can save energy.

Cost: Free

Ease: Relatively Easy

**Upgrade to energy-efficient models**: If you're in the market for a new dishwasher, consider purchasing an Energy Star-certified model, which meets energy efficiency guidelines and may qualify for rebates. Look at the energy label!

Cost: €400-€1,200+ (varies by size and features).

Ease: Moderate

**More energy-saving tips for dishwashers:**

- Scrape, Don't Pre-Rinse: Modern dishwashers are designed to handle food residues on dishes, so there's no need to pre-rinse dishes under running water. Scrape off large food particles instead.
- Load Dishes Properly: Arrange dishes so that they do not block the spray arms. Proper loading ensures that all items are thoroughly cleaned and reduces the need for rewashing.
- Use Rinse Aid: Rinse aid helps dishes dry faster and with fewer water spots, which can reduce the need for extended drying cycles.
- Avoid Excessive Detergent: Using too much dishwasher detergent can lead to excess suds and more rinse cycles. Follow the manufacturer's recommendations for detergent usage.
- Select Shorter Wash Cycles: Choose shorter wash cycles when possible, as they use less energy and water than longer, intensive cycles.
- Use Delay Start: If your dishwasher has a delay start feature, use it to run the machine during off-peak energy hours when rates may be lower.
- Regular Maintenance: Clean the dishwasher's filter and spray arms regularly to ensure they work efficiently. A well-maintained dishwasher is more energy-efficient.
- Check Water Temperature: Make sure your water heater is set to a temperature of at least 120°F (49°C) to ensure effective dishwashing.
- Fix Leaks: Check for and repair any leaks in your dishwasher promptly. Leaks can waste both water and energy.
- Load Utensils Properly: Load utensils with handles facing down to allow for better water and detergent distribution.
- Don't Overcrowd: Avoid overloading the dishwasher, as it can obstruct water flow and reduce cleaning efficiency.

## D. Water Heaters

**Lower temperature**: Reduce the water heater thermostat to 49-52°C. This is typically sufficient for most household needs and helps prevent overheating and energy waste.

Cost: Free

Ease: Relatively Easy

**Insulate the tank and pipes**: Wrapping the tank with an insulating blanket reduces heat loss. Insulate also the hot water pipes in your home, especially those that run through unheated spaces. This prevents heat loss and ensures hot water reaches its destination faster.

Cost: €20-€50 for an insulating blanket.

Ease: Moderate

**Use night tariff:** Use a night tariff when possible, this will not save electricity but will reduce the cost (bill)

Cost: Free

Ease: Relatively Easy

**More tips for domestic water heating:**

- Use water-saving shower aerators - this will reduce water flow. The payback period for new efficient showers is less than 1 year;
- If your boiler is old, replace it, possibly energy-saving. Due to the presence of scale in the water, it accumulates on the heat exchange surface of the boiler, which leads to a gradual increase in electricity consumption for water heating.
- When heating an electric boiler: During the winter the temperature of the hot water should not be higher than 55 ° C, and in the summer it is recommended that the temperature of the hot water be lower. In order to prevent Legionnaires' disease, it is necessary to heat the temperature of the hot water from the boiler to at least 60 ° C once a month.
- Hot water from TPP: Hot water leaves the subscriber station with a temperature of 52 to 55 ° C, depending on the setting of the thermostatic valve.
- Check for hidden water losses with water meters! If there is no increase in the water meter reading after two hours when the water taps in the apartment are closed everywhere, then everything is fine. Otherwise, look for leaks;
- Check for water losses from the toilet cistern! For this purpose, a water colourant can be used in it. If without dropping the cistern, after 30 minutes there is staining of the water in the toilet bowl, then there is a leak. Replacing defective seals is not a problem for anyone;
- Remember that the biggest consumer of water is the toilet cistern! Place small plastic bottles filled with water and some sand or pebbles at a safe distance from moving parts to sink to the bottom. In this way, you can save up to 20 litres per day or replace the old cistern with a new one, with a smaller volume;
- Stop the water after wetting the toothbrush and while brushing your teeth;
- Use a glass of water to rinse your mouth. Use the washing machine and dishwasher only when fully charged.
- When washing dishes by hand, do not let the rinsing water in the sink run constantly;
- Do not cool drinks with running tap water, but in the refrigerator. This will save a lot of water;
- Eliminate damage-causing leaks or drips immediately;
- When buying a washing machine (the second largest consumer of water), prefer those with a water factor of less than 9.5, which uses 35 - 50% less water and consumes up to 50% less energy per charge.

## E. Computers and Electronics:

**Enable power-saving features**: Activate power-saving modes and set computers and devices to sleep when not in use. Right-click on the desktop> Properties> Screen saver> Power. Your monitor will reactivate within seconds of moving the mouse. Turn off the monitor when you are away from your desk (while at lunch and meetings) and your computer at night.

Cost: Free

Ease: Relatively Easy

**Unplug chargers and devices**: Chargers and electronics consume energy even when not in use. Unplug or use smart power strips.

Cost: Free

Ease: Relatively Easy

**Upgrade to energy-efficient models**: When replacing devices, look for ENERGY STAR-rated models. A computer with energy class B-A can save 2,000 kWh per year

Cost: Varies by device, e.g., €500-€2,000+ for a new laptop.

Ease: Moderate

**More tips for Computers and Electronics:**

- A monitor left to work overnight uses the energy to laser print 800 pages;
- For a 12-month period, a computer left to run 24 hours a day will consume up to 2,500 kWh of electricity per year
- Hibernation is energy efficient if you leave your laptop running all night. This option is designed for laptops and may not be available for all computers. Hibernate mode uses less power than Sleep, and when you restart your computer, you return to where you left off (though not as fast as Sleep). Use Hibernation when you know you will not be using your laptop or tablet for an extended period of time and will not be able to charge the battery during this time. First, make sure that this option is available on your computer and turn it on, if available.

## F. TVs

**Adjust brightness and contrast:** Lower the brightness and contrast settings on your TV to reduce energy consumption. Many modern TVs have automatic brightness controls that adjust according to the room's lighting conditions

Cost: Free

Ease: Relatively Easy

**Power saving setting: enable power-saving features**: Most TVs have power-saving or energy-saving modes that reduce energy consumption during periods of inactivity. Enable these features in the TV settings.

Cost: Free

Ease: Relatively Easy

**Set a sleep timer:** If you tend to fall asleep while watching TV, set a sleep timer to automatically turn off the TV after a certain amount of time. This prevents the TV from running all night.

Cost: Free

Ease: Relatively Easy

**Optimize audio:** If you have external speakers or a sound system connected to your TV, make sure they are turned off when not needed to save energy.

Cost: Free

Ease: Relatively Easy

**More energy-saving tips for TVs:**

- Choose Energy-Efficient Models: When purchasing a new TV, look for models that are ENERGY STAR-certified. These TVs are designed to meet energy efficiency guidelines.
- Turn Off the TV When Not in Use: It may seem obvious, but turning off the TV when you're not actively watching it is one of the most effective ways to save energy.
- Use a Power Strip: Plug your TV and related devices (DVD players, game consoles, streaming devices, etc.) into a power strip. This allows you to turn off all devices with a single switch when they're not in use, preventing energy "vampires" from drawing power in standby mode.
- Disable Screen Savers: Modern LED and LCD TVs do not need screen savers. Disable them to save energy.
- Unplug Unnecessary Devices: If you have devices connected to the TV via HDMI or other ports, unplug them when not in use to prevent the TV from constantly searching for signals.
- Choose a Smaller Screen: Consider using a smaller TV if it meets your needs. Smaller screens typically consume less energy than larger ones.
- Stream Wisely: Streaming video content from the internet can consume a significant amount of energy. Use streaming devices or smart TVs with energy-efficient processors, and turn off streaming devices when not in use.
- Keep the TV Clean: Dust and dirt can accumulate on the TV's vents and components, leading to overheating and reduced efficiency. Clean the TV regularly to ensure proper airflow.
- Leaving your TV and all accessories attached to it in standby mode all the time can cost you up to BGN 60 per year. Use standby power strips and turn them off during the day.
- The new TV with energy class B-A can save about 160 kWh / year.

## G. Energy-saving tips for cooking

Some energy saving measures that can be useful for cooking are as follows:

- Household microwave appliances consume on average about 1/2 less energy than the energy consumed by conventional household appliances.
- When you open the oven door during cooking, you lose up to 30% of the oven temperature.
- Preheat the oven only when necessary.

- The diameter of the hob must correspond to the diameter of the pan placed on it - so the heat is transferred optimally.
- Always cover the pot when cooking.
- Turn off the hobs before the end of the boiling time to use the residual heat.
- Heat portions up to 400 g in the microwave oven - this will save both time and energy.
- When frying meat for a short time, a pan should be used.
- Making coffee in a coffee machine is 50% cheaper than boiling water on the stove.
- Use a deep fryer instead of an electric stove, so you save up to 25% electricity.
- Baking the slices with a toaster is a more energy-saving method (by about 70%) compared to using the oven.
- When cooking eggs for breakfast, it is better to use an electric egg cooker than a pot, which will save up to 50% of electricity.

## 6.5 Intelligent meters and devices for energy management in households

Lack of information is a present barrier to consumer energy saving. Lack of information constitutes a barrier on two levels: consumers lack information on the energy consumption of their household appliances, as well as on how this consumption can be reduced. By using smart plug equipment and feedback on the individual consumption patterns of their appliances, consumers will be given a very easy way to learn about how much energy their appliances are using. Smart plugs allow consumers to monitor the extent of energy savings through changed behaviour when using individual appliances. Seeing this immediate effect is one of the most promising ways to change habits.

### A. Smart equipment components

Intelligent meters and devices for energy management in households, often referred to as smart meters or smart home energy management systems, represent a significant advancement in how we measure, monitor, and control energy consumption within residential settings. These technologies combine hardware, software, and communication capabilities to provide homeowners, utility companies, and grid operators with detailed insights and improved control over electricity usage. Here's an explanation of how these systems work and their key components:

- **Smart meters**: Intelligent meters, or smart meters, are the cornerstone of these systems. They replace traditional analogue meters and digitally record electricity consumption data. Smart meters measure electricity usage at shorter intervals, often in 15-minute increments, compared to the monthly readings of traditional meters. This granular data is sent to utility companies automatically.
- **In-home energy monitors:** In addition to smart meters, some systems include in-home energy monitors or sensors that provide real-time information on electricity use within the household. These monitors can be connected to the main electrical panel or individual appliances to provide insights into energy consumption.
- **Wireless networks:** Smart meters and in-home monitors communicate with a central data collection point or the utility company through wireless networks, such as Wi-Fi, Zigbee, or

cellular networks. This enables the transmission of data without the need for physical meter readings.

- **Data management and analytics:** Homeowners can access their energy consumption data through user-friendly web portals or mobile apps. These dashboards display real-time and historical usage data, allowing residents to track their energy consumption trends and make informed decisions.
- **Control and automation:** Some intelligent systems include load control devices that can remotely manage certain appliances during periods of peak demand or high electricity rates. For example, these devices can cycle air conditioners or water heaters on and off to reduce load.
- **Thermostats**: The thermostat is a device that automatically responds to changes in ambient temperature by turning on or off a heating or cooling system to constantly maintain a set desired temperature indoors. The biggest benefit of using the thermostat is the ability to set different temperature regimes and schedules. When the operation of the heating or cooling system or appliances is optimized, significantly less energy is used in the long run.
- **Temperature control** - It is possible to set a lower temperature (heating during the day when you are not at home and at the same time a program) with digital thermostats, to reach and maintain a comfortable temperature when you get home. saving energy during our absence and at the same time when we return home, we are waiting for a cosy and warm home.
- **Smart home appliances:** Smart energy appliances, also known as smart appliances or connected appliances, are household devices and equipment that integrate advanced technology, sensors, and connectivity features to enhance energy efficiency, convenience, and functionality. These appliances are designed to interact with users and other devices, offering greater control and automation while helping homeowners manage their energy consumption more effectively.

**B. Benefits of the intelligent energy management system**

Intelligent meters and devices for energy management in households offer a range of benefits that can help homeowners, utilities, and society as a whole. Here are some of the key advantages:

| Real-time data monitoring | Energy usage insights | Reduced energy costs |
|---|---|---|
| •Intelligent meters provide real-time data on electricity consumption, allowing homeowners to track their usage patterns accurately. This data empowers consumers to make informed decisions about energy consumption | •Intelligent meters and devices offer insights into which appliances and activities consume the most energy, enabling homeowners to identify areas where they can make energy-saving improvements. | •With the ability to monitor energy consumption closely, homeowners can implement energy-saving strategies and reduce their utility bills. This can lead to significant cost savings over time. |

| Remote disconnect/reconnect | Enhanced billing accuracy | Promotion of energy efficiency |
|---|---|---|
| •Intelligent meters allow utilities to remotely disconnect and reconnect service, eliminating the need for physical visits by technicians. This enhances service efficiency and reduces downtime during maintenance or non-payment situations | •Intelligent meters provide accurate data on electricity usage, reducing billing errors and disputes. Homeowners receive more transparent and fair billing statements | •Access to real-time data and insights encourages homeowners to adopt energy-efficient practices, such as using high-efficiency appliances and turning off lights and devices when not in use. |

| Environmental benefits | Enhanced customer engagement | Promotion of energy efficiency |
|---|---|---|
| •Lower energy consumption at the household level, as a result of intelligent energy management, contributes to reduced greenhouse gas emissions and environmental preservation. | •Intelligent meters and accompanying data portals foster greater engagement between utilities and consumers, promoting energy conservation and customer satisfaction. | •Access to real-time data and insights encourages homeowners to adopt energy-efficient practices, such as using high-efficiency appliances and turning off lights and devices when not in use. |

## 6.6 Energy labels

The legislation for energy labelling and Ecodesign in the European Union aims to enhance the energy efficiency of products available in the EU market. Ecodesign establishes standardized minimum standards across the EU, eliminating the least efficient products from the market. Energy labels offer a straightforward indication of a product's energy efficiency and key features at the point of purchase. This simplifies the process for consumers to save money on household energy expenses and contribute to reducing greenhouse gas emissions throughout the EU.

