Porto Energy Hub

Energy Efficiency for all.

D3.1 – Benchmark report

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1. INTRODUCTION

Energy Efficiency is a key component to reach the new growth strategy to the transition to carbon neutrality by 2050. Moreover, it is critical to fight energy poverty, which is still a very present reality in Europe and all over the World. There are 125 million European Citizens affected by energy poverty according to the European Economic and Social Committee (EESC). Low incomes, rising energy prices and lack of energy efficiency (EE) in housing are the leading causes that make energy poverty an increasingly common reality.

Buying more affordable clean energy and saving it through several equipment and solutions will increase quality of life, as negative impacts can also be translated into severe health issues and social isolation.

According to the European Commission[1], buildings are responsible for over one third of EU's carbon emissions and accounts for about 40% of all energy used. As of now, 75% of buildings in the EU are considered inefficient from the energy point of view, yet 85% to 95% of buildings we will live in by 2050 already exist today. It is hence clear, that to move further towards a greener and carbon-neutral society we must decarbonise the buildings we currently occupy; buildings' energy efficiency renovations represent a strategical action for the development of a climate-neutral society.

Promoting energy efficiency, not only allows significant budget savings and improved energy performances but also leads to healthier and more comfortable living conditions and promotes the creation of jobs and economic growth. Renovation costs are minimal compared to the cost of constructing a new building, besides retrofit works result in long lasting energy efficiency standards and logistic advantages since the tenants can stay in their homes during renovation works. The diagram below (Figure 1) illustrates the most relevant benefits of building renovation works.

[1] European Commission | Energy Efficiency in Building | Renovation Wave. Available at https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en

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