Initially introduced in 1994 for select household appliances and expanded in 2004 with a comparative scale from A (most efficient) to G (least efficient), the EU energy label has been instrumental in guiding consumers toward more energy-efficient choices. Simultaneously, it incentivizes manufacturers to innovate by adopting more energy-efficient technologies. Beyond energy consumption details, these labels also provide specific information on other relevant usage features, such as noise emissions or water consumption.

As the market introduced increasingly energy-efficient products, and distinctions between $A^{++}$ and $A^{+++}$ became less evident to consumers, the EU energy label categories underwent a gradual adjustment, returning to the simpler A to G scale. For instance, a product originally labelled as $A^{+++}$ for energy efficiency might be reclassified as class B or lower after rescaling, despite no change in

its energy consumption. The initial A class was left empty to accommodate future, more energy-efficient models.

In 2021, five product groups underwent this rescaling process, and additional product groups with EU energy labels are expected to undergo similar adjustments in the years ahead.

## A. Fridges and freezers

The EU energy labels for household fridges and freezers (Figure 2) use, as of 1 March 2021, a scale from A (most efficient) to G (least efficient). The labels provide information on the product's:

- energy efficiency class
- energy consumption
- storage volume(s)
- whether or not it has a freezer compartment
- noise emissions

Other factors may apply to the label, for example for wine storage units, which shows the number of bottles that can be stored. By switching to more energy efficient refrigerating appliances, a household can save up to €200 over the lifetime of an average product.

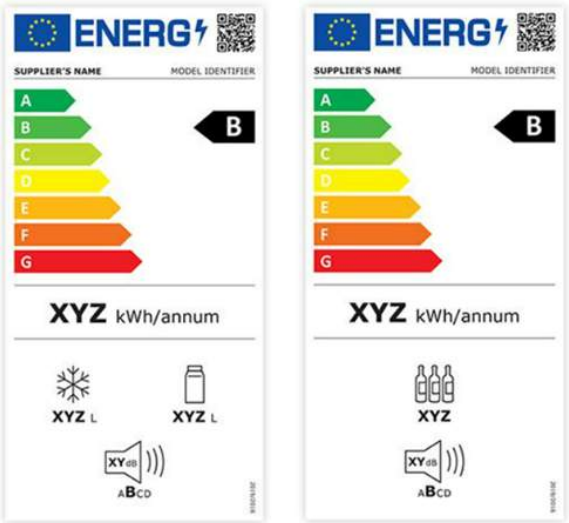



*Figure 16. Energy label for fridges and freezers*

## B. Dishwashers

The EU energy label for household dishwashers (Figure 3) uses, as of 1 March 2021, a scale from A (most efficient) to G (least efficient). The label provides information on the product's:

- energy efficiency class
- energy consumption for 100 cycles
- eco-programme duration
- water consumption for 1 cycle
- capacity of the dishwasher
- noise emissions

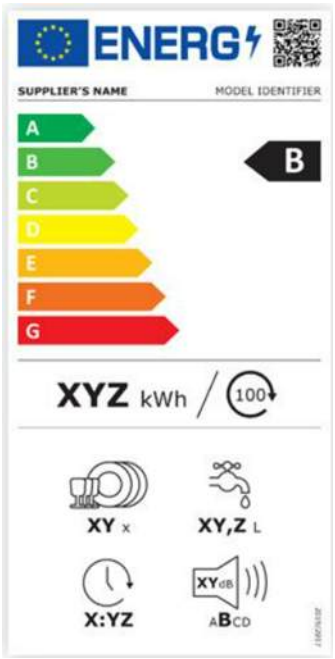



*Figure 17. Energy label for household dishwashers*

## C. Washing machines and washer-dryers

The EU energy labels for household washing machines and washer-dryers (Figure 4) use, as of 1 March 2021, a scale from A (most efficient) to G (least efficient). The labels provide information on the product's:

- energy efficiency class(es)
- energy consumption for 100 cycles
- water consumption for 1 cycle
- duration for 1 cycle
- noise emissions

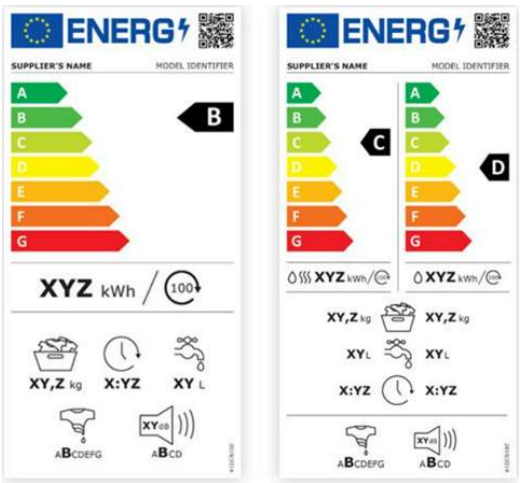



*Figure 18. Energy label for household washing machines and washer-dryers*

## D. Electronic displays including televisions

Electronic displays, such as televisions, computer monitors, or signage displays, are categorised on an energy efficiency scale from A (most efficient) to G (least efficient). The updated scaling system represents an enhancement, taking into account the screen area. These new labels (Figure 5) also provide information on a product's efficiency when displaying content in HDR, recognizing that such settings can consume up to twice as much energy as other configurations. Additionally, the label includes details about the diagonal size of the display and its resolution, enabling consumers to make more informed comparisons between similar displays.

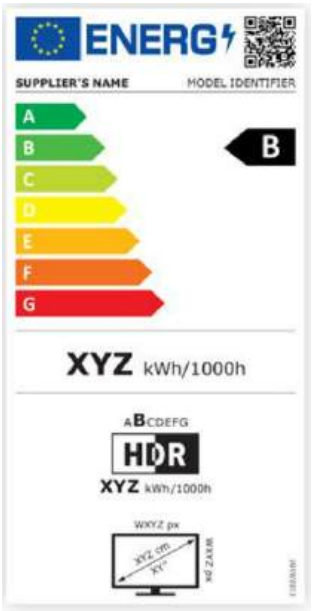



*Figure 19. Energy label for electronic displays*

## E. Lighting

Lighting products encompass various elements, including light sources like light bulbs (halogen, compact fluorescent, etc.) or LED modules/lamps. Additionally, control gears, such as ballasts, electronic components, and drivers, are considered part of lighting products, serving as devices necessary for connecting light sources to the electrical mains.

It's important to note that energy labelling and ecodesign regulations no longer apply to lamps or luminaires as of December 25, 2019, although a label was previously applicable. A luminaire constitutes a comprehensive electric light fixture responsible for distributing, filtering, or transforming light from one or more lamps, for instance, table, wall, or ceiling lamps.

Following the rescaling of the EU energy label for light sources starting from September 1, 2021, the revised labels now utilize a scale ranging from A (most efficient) to G (least efficient). This adjustment was prompted by the ongoing enhancements in energy efficiency, leading many products under the original label to attain $A^{+}$ or $A^{++}$ ratings. Consequently, the rescaling was implemented to offer consumers clearer insights into the most efficient products available on the market. The labels (Figure 6) provide information on the product's:

- energy efficiency class
- energy consumption

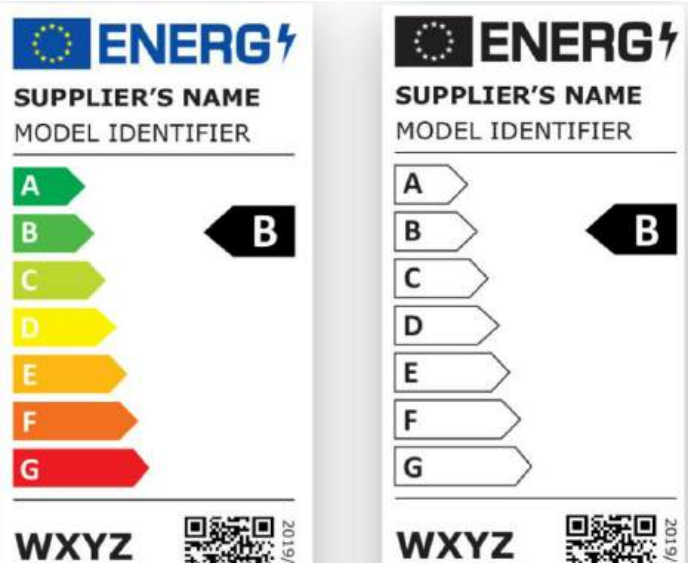



*Figure 20. Energy label for lighting products*

More information how to read the energy label of the household appliances can be found here: https://www.label2020.eu/

# 7 Communication and advising of vulnerable households

## 7.1 Energy poverty

### 7.1.1 What is energy poverty?

Energy Poverty is a 'symptom', an expression of a 'precondition' that affects our livelihoods, namely through the lack of access to essential energy services. Energy poverty typically stems from a combination of factors, including high energy costs, limited income, and homes that are inefficient in terms of energy use, which can be affected by factors such as the age, condition, and construction materials of the building envelope, as well as the energy efficiency of appliances. Additionally, factors like residential status (whether they own or rent their home) and the type of heating/cooling system in place also play a role in determining the ability to make energy-related improvements. Individuals with lower incomes often reside in dwellings with subpar insulation and frequently rely on second-hand or outdated appliances that are not energy efficient. Moreover, they often have to manage their electricity and gas expenses through pre-payment systems, which can result in them incurring higher unit costs compared to those using monthly billing systems.

The concept of energy poverty was introduced in the EU energy policy in 2009 by the Directive concerning common rules for the internal market in electricity (EC, 2009).

> ***'energy poverty is a growing problem in the Community. Member States which are affected and which have not yet done so should therefore develop national action plans or other appropriate frameworks to tackle energy poverty, aiming at decreasing the number of people suffering such situation. In any event, Member States should ensure the necessary energy supply for vulnerable customers. In doing so, an integrated approach, such as in the framework of social policy, could be used and measures could include social policies or energy efficiency improvements for housing. At the very least, this Directive should allow national policies in favour of vulnerable customers. (EC, 2009).***

However, it was only defined in 2012, in the Energy Efficiency Directive (EC, 2012):

> ***'a household's lack of access to essential energy services that underpin a decent standard of living and health, including adequate warmth, cooling, lighting, and energy to power appliances, in the relevant national context, existing social policy and other relevant policies' (EC, 2012)***

The way Energy Poverty is addressed through regulatory requirements has been significantly strengthened through the 'Fit for 55' package and in 2023, in the Energy Efficiency Directive (Recast) (EC, 2023), the Energy Poverty definition was updated to:

> ***"Article 2***
>
> ***'energy poverty' means a household's lack of access to essential energy services, where such services provide basic levels and decent standards of living and health, including adequate***

***heating, hot water, cooling, lighting, and energy to power appliances, in the relevant national context, existing national social policy and other relevant national policies, caused by a combination of factors, including at least non-affordability, insufficient disposable income, high energy expenditure and poor energy efficiency of homes…" (EC, 2023)***

### 7.1.2 How to identify people in energy poverty

Energy poverty mostly affects low-income households, retired people, unemployed or poorly paid, dependent on social benefits, and single households. A person living in energy poverty is primarily a precarious one, with low resources. It is generally mixed with poor housing, leading to difficulties in the payment of energy bills. Their economic disadvantage is often accompanied by poor energy efficiency of their homes (poor insulation, outdated heating systems, expensive or polluting fuel) and linked to poor health (elderly or disabled). It is often the case that energy-poor households are socially isolated and lack support from others. All in all, they tend to be subject to physical and mental health risks, degradation of dwellings, and excessive debt.

Energy poverty is usually measured through objective (or expenditure-based) and subjective (or consensual) indicators.

**Objective indicators** are generally based on the share of the energy costs in the total household income that is used for keeping the dwelling at an adequate temperature. These indicators can be easily compared in different Member States, ensuring that climate correction and purchasing power are taken into consideration. However, this data usually refers to the household expenditure for the provision of electricity and fuel, and therefore, it does not reflect the cost to ensure thermal comfort in the dwelling. Lack of data, particularly data with adequate granularity, is reported as an important barrier to tackling EP.

**Subjective indicators** assess basic parameters or characteristics of a dwelling and are therefore understood under a social dimension. These indicators are related to questions about the ability to maintain the appropriate temperature and pay bills before the deadline, as well as other questions about housing conditions.

Typical socio-economic and housing characteristics related to energy poverty are, as follows:

## A. Socio-economic characteristics

- Vulnerable persons or households (based on the national or local definition)
- Arrears on utility bills
- Low income
- Difficulties in coping with energy costs
- Inability to keep home adequately warm
- Inability to keep the home adequately cool
- High share of energy expenditure in relation to income

## B. Facilities / Housing characteristics

- An old building that has not been renovated, (e.g. deteriorated windows, which allow air draft)
- Insufficient heating, caused by a deprivation of heating, a lack of insulation or/and an inadequate heating system
- The use of single space/room heating, which is preferred sometimes in order to get a better control of the consumption
- Signs of humidity or mould, reflecting a bad state of the building and/or lack of heating
- Over-equipment or overheating leading to increased energy consumption
- A continued presence in the house, causing higher consumption
- Old and inefficient appliances

### 7.1.3 Consequences of energy poverty

The main consequences of EP are the following:

## A. Financial consequences:

- Use of aids and other assistance mechanisms
- Indebtedness and loans
- Use of budgets is usually used for other important needs such as housing, food, education, etc.
- Creation of restriction mechanisms or deprivation leading to other consequences.

## B. Consequences due to technical restrictions in heating:

- Under-heated housing will be humid.
- Under-ventilated housing will be humid and unhealthy.
- Humid housing will result in deterioration, enabling the development of mould, which leads to unsanitary conditions.

## C. Health consequences:

A cold environment is not by itself a factor of diseases, but generates a number of negative consequences:

- To maintain its internal temperature in a cold environment, the body has to work harder. Situations like this can lead to exhaustion.

- Cold promotes vasomotor reactions, sneezing, runny nose, which can encourage the transmission of pathogens.
- Colder air temperature in many situations means not sufficient air humidity.

**D. Suspected causal links regarding cold living conditions exist for a number of diseases:**

- Respiratory diseases
- Cardiovascular diseases
- Arthritis
- Depression

## 7.2 Communication skills

### 7.2.1 How to improve your communication skills

Effective communication encompasses various skills that enable individuals to convey messages clearly and interact with others successfully. Some types of basic communication skills along with brief explanations are given in the following Table 1.

*Table 17. Basic communication skills*

| Communication skill | Explanation | What to do |
|---|---|---|
| **Verbal communication** | Verbal communication involves using words to convey messages. It includes speaking, listening, and the ability to articulate thoughts and ideas clearly. | • Practice speaking clearly and confidently.<br>• Expand your vocabulary and language skills.<br>• Work on voice modulation and tone to convey emotions effectively |
| **Effective communication** | The ability to communicate clearly and effectively with citizens, team and partners is essential to ensure proper understanding and cooperation. | • Adapt technical language to everyday vocabulary that is easy to understand (use of comparisons, analogies, etc.) |
| **Nonverbal communication** | Nonverbal communication refers to the use of body language, facial expressions, gestures, and tone of voice to convey meaning. It can often convey emotions and attitudes more strongly than words. | • Pay attention to your body language and gestures.<br>• Practice maintaining eye contact without staring.<br>• Use facial expressions that match your message. |

| | | |
|---|---|---|
| | NONVERBAL LANGUAGE- SIGNS OF DISTRUST AND DISCOMFORT<br>• Avoidant eye contact: The person may avoid making eye contact or looking away, indicating a lack of confidence or discomfort.<br>• Crossing your arms: Crossing your arms over your chest can be a defensive gesture that indicates a protective or closed-off attitude.<br>• Lack of facial expression: Lack of facial expression or a tense facial expression may suggest discomfort or distrust.<br>• Restless gestures: Nervous or restless movements, such as touching your hair, hands or fingers, can be signs of tension or anxiety.<br>• Physical distance: Physically moving away from the person or subtly backing away can be an indicator of discomfort or need for personal space.<br>• Fixed or intense gaze: In some cases, an intense or fixed gaze can be interpreted as a sign of distrust, especially if it feels threatening.<br>• Excessive blinking: Excessive blinking or rapid blinking can indicate nervousness or stress.<br>• Muscle tension: Tension in the muscles of the neck, shoulders or jaw can be a sign that the person is uncomfortable.<br>• Closed body language: Keeping the body hunched or closed, such as hunching or hunching, may indicate that the person is protecting themselves in some way.<br>• Unusual voice tones: Changes in voice tone, such as | • Adequate eye contact: Maintaining adequate eye contact conveys confidence. Looking into the eyes of the person you are talking to shows that you are engaged and honest in the conversation.<br>• Relaxed and friendly facial expression: An open and friendly facial expression shows that you are comfortable and receptive. Smiling appropriately can make the message more pleasant and trustworthy.<br>• Open, relaxed posture: Maintaining an upright, open posture with your arms down at your sides or open shows confidence. Avoiding a closed posture, such as crossing your arms, can contribute to more positive communication. |

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| | becoming more tense or lower than normal, can be signs of discomfort. | |
| **Active listening** | Active listening is the skill of giving full attention to a speaker, understanding their message, and providing feedback to demonstrate understanding. It involves not just hearing but also comprehending and empathizing. | • Focus on the speaker and minimize distractions.<br>• Use verbal cues like nodding and "I see" to show you're listening.<br>• Avoid interrupting; let the speaker finish before responding. |
| **Empathy** | Empathy is the capacity to understand and share the feelings of another person. It involves showing compassion, acknowledging emotions, and providing support | • Practice putting yourself in others' shoes to understand their feelings.<br>• Listen actively and validate their emotions.<br>• Show empathy through your responses and actions. |
| **Clarity and conciseness** | Communicating with clarity means expressing thoughts and ideas in a straightforward and easily understandable manner. Being concise involves using as few words as necessary to convey the message effectively | • Organize your thoughts before speaking or writing.<br>• Use simple and direct language.<br>• Eliminate unnecessary words or details. |
| **Conflict resolution** | Conflict resolution is the ability to address and resolve disagreements or disputes in a constructive and peaceful manner, often involving active listening, negotiation, and problem-solving | • Develop problem-solving skills.<br>• Practice active listening during conflicts.<br>• Focus on finding mutually agreeable solutions |
| **Assertiveness** | Being assertive means expressing one's needs, opinions, and feelings confidently and respectfully while also respecting the rights and opinions of others. It strikes a balance between passive and aggressive communication. | • Build self-confidence in expressing your needs and opinions.<br>• Use "I" statements to communicate your feelings and preferences.<br>• Maintain respect for others' opinions while expressing your own. |
| **Interpersonal skills** | Interpersonal skills involve the ability to interact and build positive relationships with others. These skills include effective communication, active listening, empathy, and conflict resolution. | • Develop rapport with others through genuine interest and respect.<br>• Practice effective communication, empathy, and conflict resolution. |

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| | | • Foster positive relationships through trust and cooperation. |
| **Cultural sensitivity** | Cultural sensitivity is the awareness and respect for cultural differences in communication styles, norms, and customs. It ensures effective communication in diverse settings. | • Educate yourself about different cultures, norms, and customs.<br>• Avoid making assumptions or judgments based on cultural differences.<br>• Be open to learning and adapting to diverse communication styles |
| **Adaptability** | Adaptability in communication is the skill to adjust one's communication style and approach based on the context, audience, and situation. It allows for effective communication in various scenarios | • Assess the communication needs of each situation or audience.<br>• Be flexible in your approach and adapt to different communication styles.<br>• Continuously learn and adjust based on feedback. |
| **Feedback giving and receiving** | Providing constructive feedback helps others improve, while receiving feedback gracefully is essential for personal and professional growth. Effective feedback is specific, actionable, and respectful. | • Provide constructive feedback with specific examples.<br>• Be open to receiving feedback and use it for self-improvement.<br>• Foster a culture of open and honest feedback in your relationships. |
| **Conflict avoidance** | Sometimes, avoiding unnecessary conflicts is a valuable communication skill. It involves recognizing when a situation doesn't warrant a confrontation and choosing to let minor issues go. | • Prioritize which conflicts are worth addressing and which can be let go.<br>• Practice diplomacy and compromise when minor conflicts arise.<br>• Focus on maintaining positive relationships. |

### 7.2.2 Forms of communication

There are three forms of communication: **verbal, para-linguistic** and **non-verbal** communication.

**Verbal communication** refers to all elements of speech: **words, letters, sentences and numbers**

- Purely verbal communication is very difficult. As we have already learned in the discussion of perception, what we say is frequently understood very differently by the person with whom we are speaking, because the other person has a different understanding of the words we choose.
- Speech conjures up images which the person speaking and the person addressed do not always understand in the same way, frequently representing a source and cause of misunderstandings and anger.

**Para-linguistic communication** refers to the **manner in which we speak**: intonation, speaking rate, pauses, laughing, sighing. These elements are influenced by sensations, such as nervousness, as indicated by "ums" and "hms", speaking rate or, for example, irritation and anger expressed by speaking loudly.

**Non-verbal communication** includes:

- **Body language:** posture, gestures and facial expressions
- **External attributes**, such as clothing; jewelry; status symbols, such as holidays, a car, a flat/house create and characterise the impressions conveyed. This represents a type of code, characterising a certain image of a person.
- **Posture:** The manner in which a person appears before another person for the purpose of discussions, for example with shoulders hanging, breast stretched forward, etc.
- **Gestures:** Forms of expression by the body:
  - Nodding the head – signalling agreement
  - Pat on the back – signalling encouragement
  - Shaking hands – greeting
  - These gestures are however not understood in the same way in all cultural groups.
- **Facial expressions:** Possible facial expressions: The signals conveyed by facial expressions are nearly identical in all cultural groups. They therefore have a significant influence on communication.
- **Gaze:** The eyes are a **central part of the face**. The gaze is an important instrument for establishing contact as it can demand contact; it can signal distance, it can express sympathy and feelings or it can refuse contact.

## 7.3 Communication with vulnerable people

### 7.3.1 Dos and Don'ts for communication with vulnerable people

Effective communication with vulnerable individuals is built on trust, respect, and understanding, while avoiding behaviours that may cause discomfort or harm. The most important "dos" and "don'ts" are shown in *Table 18*.

*Table 18. "Dos" and "don'ts" when communicating with vulnerable people*

| Dos for Communicating with Vulnerable People | Explanation | Don'ts for Communicating with Vulnerable People | Explanation |
|---|---|---|---|
| **Show empathy and actively listen.** | Acknowledge their feelings and concerns. | **Rush or pressure them.** | Avoid making them uncomfortable or anxious. |
| **Be patient and give them time.** | Understand they may need more time to express themselves or make decisions. | **Make assumptions about their experiences.** | Each person's situation is unique; avoid generalizations. |
| **Use plain and clear language.** | Communicate in a straightforward manner, avoiding jargon or technical terms. | **Use stigmatizing language or labels.** | Refrain from using derogatory or judgmental language. |
| **Respect their autonomy and choices.** | Acknowledge their right to make decisions about their own lives. | **Minimize or dismiss their concerns.** | Take their concerns seriously, regardless of size. |
| **Ask open-ended questions to encourage dialogue.** | Promote conversation by asking questions that require more than a yes/no answer. | **Overwhelm with too much information at once.** | Provide information in manageable portions. |
| **Maintain privacy and confidentiality.** | Ensure that their personal information and discussions remain private. | **Violate personal boundaries.** | Respect their privacy and avoid prying questions. |
| **Provide information and resources.** | Offer details about available resources, support services, or community organizations. | **Assume they need saving or rescuing.** | Allow them to make decisions; don't impose help. |
| **Treat them with respect and dignity.** | Interact with them in a respectful and dignified manner. | **Display impatience or frustration.** | Maintain patience and compassion in interactions. |
| **Offer reassurance and emotional support.** | Let them know that you are there for them and that help is available. | **Discriminate based on their circumstances.** | Treat everyone fairly and equally, without bias. |
| **Use open questions: "tell me about …".** | | **Don't use "Energy poor" or "vulnerable"** | The terms "vulnerable" or "poor" or "energy poor" should not be used in communications with households! |

| | | | |
|---|---|---|---|
| **Use probing questions: "I want to understand a bit more, can you give me some examples …"** | | **Avoid leading questions: "presumably …"** | If the customer doesn´t want to disclose information it may not be reasonable to continue asking questions. |
| **Be friendly** | Engage in small talk to establish the atmosphere for discussions (weather, flat, travel route, etc. – whatever appears to be appropriate) | **Make empty promises** | Don't make promises you can't keep. It's important to be honest about the limitations and extent of the help you can offer. |
| | | **Being invasive** | Respect boundaries and do not enter private areas of the home without permission or a valid reason. |
| | | **Disregarding consent** | Make sure you obtain consent before taking photos, recording audio or video, or sharing information with third parties. |

## 7.4 Vulnerable households advising step-by-step

Preparing for an energy advising visit to vulnerable households requires careful planning and consideration of the unique needs and challenges faced by these households. Here are steps to help you prepare for such visits.

### A. Preparation

**1. Be sure for the goals:**

Clarify the purpose of the visit. Is it to reduce energy costs, improve energy efficiency, or address specific concerns (e.g., heating, cooling, insulation)?

**2. Gather information:**

Ask for relevant information about the household, such as energy bills, the home's layout, age, and any existing energy-efficient measures or concerns.

**3. Schedule appointments:**

Set up appointments with the household members to ensure their availability and cooperation during the visit.

**4. Assemble necessary materials:**

Prepare materials you may need during the visit, such as energy efficiency pamphlets, checklists, and informational resources.

**5. Equip yourself:**

Bring any tools or equipment needed for assessments, such as a flashlight, a thermal camera, a power meter, or a notebook for recording information.

**6. Dress appropriately:**

Wear comfortable and appropriate clothing, especially if you'll be inspecting areas like attics or crawl spaces.

Dress professionally and respectfully to convey seriousness and credibility.

**7. Prepare a checklist:**

Use a checklist of areas to assess, questions to ask, and common energy efficiency issues to look for during the visit.

**8. Establish trust:**

Begin the visit by introducing yourself, explaining your role, and building rapport with the household members. Show empathy and respect for their situation.

## B. Household visit

**1. Introduce yourself**

Present your ID cards, hand over a business card, certificate of training.

**2. Explain the objective of the visitation and how the visitation is going to be performed.**

Explain the purpose of your visit, your duties, and how you can help. Clear up any misunderstandings and offer transparency in your role.

**2. Transition to advisory discussions**

Inform your customer exactly about the procedure you will follow.

**3. Present and ask to sign the Consent form**

**4. Acquire/correct client data**

Household size, energy behaviour, and any energy issues they meet

**5. Conduct a simple home energy assessment**

Walk through the home to assess its energy performance. Check for drafts, insulation quality, appliance efficiency, and the condition of heating and cooling systems.

**6. Identify energy-saving opportunities**

Based on your assessment, identify specific areas where energy efficiency improvements can be made. Prioritize recommendations based on the household's needs and budget.

**7. Provide practical advice**

Offer practical, actionable advice for reducing energy consumption and improving comfort. Explain the benefits and potential cost savings of each recommendation.

**8. Give the REVERTER brochure for energy-saving tips**

**9. Offer assistance**

Inform the household of available assistance programs, incentives, or financial aid for energy efficiency improvements. Help them with the application process if necessary.

**10. Share information about the One stop Shop**

Explain the OSS can offer more detailed assistance in: incentives, financial aid. Encourage them to visit the OSS. Explain the meaning of the One Stop Shop, the possibilities for support, and provide the location and contacts (brochure)

**11. Address concerns and questions**:

Be prepared to answer questions and address any concerns the household members may have. Provide clear explanations and options.

**12. Document findings**

Take notes during the visit to document your findings and recommendations. This will help in follow-up discussions and reports.

**13. Leave contacts**

Leave your telephone number or business card in case the customer has questions.

**14. Say "Thank you"**

Politely thank the person and leave.

**For the OSS personnel:**

**1. Follow-Up**: Update the data gathered from the RAs to the platform/visitation. Revise and validate the data with the RA. After the visit, follow up to check on their progress, answer additional questions, and provide further assistance if needed.

**2. Report and documentation**

If the household visits the OSS for more info, prepare a detailed report summarizing the assessment, recommendations, and any actions taken during the visit. Share this report with the household for reference.

**3. Coordinate with support Services**

If the household faces additional challenges beyond energy efficiency (e.g., financial hardships, health issues), coordinate with relevant support services or organizations to provide holistic assistance.

Remember that vulnerable households may have unique circumstances and sensitivities, so approach your energy advising visit with empathy, patience, and a focus on practical solutions that can improve their energy efficiency and overall well-being. However, it is important to judge your communication and words according to each setting and situation.

Some common tips for the visits are given in *Figure 21*.

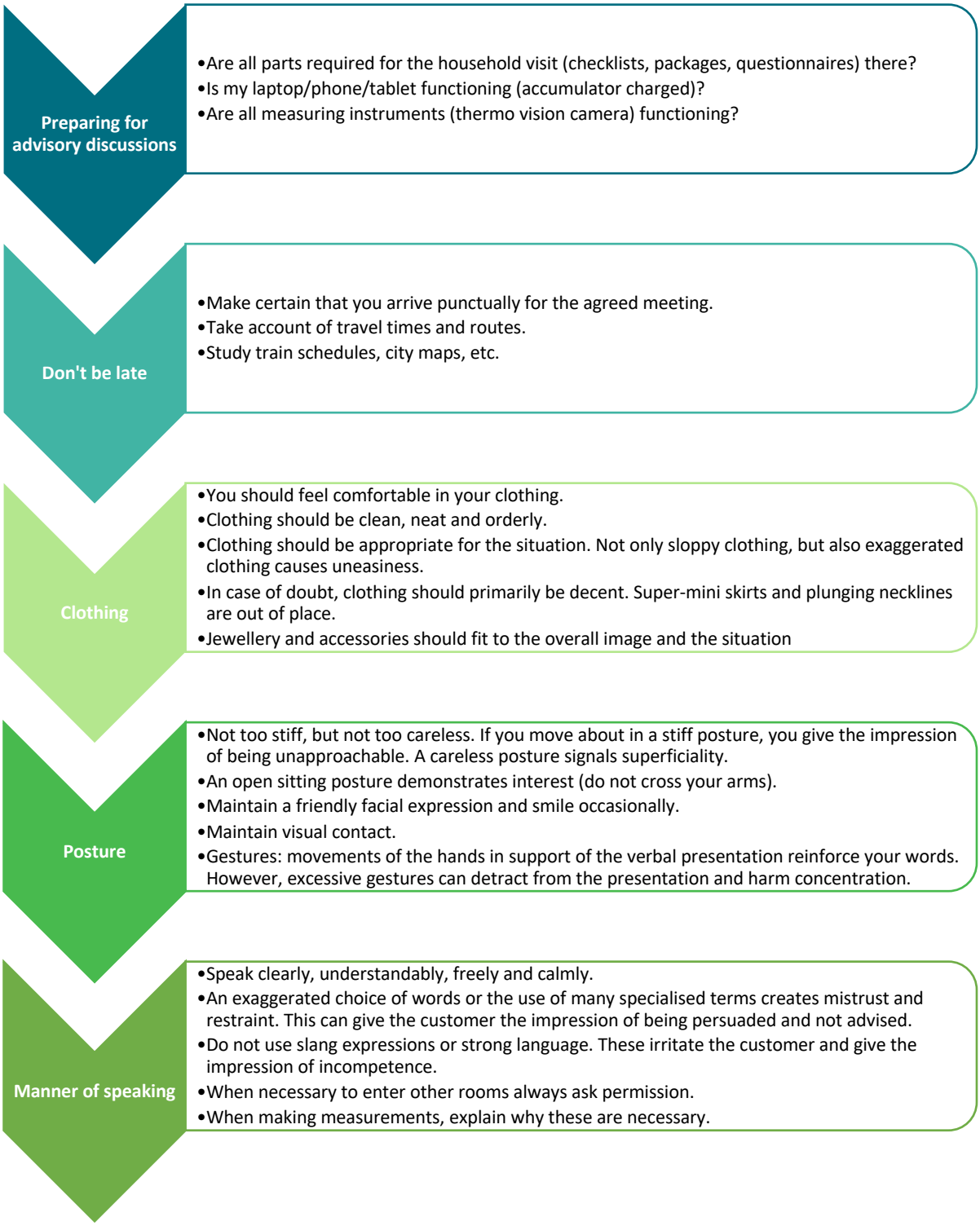


*Figure 21. Common tips for the household visits*

## 7.5 Reacting to atypical situations

Mentally preparing for visits to households where you may encounter compromising situations, violence or extreme poverty is essential to play your role effectively and compassionately. Some steps for mental preparation and how to deal with difficult situations are shown in Figure 2.

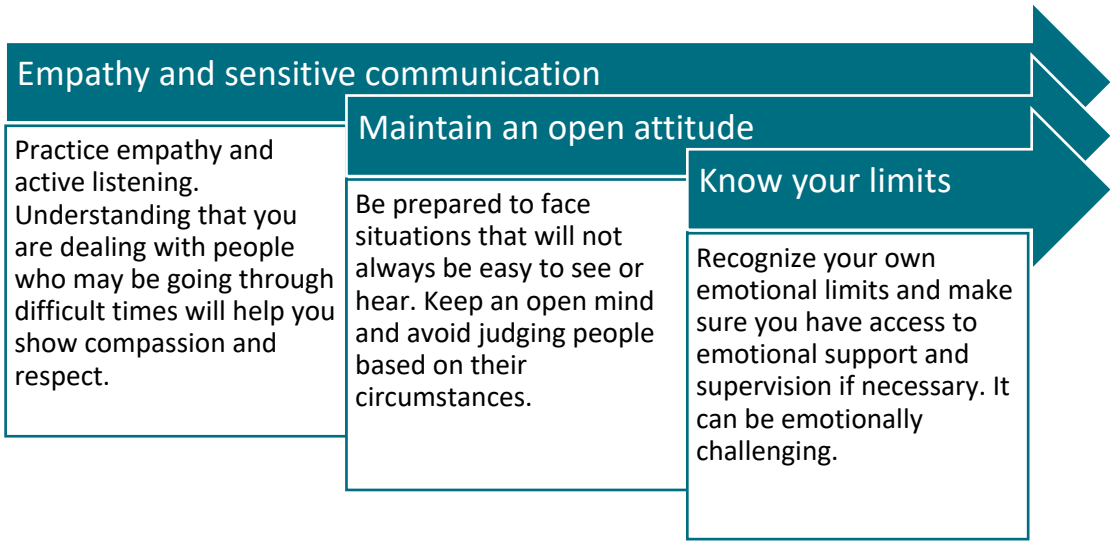


*Figure 22. Mental preparation for dealing with atypical situations*

How to proceed to avoid problems related to uncomfortable or even dangerous situations:

- Announce your visit: Always announce your visit in advance and schedule a suitable time. Confirm the visit the day before. Surprise can be uncomfortable and provoke resistance.
- Actively listen: Allow people to speak and express their concerns. Listen without judgment and offer a sympathetic shoulder.
- Visits in pairs of ambassadors: in the case of conflictive neighbourhoods, visits in pairs will be considered and will be carried out during daylight hours.
- Report to authorities: If you encounter situations of abuse or immediate danger, it is your duty to inform the relevant authorities to ensure the safety of those involved.
- Prioritize personal safety: Your safety is the most important thing. If you perceive an immediate threat to yourself or others, find a safe place.
- Stay calm: Try to stay calm in potentially dangerous situations. Panic can make it difficult to make good decisions.
- Communicate your concern: If you are accompanied by others, immediately communicate your concerns and perceived danger signs.
- Call authorities: If there is a clear and serious threat, call law enforcement, such as the police, and provide the location and a description of the situation.
- Exit the situation: If it is safe to do so, remove yourself from the dangerous situation. Leave the home or area as soon as possible.

- Don't become an intermediary in cases of violence: If you perceive domestic violence or a dangerous conflict, do not become an intermediary. Instead, call authorities and alert trained professionals.
- Do not intervene in dangerous situations: Do not try to intervene in violent or dangerous situations if you are not trained to do so. Your safety is paramount.
- Inform your supervisors or contacts: After ensuring your safety, inform your supervisors, employers or relevant contacts about the situation you have experienced.
- Seek emotional support: After a potentially dangerous experience, seek emotional support. Talking to colleagues, friends, or mental health professionals can be helpful in processing what you've experienced.

Remember that your safety is the most important thing in any situation. You should not take unnecessary risks. It is always preferable to call authorities or trained hazard professionals rather than attempting to address the situation on your own.

# 8 Establishment and operation of OSS

## 8.1 Desk Research

In the REVERTER project, extensive studies have been conducted to understand the vulnerability situation of the 4 municipalities where the One-Stop Shops will operate: PESTEL analysis, surveys, analysis of building characteristics.

A “desk research” that includes PESTEL analysis and surveys is essential for designing an effective One-Stop Shop. The PESTEL analysis provides a comprehensive understanding of the external context in which the One-Stop Shop will operate, identifying political, economic, socio-cultural, technological, legal, and environmental factors that can influence the operability and success of the OSS. This ensures that the One-Stop Shop is aligned with existing policies, sensitive to economic and socio-cultural conditions, leverages appropriate technologies, operates within a clear legal framework, and contributes positively to the environment.

Surveys, on the other hand, offer a direct internal view of the needs, desires, and challenges of vulnerable households targeted by the One-Stop Shop. They enable the design of services that are truly useful and accessible to these households, identifying barriers they might face and tailoring proposed solutions to effectively meet their specific needs in terms of energy efficiency and reducing energy poverty.

## 8.2 One-Stop Shop Design

### 8.2.1 One-Stop Shop Services and Key Activities

#### *8.2.1.1 Scope and goals*

The ONE-STOP SHOP of the REVERTER project follows the “Facilitation” business model. The main objective is to inform citizens about how to improve energy efficiency in their homes and the procedures necessary to rehabilitate them to prevent energy poverty.

#### *8.2.1.2 Services and activities*

The activities that REVERTER's One-Stop Shop will carry out will be:

- A1. Raise awareness on energy renovation benefit.
- A2. Inform and educate households.
- A3. Provide information on optimal renovation works.
- A4. Provide information on available financial support schemes
- A5. Conduct a preliminary building analysis.

Optional activities could be:

- A6. Provide information to prepare all documents necessary for accessing to financial instruments.
- A7. Provide advice on how to optimize energy bills.

The objective and general tasks to be developed for each of the services detailed above will be specified below.

## A1. Raise awareness on energy renovation benefits

This activity aims to raise awareness about energy efficiency, building renovation related topics. This may include:

- Conducting awareness campaigns about the importance of energy efficiency and reducing energy poverty.
- Distributing informational materials, such as brochures or flyers, explaining the improvements that can be made in homes to save energy and enhance comfort.

## A2. Inform and educate households

This service aims to inform the public about how energy renovation can improve energy efficiency, reduce expenses, improve quality of life, and increase property value. This may include:

- Organizing talks, seminars, or workshops to showcase the benefits of saving energy and money through energy renovation.
- Distributing informational materials, such as brochures or flyers, explaining the improvements that can be made in homes to save energy and enhance comfort.

## A3. Provide information on optimal renovation work

This service offers advice on which renovation works are most suitable and effective for each building or home. Additionally, it provides information on the process of carrying out the renovations. This includes:

- Identifying areas in the home where energy efficiency can be improved and providing guidance on how to do so.
- Providing information about the installation of new insulation systems, energy-efficient windows, low-consumption heating and cooling systems, etc.
- Offering personalized reports on which types of renovations and improvements are most suitable for the needs and characteristics of each home.

## A4. Provide information on available financial support schemes:

This activity aims to help homeowners and landlords understand the financing options and grants available for energy renovations and explain how they can access them. The tasks to be developed include:

- Providing information on grant programs, tax credits, or other financial incentives available for energy renovation.

- Advising on bank loans, mortgage credits, or other financing options that can facilitate improvement works.
- Collaborating with local financial entities to offer preferred loan options or flexible payment plans.

### A5. Conduct a preliminary building analysis:

This service includes an initial review of the current state of the house to identify areas for improvement in energy efficiency. This can be done through:

- Visual inspection of the home to identify obvious problems, such as inadequate insulation or poor condition of windows.
- General measurements of the home
- Utilizing tools or technologies to measure and record data such as current energy consumption and thermal losses.
- Generating an initial report that highlights areas for improvement and preliminary recommendations to reduce energy consumption.

The objective and tasks of the optional services that the One-Stop Shop could offer will be detailed below.

### A6. Provide information to prepare all documents necessary for accessing to financial instruments (optional)

This service provides support in preparing and submitting all the required documents for financing applications. Possible activities include:

- Offering templates and guides for document preparation.
- Conducting document reviews and assisting in the application process.

### A7. Provide advice on how to optimize energy bills (optional)

This service is focused on helping consumers better understand their electricity and gas bills. The goal is to identify opportunities to save money by adjusting pricing options and providers. This could include:

- Reviewing consumers' bills to identify possible areas for savings, such as reducing the contracted power if it is feasible.
- Advising consumers on different tariffs and providers that could be more economical or suitable according to their consumption.
- Organizing sessions to clarify the different components of energy bills and how these can be adjusted to optimize costs.
- Providing individualized support to resolve doubts and assist in the process of changing tariffs or providers if deemed convenient.
- Creating and distributing informational material to help consumers better understand and manage their energy bills.

These are the main activities and tasks to be developed in the REVERTER pilots' One-Stop Shop. However, in an Integrated One-Stop Shop, other services would be available: 360º advice (technical, economic, and administrative), project monitoring, grant processing, a directory/database of technicians and other professionals, energy audits, etc.

#### *8.2.1.3* Format *of the One-Stop Shop*

The One-Stop Shop will carry out its activities in person at each of the physical OSSs of the four pilots. In addition, it will be supported by a Digital One-Stop Shop that will include information of interest to owners and communities about the benefits of energy refurbishment, best practices, the services offered by the physical OSSs, and how to contact them.

### 8.2.2 OSS Structure

#### *8.2.2.1 Organizational structure*

Following the "one-stop-shop" model, each pilot must offer technical, administrative, and financial assistance to vulnerable households. Therefore, it is recommended that the OSS staff has a set of Skills and Abilities to provide a service that meets the needs and desires of citizens and provides the highest quality service to encourage and streamline energy refurbishment and the use of renewable energies. These Skills and Abilities, while not an exhaustive list, would be the ones that should be included:

- Technical knowledge of energy efficiency and renewable energies.
- Ability to explain complex technical concepts in a simple, straightforward, and understandable way for the average citizen.
- Knowledge in the design of renovation projects.
- Knowledge in the management of changes in energy suppliers.
- Knowledge in the processing and management of grants.
- Basic knowledge of marketing, communication, and design.
- Knowledge of financial solutions.
- Administrative knowledge and customer service skills.
- Knowledge in managing people in situations of energy poverty and vulnerable profiles, etc.

**One-Stop Shop Personnel**

Each One-Stop Shop will require a different number of human resources depending on its scope. The essential professional profiles for the development of the services are described below. It should be noted that one person could have a dual profile and fulfil the responsibilities of several roles, depending on the resources available.

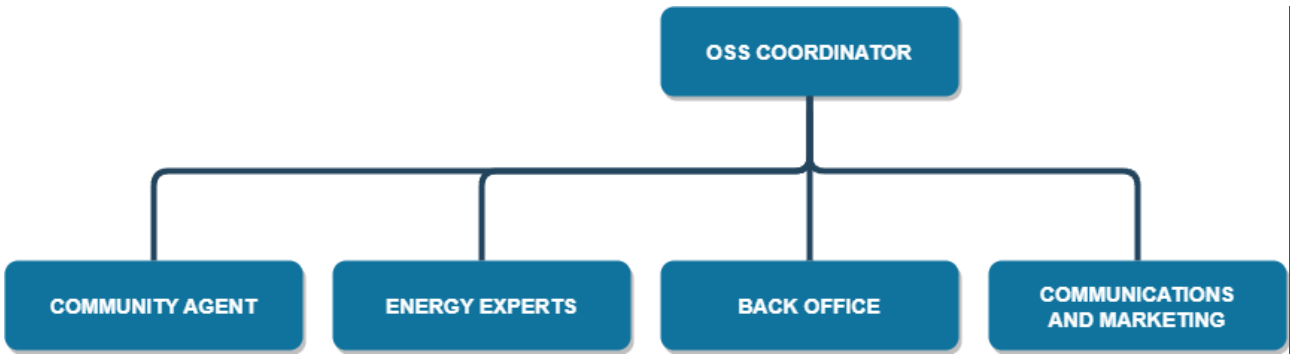


*Figure 23. OSS generic organizational structure*

This is a standard OSS organizational chart, understanding that depending on the final human resources available for each pilot, this structure may be adapted to align with the context. An organizational chart will be designed for each pilot, adapting it to the available resources and taking into account the existing OSS structure, as is the case with the Riga pilot.

**Energy Expert**

A technical profile with training in the field of energy efficiency, who will be responsible for accompanying and providing specialized advice to users.

Requirements:

- Basic training in building refurbishment and renewable energy.
- Knowledge about the processes for renovating a home.
- Knowledge of local regulations
- Knowledge of administrative processes and existing financing options.
- Knowledge of the local context (economy, demographics, characteristics of the building stock, etc.).

It is recommended, although not a requirement, that this role be carried out by someone with skills, experience, and academic training as described below.

Recommended academic background and experience:

- Education: Architecture, Technical Architecture, Engineering, or similar.
- Experience in the coordination and design of energy efficiency projects.
- Experience in projects and works of energy refurbishment and knowledge in carrying out administrative procedures such as management and processing of grants, construction licenses, bonuses, among others.
- Knowledge of current building technical regulations and other related regulations.
- Experience in energy audits.
- Experience in customer service.
- Specialization in renewable energies and energy refurbishments.

- Knowledge in the processing of administrative processes related to the energy refurbishment of a home, such as processing licenses, grants, bonuses, etc.

Recommended Skills and Abilities:

- Ability to coordinate various projects at the same time.
- Ability to travel throughout the municipality.
- Customer orientation.
- Assertive communication and active listening. Ability to communicate complex technical ideas to the public.
- Teamwork.
- Dynamic and decisive person.
- Organized and autonomous person.

**Back office**

This is a profile that will perform administrative functions. It takes care of all the tasks and administrative procedures essential for supporting the One-Stop Shop in its management. It is a fundamental pillar that articulates the rest of the team.

Requirements:

- Knowledgeable about the local context (economy, demographics, characteristics of the building stock, etc.).
- Administrative Skills: document management, database management, and the ability to organize and coordinate multiple tasks and projects simultaneously.

It is recommended, although not a requirement, that this role be carried out by someone with skills, experience and academic training as described below.

Recommended academic background and experience:

- University degree or professional training in administration, accounting, or similar.
- Theoretical and practical knowledge of the energy sector.
- Experience dealing with people with vulnerable profiles.
- Basic training in building refurbishment and renewable energy.
- Knowledge about the processes for renovating a home.

Recommended Skills and Abilities:

- Empathetic and patient person.
- Good conflict management skills.
- Ability to coordinate various projects at the same time.
- Assertive communication and active listening. Ability to communicate complex technical ideas to the public.
- Teamwork.

- Dynamic and decisive person.
- Organized and autonomous person.

**Community Agent**

A more social profile, in line with the functions of a community agent and/or mediator.

Requirements:

- Knowledgeable about the local context (economy, demographics, characteristics of the building stock, etc.).
- Effective Communication Capabilities.
- Negotiation and Conflict Resolution Skills.

It is recommended, although not a requirement, that this role be carried out by someone with skills, experience and academic training as described below.

Recommended academic background and experience:

- University degree or professional training in social education, mediation, or psychology with experience.
- Ability to travel throughout the municipality.
- Basic training in building refurbishment and renewable energy.
- Experience dealing with people with vulnerable profiles.
- Experience in community mediation.

Recommended Skills and Abilities:

- Empathetic and patient person.
- Good conflict management skills.
- Ability to coordinate various projects at the same time.
- Assertive communication and active listening. Ability to communicate complex technical ideas to the public.
- Teamwork.
- Dynamic and decisive person.
- Organized and autonomous person.

**Communication, Marketing, and Design**

This person will develop the communication strategy to disseminate the One-Stop Shop activities creative ideas and raise awareness on energy renovation benefit concepts. This profile will provide designed documents (leaflets, brochures, roll-ups) to publicise and disseminate information to fulfil the objectives established by the OSS to promote energy refurbishment in an accessible manner.

Requirements:

- Effective Communication Capabilities.

- Basic knowledge of social media and web management.
- Knowledgeable about building refurbishment and renewable energy.
- Knowledgeable about the local context (economy, demographics, characteristics of the building stock, etc.).

It is recommended, although not a requirement, that this role be carried out by someone with skills, experience, and academic training as described below.

Recommended academic background and experience:

- Experience in Communication, Marketing, or Design. It would be beneficial if the candidate could demonstrate 2 years of experience in communications. A university degree in this field would be positively valued.
- Knowledge in Energy Refurbishment: understanding of sustainable and energy-efficient practices and technologies.
- Design Technologies and Software.

Recommended Skills and Abilities:

- Creativity.
- Effective Communication to communicate technical topics in a clear and accessible manner.
- Analytical Skills to examine data and marketing campaign results to assess effectiveness and make improvements.

**Coordinator**

The coordinator or manager of a One-Stop Shop plays a crucial role in integrating and supervising OSS activities in their day-to-day operations. This person will determine the strategy and action plan for the OSS to meet its objectives and will adapt it in relation to the results obtained throughout the operation. The coordinator will be in charge of contacting and coordinating the different stakeholders.

Requirements:

- Knowledgeable about building refurbishment and renewable energy.
- Knowledgeable about the local context (economy, demographics, characteristics of the building stock, etc.).
- Ability to lead and motivate the OSS team to achieve set goals.
- Ability to communicate clearly and persuasively with stakeholders and team members.
- Ability to identify priority strategies and lines of action to achieve the OSS's objectives.
- Ability to interpret monitoring reports and develop action and change management plans to improve results.

It is recommended, although not a requirement, that this role be carried out by someone with skills, experience and academic training as described below.

Recommended academic background and experience:

- Degree in Project Management or Similar.

- Basic knowledge of energy efficiency, energy refurbishment of buildings, and associated technologies.
- Project management skills, including planning, organizing, and overseeing the team.
- Knowledge of the local context of the OSS.
- English proficiency.
- Knowledge of current laws and regulations related to energy efficiency and sustainability.
- Understanding the principles of sustainability and how to apply them to energy refurbishment projects.
- Experience in Event Coordination.

Recommended Skills and Abilities:

- Ability to manage and coordinate multiple projects simultaneously, meet deadlines, and achieve objectives.
- Ability to establish and maintain positive relationships with stakeholders and other actors involved in the project.
- A strong focus on achieving goals and effectively measuring results.
- Ability to adapt to changes in circumstances and project needs.

**Associated personnel (Ambassadors)**

Associated personnel will be responsible for visiting vulnerable households. Specifically, they will be responsible for conducting a preliminary building analysis and transfer the data to the One-Stop Shop.

Requirements:

- Passionate about energy efficiency and eager to make a positive impact on vulnerable households.
- Available to spend a few hours per week to help vulnerable household.

It is recommended, although not a requirement, that this role be carried out by someone with skills, experience and academic training as described below.

Recommended academic background and experience:

- Basic training in building refurbishment and renewable energy.
- Knowledge about the processes for renovating a home.
- Knowledge of local regulations
- Knowledge of administrative processes and existing financing options.
- Knowledge of the local context (economy, demographics, characteristics of the building stock, etc.).

Recommended Skills and Abilities:

- Empathy and Interpersonal Skills to connect with vulnerable households and create a comfortable environment for visits.

- Effective Communication to communicate clearly and persuasively present the benefits of energy refurbishment.
- Ability to collect data accurately and completely on the conditions of homes and the needs of tenants.
- Respect and collaborate with the team in a productive way.
- Ability to adapt to different situations.

**Other Partners (technicians, constructors, etc.)**

In the case of a "Integrated" One-Stop Shop, it could provide to the household a database/directory of professionals (technicians, installers, builders) to provide budgets to those interested in refurbishment works and to carry out the necessary work throughout the process: drafting the project, documentation, processing of subsidies if any, construction, work monitoring, etc. This One-Stop Shop aims to provide information to promote energy rehabilitation and does not monitor the entire construction process.

As a "Facilitation" OSS, this does not require external partners for the provision of professional services to start refurbishment works.

#### *8.2.2.2 Participants roles and responsibilities*

The team configuration will vary depending on the pilot and may change over time, adapting to the needs and requirements of the municipality at each moment. However, initially, it is proposed that the OSS, at a minimum, consists of the following roles and professional profiles.

**One-Stop Shop Personnel:**

- **Energy Expert:** A person knowledgeable about energy efficiency and renewable energies who will be responsible for accompanying and advising citizens on a technical, administrative, and financial level throughout the process:
    - Conduct energy reports based on information obtained during visits.
    - Inform about the procedures and management of grants, licenses, and bonuses.
    - Financial advice to introduce and explain in a simple way the different financing solutions existing in the market to facilitate their comparison.
    - Accompaniment and dynamization of awareness and sensitization days, such as awareness mornings, informative sessions, round tables, etc.
    - Provide advice to citizens on optimizing energy bills and tips on good domestic habits.
    - Drafting follow-up reports of the OSS and achieving the project's objectives.
- **Community Agent:** A person who will take care of mediation tasks with citizens and communities:
    - Support in the organization of awareness and sensitization sessions.

- Act as a liaison between the One-Stop Shop and citizens, ensuring that the needs and concerns of the community are heard and addressed.
- Organize and lead workshops, talks, and presentations in the community to raise awareness of the benefits of energy renovation and the opportunities available through the One-Stop Shop.
- Conduct surveys and interviews in the community to identify specific needs in terms of energy renovation and potential beneficiaries of the One-Stop Shop, if applicable.
- Assist citizens in understanding and navigating the procedures and requirements necessary to access One-Stop Shop services.
- Collect constant feedback from One-Stop Shop users and transfer it to the team to make continuous improvements to the services offered. Perform follow-up of visits once conducted.
- Establish and maintain relationships with other local entities, such as neighbourhood associations, NGOs, schools, and companies, to enhance the effectiveness and reach of the One-Stop Shop.
- Monitor and report regularly on the impact and effectiveness of the One-Stop Shop interventions in the community.
- Provide personalized advice and support to citizens who require more detailed information or help on energy renovations.

- **Back Office:** A person who will take care of the OSS's administrative tasks:
  - First telephone and online attention.
  - Management of the One-Stop Shop email.
  - Schedule visits to properties and communities of owners.
  - Organization of informative sessions in communities of owners.
  - Support in the organization of awareness and sensitization sessions.
  - Inform, guide, and advise people requesting the service.
  - Provide advice on good domestic habits.
  - Information on existing grants and financing options.
  - Management of the digital platform.
- **Communication, Marketing, and Design:** A person who will create and implement the communication and dissemination plan. This person will be the project's community manager, responsible for the organization and planning of social marketing actions, digital marketing actions, management of social networks, and design of graphic and audiovisual material of the OSS.
  - Administer and regularly update the project's social media profiles and website, ensuring that the content is up-to-date, relevant, and engaging.
  - Supervise and respond to comments or messages on social networks to maintain an active and committed community.

    - Develop attractive content and stories that resonate with the community and stakeholders and promote the mission and vision of the project.
    - Examine and evaluate the effectiveness of communication campaigns and strategies, adjusting as necessary to improve performance and reach.
    - Prepare regular reports summarizing activities, results, and recommendations for future communication strategies.
- **Coordinator:** Responsible for coordination, monitoring, and reporting of the One-Stop Shop team.
    - Ensure the proper functioning of the service and daily operations.
    - Coordination and supervision of the OSS team.
    - Participation in the One-Stop Shop's strategic dissemination events, as well as in the search and involvement of stakeholders.
    - Conduct follow-up reports of the program and collaborate in the drafting of an action plan and change management to achieve the objectives defined in the project.
    - Support in identifying the strategy and priority lines of action.

**Associated Personnel (Ambassador-EA):**

- **Associated Personnel:** A volunteer or energy ambassador, ideally with prior knowledge in energy efficiency and renewable energies, who will be responsible for conducting initial visits to vulnerable homes and promoting visits to the One Stop Shop:
    - Basic initial advice to tenants through an initial diagnosis that will be carried out through an on-site visit to the property to understand the state of the housing, inform about energy efficiency measures and renewable energies that could be implemented, provide advice on best practices, and disseminate the environmental, economic, and comfort benefits of energy refurbishment.
    - Transfer the data obtained during the visits to the One Stop Shop staff.
    - Promote visits to the One Stop Shop.

Table 1 provides a RACI matrix to clarify the responsibilities associated with tasks, deliverables, or decisions within the project.

**Key:**

- **R**: Responsible
- **A**: Accountable
- **C**: Consulted
- **I**: Informed

In this matrix:

- The "Responsible" is the one performing the task.
- "Accountable" is the one ultimately answerable for the correct and thorough completion of the task.

- "Consulted" are the ones whose opinions are sought; and with whom there is two-way communication.
- "Informed" are the ones who are kept up to date on progress; and with whom there is just one-way communication.

*Table 19. RACI matrix to clarify responsibilities within the project*

| Tasks | OSS Personnel | | | | Associated Personnel |
|---|---|---|---|---|---|
| | Energy Expert | Back Office/ Community Agent | Comm., Marketing, and Design | Coordinator | (RA) |
| Raise awareness on energy renovation benefits | R | R | I | A | I |
| Design and plan information and awareness campaigns. | | I | R | A | |
| Organize and conduct presentations or workshops in the community. | R | I | R | A | |
| Collaborate with local media to disseminate information and benefits. | R | I | R | A | |
| Develop and maintain relationships with key stakeholders. | | | | R/A | |
| Inform and advise citizens | R | I | | A | |
| Evaluate the effectiveness of the awareness strategies implemented. | | | | R | |
| Provide information on optimal renovation works | R | R | I | A | I |
| Advise citizens on the best renovation practices adapted to their needs. | R | I | | A | |
| Conduct a preliminary building analysis | R | I | I | I | |
| Schedule and organize visits to vulnerable households | I | R | | A | I |
| Conduct on-site visits to evaluate the current state of the buildings. | R | | | A | |
| Inform and advise on how to improve homes energetically. | R | | | A | R |
| Compile and organize the information collected for analysis. | R | R | | A | |
| Prepare a preliminary report with findings and recommendations. | R | | | A | |
| Coordinate with One-Stop Shop to plan actions based on the analysis. | | | | R | |
| Provide information on available financial support schemes | R | | | A | |
| Evaluate the applicability and advantages of each financial option. | R | | | A | |
| Keep information on financing and grants updated. | R | | | A | |

| | | | | | |
|---|---|---|---|---|---|
| **Advise applicants on the best options according to their needs.** | **R** | | | **A** | |
| **Create and maintain relationships with financial entities and subsidy organizations.** | | | | **R/A** | |
| **Optional activities:** | | | | | |
| **Provide information to prepare all documents necessary for accessing financial instruments** | **R** | | | **A** | |
| **Assist in the compilation of documents necessary for financial applications.** | **R** | | | **A** | |
| **Offer advice on the specific requirements of each financial instrument.** | **R** | | | **A** | |
| **Review and verify the accuracy and completeness of prepared documents.** | **R** | | | **A** | |
| **Provide continuous assistance with any questions or concerns.** | **R** | | | **A** | |
| **Ensure that requests are made according to established guidelines and deadlines.** | **R** | | | **A** | |
| **Provide advice on how to optimize energy bills.** | **R** | | **I** | **A** | |
| **Examine and review users' current energy bills.** | **R** | | | **A** | |
| **Identify opportunities to reduce costs and improve energy efficiency.** | **R** | | | **A** | |
| **Advise on changes in contracts or energy suppliers.** | **R** | | | **A** | |
| **Education and training on understanding and managing energy bills.** | **R** | | **I** | **A** | |

#### *8.2.2.3 Internal Information Exchange*

This internal communication plan aims to establish clear guidelines to guarantee effective and efficient communication between all participants involved in One Stop-Shop operations.

*Table 20. Internal communication plan*

| Recipients | Necessary Information | Communication Frequency | Responsible | Format |
|---|---|---|---|---|
| **Name of Interested Party or Group to whom the communication is directed** | Contents that need to be communicated | How often should it be reported? | Person responsible for providing information | Format in which information is sent |
| **One-Stop Shop Personnel & RA** | **Policy and procedure updates.** | Monthly | Coordinator | Meetings and E-mail |

| | | | | |
|---|---|---|---|---|
| **One-Stop Shop Personnel & EA** | **Training and development opportunities.** | Monthly | Coordinator | E-mail |
| **One-Stop Shop Personnel & EA** | **Feedback and performance evaluation.** | Quarterly | Coordinator | Meeting |
| **One-Stop Shop Personnel** | **Organizational changes.** | Daily | Coordinator | Meeting and e-mail |
| **One-Stop Shop Personnel & RA** | **News and upcoming events.** | Monthly | Coordinator | Meeting |
| **One-Stop Shop Personnel** | **Relevant data and reports.** | Quarterly | Coordinator | Meeting and report |

### 8.2.3 Material and economic resources

The OSS should have the following material resources available.

1. OSS supplies
2. Technological resources
3. Measuring tools
4. Samples of materials
5. Communication and dissemination materials, channels, and tools
6. Digital One Stop-Shop

#### *8.2.3.1 One-Stop Shop supplies*

Here's a detailed list of OSS furniture, supplies, and tools commonly required for an OSS:

**OSS Furniture:**

1. Desks: Ergonomically designed for comfort. Should include spaces for computers, keyboards, and drawers for storage.
2. Chairs: Ergonomic OSS chairs that provide good lumbar support and are adjustable to various heights and angles.
3. Filing Cabinets: For storing important documents, project files, and other paper resources.
4. Shelves: For books, binders, and other reference materials.
5. Meeting Table: A large table for group discussions and client meetings.
6. Lighting: Adequate overhead lighting, as well as task lighting for desks.
7. Whiteboards/Chalkboards: For brainstorming sessions, planning, and team meetings.
8. Partitions/Dividers: If an open OSS plan is used, partitions can help create semi-private spaces.

**Tools:**

1. Computers: Desktops or laptops equipped with necessary software for design, analysis, and communication.
2. Printers & Scanners: For printing documents and scanning.
3. Photocopier: For making multiple copies of documents.
4. Projectors: For presentations and team meetings if it necessary.
5. Telephones: With voicemail capabilities for communication with clients and team members.

**Supplies:**

Items facilitate daily tasks, organize documents, schedule appointments, and ensure smooth communication within the team and with clients. This includes essential items: various sizes of paper, writing tools, staplers, paper clips, binders, notebooks, post-it notes, envelopes, stamps, folders, calculators, and calendars/planners.

#### *8.2.3.2 Technological resources*

Technological resources are essential for the efficient operation of an energy refurbishment OSS, as they facilitate both project planning and management, as well as communication with households and stakeholders. Below, the technological resources necessary with some software examples (These are not requirements but rather existing market examples):

1. **Information Systems and Databases:**
    - Project Management System: Tools such as Trello, Calendar or Microsoft Project that assist in planning, organizing, and monitoring projects.
    - Building Database: To store relevant information about the examined buildings, such as their structure, energy systems, interventions made, etc.
2. **Communication Tools:**
    - Video Conferencing Platforms: Zoom, Microsoft Teams, Google Meet, among others, for virtual meetings, client presentations, or training sessions.
    - Instant Messaging Tools: Slack, WhatsApp Business, or Teams for quick and direct communication within the team and with clients.
3. **Storage and Backup Solutions:**
    - Cloud Storage: Services like Google Drive, Dropbox, Microsoft OneDrive, or iCloud for storing and sharing documents, images, plans, and other important files.
    - Backup Systems: To perform regular backups and ensure data integrity and availability.
4. **Security and Protection:**
    - Antivirus and Antimalware Software: Like McAfee, Norton, Bitdefender, etc.
    - Firewalls: To protect the OSS network against external threats.
    - VPN (Virtual Private Network): To ensure secure connections, especially if the team works remotely.

5. **Web Platform and Related Tools:**
    - Content Management System (CMS): Like WordPress to maintain and update the website.
    - Web Analytics Tools: Google Analytics or similar, to monitor traffic and visitor behaviour on the website.
    - SEO Tools: Such as SEMrush to optimize website visibility in search engines.

#### *8.2.3.3 Measuring tools*

Measuring equipment plays an essential role in pre-diagnosis visits to vulnerable homes, allowing an accurate assessment of the current conditions of the home in terms of energy efficiency and environmental quality. These devices can identify problem areas, such as heat leak points, excessive humidity, or poor ventilation, which may be negatively affecting the well-being of inhabitants and unnecessarily increasing energy costs. By measuring and recording data in real time, these devices provide a clear and objective image of intervention needs in the home.

They allow areas where energy improvements can have a significant impact on residents' quality of life to be quickly identified and addressed. By providing quantitative data, measurement teams ensure that decisions are made based on evidence, thus maximizing the effectiveness and efficiency of any proposed renovation or intervention. The OSS's energy experts will be able to prepare more accurate reports on the homes visited by the Associated personnel (Ambassadors).

1. Diagnostic and Evaluation Equipment: This might, for example, include:
    - Thermal imaging cameras.
    - Humidity and temperature meters.
    - Measuring lasers or measuring tape.
2. Calibration Tools: To ensure that measurement equipment provides accurate readings.

#### *8.2.3.4 Samples of materials*

It is important to have samples of materials in the OSS to show examples of possible building improvements, it allows:

- Visual and Tactile Concretion: Although it is possible to describe the properties and benefits of a material, there is nothing like being able to see and touch it in person. Samples allow people to tangibly understand the characteristics and quality of the materials.
- Informed Decision Making: When people can compare different samples, they can make more informed decisions about which materials best fit their needs and budgets.
- Education and Awareness: Samples serve as educational tools. By introducing different materials, the One-Stop Shop can highlight the importance of energy efficiency, demonstrating how certain materials can improve insulation, reduce energy costs, and increase comfort.

- Promoting Sustainable Solutions: By having samples on hand, One-Stop Shop can actively promote more sustainable and eco-friendly solutions, showing customers greener alternatives and how they compare to traditional solutions.
- Trust Building: The presence of physical samples can increase customer trust in the One-Stop Shop. By seeing that the OSS invests in showing them real options, clients can feel that they are being guided in a professional and transparent manner.
- Innovation and Update: The world of energy efficiency is constantly evolving. By maintaining an up-to-date set of samples, the One-Stop Shop demonstrates that it is abreast of the latest innovations in materials and technologies.
- Establishing Relationships with Suppliers: By requesting and maintaining samples, the One-Stop Shop can establish and strengthen relationships with suppliers and manufacturers. These relationships can be beneficial for obtaining discounts, training, and staying up to date on the latest products on the market.

Below are some examples of materials that could be in the OSS:

1. Insulating Materials: Such as mineral wool, expanded polystyrene, polyurethane foam, among others, used in refurbishment to improve thermal envelope.
2. Renewable Energy Equipment: Such as photovoltaic solar panels, thermal solar collectors, small-scale wind turbines, among others.
3. Efficient Lighting Systems: Like LED lamps, lighting control systems, and motion sensors.

These material resources are just general examples.

#### *8.2.3.5 Communication and dissemination materials, channels, and tools*

Dissemination materials are essential to inform, educate and raise awareness among the community and potential stakeholders about the importance of energy refurbishment and the services offered by the One Stop Shop. Here are some of the outreach materials that might be needed:

- Brochures and Leaflets: These can provide general information about the One-Stop Shop, benefits of energy refurbishment, best practices, success stories and contact details.
- Posters and Banners: They can be used at events, conferences or within the OSS to highlight key statistics, benefits and services offered.
- Roll-ups: They are an essential communication tool, especially at events, conferences or in the One-Stop Shop lobby. They are vertical roll-up banners that stand on their own, are visible from a distance and can be transported and stored with ease.
- Videos: These can include testimonials from satisfied customers, tutorials on how to improve energy efficiency, or presentations on One-Stop Shop services.
- Press Kits: These can include press releases, high-quality photos, infographics, and other useful media materials.
- Presentations: Slides and presentation materials for workshops, seminars, and other educational events.

- Infographics: Graphic representations that simplify and visualize complex data and statistics related to energy efficiency and refurbishment.
- Social media post: Regular posts on platforms like Twitter, Facebook, Linkedin and Instagram can help keep the community informed and engaged.

It is important that all these materials are coherent in terms of design and message. It is important to update them regularly.

## 8.3 One-Stop Shop Deployment

### 8.3.1 Technical-Legal framework

The specific objective of this task is to define the set of documents that will regulate the relationship between the different participants in the program.

**Data protection:**

This document includes the authorization of the owner to visit their home, to collect the necessary data for the development of the project, and to follow up for monitoring the project's KPIs. This document includes the authorization of the owner to follow up on the household visit through the contact channel provided.

### 8.3.2 One-Stop Shop Conditioning

#### *8.3.2.1 Adequacy of premises and infrastructure*

The OSS must be an accessible space that complies with local regulations. Additionally, it is important that the design and layout of the One-Stop Shop reflect the importance of energy efficiency and sustainability. The citizen must recognize the services provided and identify the OSS from the outside. So, identification signs will be necessary at the entrance to the premises and in the distributor in the case of sharing the space.

The OSS must be correctly identified as it could be within the town hall, shared office space, etc. There must be a conditioned space where OSS personnel can speak to citizens who require its services. This space may well be just a customer service desk. However, it is recommended that the OSS has the following spaces or can have access to shared spaces that can fulfil these functions:

- Reception: A welcoming area to greet visitors and provide a positive first impression of the service. First attention space.
- Work OSSs: Dedicated spaces for One-Stop Shop staff where they can carry out their daily tasks, answer calls and manage projects.
- Meeting room: A place to hold internal meetings, client presentations or informational workshops. It is recommended that you have a large worktable, projector, whiteboard, etc.
- Sample area: A space where samples of materials and technologies related to energy efficiency can be displayed for visitors to see and touch.
- Warehouse or archive: A secure place to store documents, tools, and other relevant materials.

Many OSSs will be located within other premises or public facilities. These will have rest spaces, bathrooms, convention rooms, etc. If it is an independent space, the premises should have:

- Rest area or kitchen: A small space with basic facilities so that staff can take a break, eat or prepare drinks.
- Bathrooms: Adequate facilities for staff and visitors.
- Training or workshop space: Depending on the nature of the One-Stop Shop, it might be useful to have a dedicated space for training and education for both staff and clients.
- Technology zone: A specific space for servers, printers, copiers and other technological equipment.

#### *8.3.2.2 OSS Management tools*

It is essential to have an OSS management system, specifically for managing leads, with leads being people interested in receiving information. This management system can be an Excel template or a digital platform. A system that allows for the automation of time-consuming daily operational tasks in project management by OSS staff, thereby significantly improving the quality and efficiency of the service. This, in turn, enables an increase in the program's activity and, consequently, its impact.

This document or platform should provide reports on service tracking in relation to leads, projects, and feedback from users who have used the service. It should also facilitate the program management and the administrative management of leads by the energy expert, back OSS, and other members of the OSS team. It's an internal management system of the OSS, only for the One-Stop Shop staff.

The platform should have the following characteristics and functionalities:

- **Easy to Use:** A very intuitive tool with a logical interface where relevant information is accessible and easy to find.
- **Operational Functionalities:** Allows for tracking a lead and changing its status as the process progresses, maintaining a history of statuses and tasks performed for that lead. It should allow for viewing data and storing this data over a long period of time, as this will be necessary to measure impact.
- **Project Management Platform:** Automates basic administrative management processes of the projects to reduce the need for manual actions: creation of reports, project tracking, KPI tracking, etc.
- **Generation of Reports:** Enables the creation of comprehensive reports and visualizes data in an aggregated and simple manner to monitor the program and make informed decisions.

The platform can integrate other digital tools necessary for the daily operations of the OSS such as the creation of emails and work environments, OSS tools, etc.

An example of the recommended sections of the platform would be:

- **Dashboard (Home Screen):** Provides a personal summary of ongoing leads, completed tasks, etc., and a general summary of the entire program.
- **Users:** Defines the users who have access to the platform and their roles.
- **Leads:** List of leads/people interested in receiving information of the One-Stop Shop.

- **Incidents:** Records any incidents that may have occurred in the program.
- **Information Requests:** Collects information requirements.
- **Tasks:** Lists the activities that platform users need to perform. These can be filtered by user, status, due date, etc.
- **Repository:** Relevant documentation for users utilizing the platform.
- **Reports:** Reports that can be automatically generated by the platform.

Such a system will significantly enhance the efficiency and effectiveness of managing leads and projects in the One-Stop Shop, ensuring that all information is systematically organized and easily accessible for analysis and decision-making.

### 8.3.3 Lead generation strategy

In marketing, sales and communication “lead generation” is the process of identifying and attracting potential customers, known as leads, who have expressed interest in a product or service. In the context of the REVERTER project and One-Stop-Shops, lead generation is a process of raising awareness about the need of building renovation, understanding the main benefits from the building renovation and taking further steps towards starting renovation process.

**Barriers**

Potential beneficiaries likely have not considered the need to make reforms in their housing to improve energy efficiency, and if they have detected deficiencies, the economic effort it entails and the complex process has led them to ultimately not consider making reforms to improve their homes energetically.

Proposals for energy improvement can be perceived as unnecessary or not a priority. Consequently, the communication process to generate demand should respond to general issues such as: quality of life, economic profitability, health improvements for tenants, etc.

Policies to reduce demand, GHG emissions, CO2, or energy dependence are concepts often unknown to citizens and do not necessarily respond to their most immediate interests, especially in cases of vulnerable households.

The OSS personnel are advised to take following steps in generating demand.

*Table 21. Steps to generate demand*

| Stage | Awareness | Value and solution propositions | Conversion |
|---|---|---|---|
| **Goal** | Target audience is aware of the problem | Target audience understands the main benefits from the building renovation and knows where to search for possible solutions/ consultations / financial support | Target audience is willing to take next steps towards building renovation |
| **What target audience do / feel or know?** | • Target audience is aware of the problem<br>• Target audience is aware that solutions exist<br>• Target audience is willing to explore solutions<br>• Target audience know that OSS can help with providing information and competent advice | • Target audience obtains specific information from OSS personnel or Digital OSS<br>• Target audience participates in specific targeted events<br>• Target audience understand what would be next steps to take<br>• They know where to search for additional information and advice | • Target audience is ready to take next steps |
| **Activities** | A1. Raise awareness about energy efficiency and renovation benefits | A2. Inform and educate households<br>A3. Provide information on optimal renovation works<br>A4. Provide information on available financial support schemes<br>A5. Conduct a preliminary building analysis<br>A6. Provide information to prepare all documents necessary for accessing to financial instruments.<br>A7. Provide advice on how to optimize energy bills | A6. Provide help to prepare all documents necessary for accessing financial instruments |
| **Channels** | • Social media communication<br>• Communication on media (newspapers, radio, TV)<br>• SEO strategy<br>• Campaigns | • Consultations with OSS personnel<br>• Consultations with Energy Ambassadors<br>• Testimonials by those who have already got their building renovated (case studies)<br>• Household visits | In person or online/telephone consultation |

| | | | |
|---|---|---|---|
| **CTA (Call to action)** | • Learn more on Digital OSS<br>• Visit the OSS<br>• Visit OSS social media<br>• Attend events organized by the OSS | • Apply for free consultation with OSS personnel<br>• Apply for free household visit | • Apply for free consultation<br>• Apply for free household visit |

The communication tools and messages will vary depending on specific pilot area. However, they will all have similar approach. Communication and dissemination partner WIT in collaboration with OSS personnel and project partners who are responsible for implementation on the OSS has prepared main guidelines for all the OSS to generate the leads.

#### *8.3.3.1 The approach to keywords*

The approach to keywords is divided in two main blocks.

### SEO

Search Engine Optimisation of Digital OSS contributes to all three steps of lead generation.

*Table 22. Steps for Lead Generation*

| Stage | Awareness | Value and solution propositions | Conversion |
|---|---|---|---|
| **Description** | Target audiences who are searching for possible solutions to their problem – not in particular related to renovation. | Target audiences who are searching information about renovation. | Target audiences who are searching for specific information to take the first steps. |
| **Description of needs** | How to reduce electricity bill<br>How to save money on heating<br>Why there is mold / humidity in my home and similar. | Support to renovation<br>Renovation process<br>How much does renovation cost<br>Why renovate<br>What are the benefits of renovation | What documents to submit for renovation |

By taking into consideration these stages the specific content will be created and added to the website. It will be managed by the OSS personnel that will be trained both: How to optimise the content for Google Search Engine and how to add the content to the Digital OSS in practise (to the CMS – content management system).

The specific keywords have been already identified. The results from SEO will be monitored every 6 months and strategy towards content and this lead generation strategy will be adjusted.

Provided training materials on SEO on the Digital OSS are in English and they provide step by step process from writing a post to publishing it.

### Specific messages

The specific keywords used in communication might vary in each pilot. These specific keywords are defined in this material. However, as the project will evolve they might change as the OSS personnel will be able to monitor which of them performs the best. These keywords can be included in the social media posts, press releases, videos and other communication materials aimed at the target audience. This approach applies mainly on “awareness” stage.

**Description of the suggested “Gold keywords”:**

- reduce your energy bills
- increase the value of your property
- increase comfort of your family
- invest in your property and health not in your bills
- stop burning your money on heating

As the cultural background is different in each of the pilot countries the specific gold keywords are provided bellow.

#### *8.3.3.2 Suggested lead generation strategies and channels*

These lead generation campaigns and channels are mainly applicable for awareness and value and solution proposition stages.

The set of events does not exclude any other events that OSS personnel would like to implement to reach the goal of the project. In addition, the OSS personnel can also implement activities on its own that are not part of the project but are additional to it.

The list of possible communication channels suggests for the OSS personnel to implement following specific activities:

- Door-to-Door campaigns
- Partnerships with local organizations
- Media – local press releases, articles or interviews on local newspapers, radio TV
- Local community events and workshops

## 8.4 One-Stop Shop Operations

### 8.4.1 Activity Procedures

In this section, the protocols to be followed for the development of activities in the One-Stop Shop will be detailed.

#### *8.4.1.1 A.1 Raise awareness on energy renovation benefits*

**Objective:** Carry out the lead strategy plan by organizing events or dissemination publications so that the population is aware of the problem. The main objective is to generate interest in energy rehabilitation so that vulnerable households want to visit the OSS and finally do so.

**Procedure:**

1. Event Planning:
    - Define the objective, target audience, and format of the event. (Examples: World Cafés, Round Tables, hands on workshops, Collective Dialogues and sharing practices, among others.)
    - Prepare informational and visual materials to present during the event.
    - Prepare a strategy to promote the event – channels, timing, concept.
    - Prepare materials for event promotion campaign – social media posts, press releases, info on digital OSS and other materials.
2. Event Promotion:
    - Coordinate with the Communication and Marketing manager the activities and collect results during the campaign to adjust, improve and so on.
    - Involve local and regional media if it is possible.
    - Engage stakeholders to participate in the events.
    - Use suggested communication channels, messages and visual materials to promote the event and ensure wide participation.
3. Conducting the Event:
    - Present the benefits of energy renovation in a clear and attractive manner.
    - Encourage public participation through question-and-answer sessions or open discussions.
    - Encourage attendees to visit the One-Stop Shop for personalized advice. Ask them to subscribe our newsletter and visit web site.
    - Collect feedback from participants to improve future events.
4. Data Collection:
    - Inform about data protection.
    - Request information for project tracking and reporting.
    - Find out if they were aware of the One-Stop Shop before the organization of the event.
5. Monitoring and Reporting:
    - Track the impact of the event on networks.
    - Track the impact of the event:
        - Number of participants
        - Satisfaction of participants

- Feedback from participants
- Number of people advised during the event.
- Number of people seeking advice due to the organized event.

**Support Materials:**

- PowerPoint presentations or similar visual materials that highlight key points.
- Brochures or printed materials that participants can take away for further reference.
- A list of online resources or platforms where participants can find more information or support later.
- Appropriate audiovisual equipment for the presentation (projector, microphone, etc.).
- Samples of materials
- In the case of outdoor events:
    - Folding tables.
    - Tent
    - Television
    - Roll-ups"

#### *8.4.1.2 A.2 Inform and educate households*

There are different scenarios in which this information can be offered: during visits/calls to the One-Stop Shop or during household visits.

### Advisory at the physical OSS or online/phone call

**Objective:** To provide information and personalized advice on the benefits of energy renovation and other questions regarding procedures and financing at the One-Stop Shop.

**Procedure**

Reception and Welcome:

- Greet visitors in a friendly and professional manner.
- For telephone inquiries, ensure to respond promptly and maintain clear and respectful communication.

Identification of Needs:

Ask and identify the specific needs of the visitor or caller to offer personalized information and advice.

Provision of Information:

- Clearly and understandably explain the benefits of energy renovations, such as savings on energy bills, improved thermal comfort, and contribution to environmental sustainability. See the corresponding training module.
- Present practical examples or success stories to illustrate the benefits of energy renovation.
- If the assistance is via phone/online, invite the interested party to visit the One-Stop Shop for more information.
- Inform about the possibility of conducting visits to perform a preliminary diagnosis of the home.

Data Collection:

- Inform about data protection.
- Request information for project tracking and reporting.
- Find out how they heard about us.

**Support Materials:**

- Informative brochures on the benefits of energy renovation.
- Graphs or diagrams illustrating energy savings and environmental benefits.
- A list of useful resources or links where visitors can find more information.
- Samples of materials (thermal insulation, joinery with thermal break, etc.).

## Advisory during visit to the respective households

This will be detailed in section 8.4.1.4 of this document.

#### *8.4.1.3 A.3 Provide information on optimal renovation works*

The action protocols will be the same as in the previous point. Consult the corresponding training module.

#### *8.4.1.4 A.4 Conduct a preliminary building analysis*

**Objective:** To conduct a preliminary analysis of buildings to identify opportunities for improvement in energy efficiency and point out possible areas for renovation or energy efficiency improvements.

**Procedure:**

1. Preparation:
    - Ensure that Ambassadors are adequately trained and familiar with the tools and methods of preliminary analysis.
    - Coordinate and plan the visit, ensuring that permissions and necessary access are obtained.

- Necessary information includes:
    - Exact address of the visit.
    - Person who will attend to the Ambassadors during the visit.
    - Contact of the interested party to send a reminder of the visit.
- Information to be provided:
    - Name of the Ambassador who will carry out the visit.
    - Date and time of the visit.
    - An explanation of how the visit will be conducted and the expected results.

- Send a reminder of the visit to the interested party by email or call, depending on the contact details provided. Previous data will be confirmed.

2. During the Visit (Ambassadors):
    - Introduction of the Ambassador. Provide identification.
    - Explanation of the purpose of the visit.
    - Request for permissions (consent form to be signed) and inform about REVERTER data protection regulation. Request for permission to access their home.
    - Explain how the visit will be conducted and ask for permission to access the home.
    - Conduct an initial visual review. If it is not safe to access the home, inform the interested party and postpone the visit until safe access is possible.
    - Answer the questionnaire.
    - Answer the contact form if they accept that the OSS contact them after a period of time to follow up on the visit and evaluate its impact.
    - Optional: Capture clear photographs of problem areas for future reference and analysis if permitted. Do not take photographs of people. It is not a requirement.
    - Optional: In the event that tenants would like a more personalized evaluation of their home, a second exhaustive visit will be carried out.
        - Perform basic measurements such as temperature, the surface of the windows, living area surface, energy consumption, and other relevant factors for energy efficiency.
        - Identify deficiencies and areas for improvement.
    - Discuss these deficiencies and inform about the areas of improvement.
    - Provide interesting information: benefits of energy refurbishment, best practices, available subsidies, etc.
    - Clarify any doubts generated.
    - Encourage visiting the OSS for more information. Provide information about the OSS services and contact details.
    - Thank them for facilitating the visit. This moment would be interesting to expose that the OSS is interested in conducting as many visits as possible in the area and if the

tenant knew of anyone who would like a preliminary analysis of their home, the One-Stop Shop would appreciate if they provided the OSS contact for information.

- Say goodbye.

3. After the Visit:
    - Compile the collected data (questionnaire and pictures (optional)).
    - Transfer the information from the questionnaire to a database.
4. Communication and Follow-up (if the tenant agreed):
    - Coordinate a follow-up plan. Between 1 and 6 months after the visit (recommended).
    - Introduction and identification.
    - Remind tenants that it was agreed to follow up on the visit.
    - Proceed to answer the monitoring, improvement, and impact questionnaire.
    - Clarify any doubts generated.
    - Encourage visiting the OSS for more information.
    - Provide information about the OSS services and contact details.
    - Thank them for their time and say goodbye.

**Support Materials:**

- A checklist for the energy assessment of buildings.
- Questionnaire to collect data during the analysis. In the absence of this technology, the sheet with the data to be collected during the visit will be printed.
- Camera for capturing photos of areas that need attention or improvement.
- Laser meter, thermal camera, and other basic tools for measuring environmental conditions.
- Brochures with basic information for households: benefits of energy refurbishment, best practices, One-Stop Shop services and contact, available subsidies, etc**.**

#### *8.4.1.5 A.5 Provide information on available financial support schemes.*

The action protocols will be based on the available financial support schemes.

#### *8.4.1.6 A.6 Provide information to prepare all documents necessary for accessing to financial instruments (optional).*

**Objective:** Provide information to help stakeholders to prepare and organize all necessary documents to apply for and access available financial instruments for the energy renovation of buildings.

**Procedure:**

1. Research and Information Compilation:

- Maintain an updated database of all available financial instruments, including grants, loans, and tax incentives. Consult the corresponding training module.
- Compile and keep up to date the guides, requirements, and specific criteria for each financial instrument.

2. Preliminary Advice:
    - Request for permissions and data protection.
    - Examine the specific needs of the project and identify the most suitable financial instruments.
    - Provide clear and concise information about the appropriate financial instruments and their application process.
3. Optional. Document Preparation:
    - Use standardized templates and forms to assist in compiling and organizing documents.
    - Ensure that all documents are complete, accurate, and presented in a professional manner.
4. Optional. Review and Verification:
    - Review all documents to ensure they meet the specific requirements of each financial instrument.
    - Verify that all provided information is accurate and backed up by relevant documentation.
5. Optional. Support during the Application Process:
    - Assist in submitting applications and ensure that it is done according to specific guidelines.
    - Provide ongoing support during the application process, answering any questions or clarifying doubts that may arise.
6. Optional. Monitoring:
    - Regularly track the status of the application and maintain constant communication with financial entities.
    - Assist in responding to any questions or additional requirements from financial entities.

**Support Materials:**

- Updated list of available financial instruments and their eligibility criteria.
- Guides or manuals detailing the application process for each financial instrument.
- Optional. Standardized document templates and forms required for each type of financial instrument.

#### *8.4.1.7 A.7 Provide advice on how to optimize your energy bill (optional)*

**Objective:** Advise on how to understand and optimize energy bills, helping to identify opportunities for savings without the need for significant changes in the home or consumption habits.

**Procedure:**

1. Examine Existing Bills:
    - Collect recent energy bills to examine consumption patterns and rates applied to each pilot.
    - Compare the energy bill with estimated energy consumption.
    - Identify any charges or fees that may be reduced or eliminated.
2. Identify Saving Opportunities:
    - Use tools and resources to identify saving opportunities, such as changing rates or providers.
    - Study options for reducing contracted power if possible.
3. Develop Optimization Strategies:
    - Provide specific recommendations for optimizing the bill, such as switching to a tariff with cheaper hours or adjusting the contracted power.
    - Consider the possibility of changing to a more economical provider if convenient.
4. Personalized Advice:
    - Request for permissions and data protection.
    - Provide personalized advice, tailoring optimization strategies to the specific needs and circumstances of each user.
    - Resolve doubts and provide clarifications on any aspect of the energy bill.
5. Education and Training:
    - Use educational materials to educate about understanding energy bills and how to manage them efficiently.
    - Organize informational sessions or workshops to educate about efficient energy bill management.
6. Ongoing Support and Monitoring:
    - Offer ongoing support for any inquiries or necessary clarifications related to the energy bill.
    - Perform monitoring to ensure that optimization strategies are implemented correctly and are yielding positive results.

**Support Materials:**

- Spreadsheets or applications to examine and work on energy bills.
- Educational materials such as guides, infographics, or videos that facilitate understanding of energy bills.
- A list of energy service providers, with their current rates and offers.

### 8.4.2 Monitoring committee

The Monitoring Committee has the responsibility of overseeing the progress of the One-Stop Shop and that the objectives are met efficiently, effectively and ethically. Its functions include:

- Regularly review the progress of the project based on predefined objectives and goals.
- Ensure that the activities carried out are aligned with the objectives and goals of the project.
- Evaluate the performance and results of the different phases of the project.
- Generate detailed reports detailing findings, achievements, challenges and recommendations.
- Communicate results and evaluations to relevant stakeholders.
- Identify potential risks and challenges in the early stages.
- Design and implement mitigation strategies to address identified risks.
- Monitor these risks and adjust strategies as necessary.
- Act as a bridge between One-Stop Shop teams and stakeholders, ensuring fluid and transparent communication.

The committee should meet regularly to review the progress of the project and ensure it is aligned with the objectives.

Composition of the OSS Monitoring Committee will be made up of the coordinator of One-Stop Shop and the municipality or OSS promoter:

- Coordinator: As an OSS leader, they have a global vision of all activities and, therefore, can provide Desirable knowledge insights into the progress of the operation. Responsible for preparing monthly OSS monitoring reports, detecting risks, and proposing an action plan to minimize them. The coordinator will evaluate the impact and effectiveness of the implemented actions and will ensure that all stakeholders are informed about progress, challenges and decisions made. Decisions will be made based on feedback and reports to improve or reorient actions if necessary and will establish a calendar of meetings to monitor OSS performance (see communications plan). Regular reports will be sent to the municipality or OSS Promoter.
- OSS Promoter: Will provide an external perspective and ensure that the objectives and interests of the project are met.

However, the other members of the OSS will be key to the quality of the One-Stop Shop services and to achieve the objectives.

- Energy Specialist: Responsible for ensuring that the data obtained during the day in the OSS and the visits of the Ambassadors is correct.
- Back Office: Will ensure that administrative and financial processes are being carried out correctly and that all requirements are met.
- Community Agent: Provides direct feedback from the field and stakeholders, being the bridge between the community and the OSS Personnel.

- Communication, Marketing and Design expert: Evaluates the effectiveness of communication campaigns and how they are influencing the progress and perception of the project.

These agents will provide their feedback to the OSS Coordinator regularly so that it can write monitoring and performance reports.

# Conclusion

In conclusion, this handbook serves as a comprehensive and practical guide for anyone seeking to be trained under the REVERTER program. It offers a well-structured, step-by-step framework covering technical knowledge, social engagement strategies, and practical tools needed to support vulnerable households in addressing energy poverty. From understanding energy concepts and renovation techniques to mastering communication with at-risk groups and establishing One-Stop Shops, the material is designed to empower trainees with the competence and confidence to make a real impact. Whether you're an Energy Ambassador, OSS personnel, or a stakeholder in the field, this handbook is your roadmap to becoming a knowledgeable and effective agent of change in the transition to more sustainable and inclusive energy practices.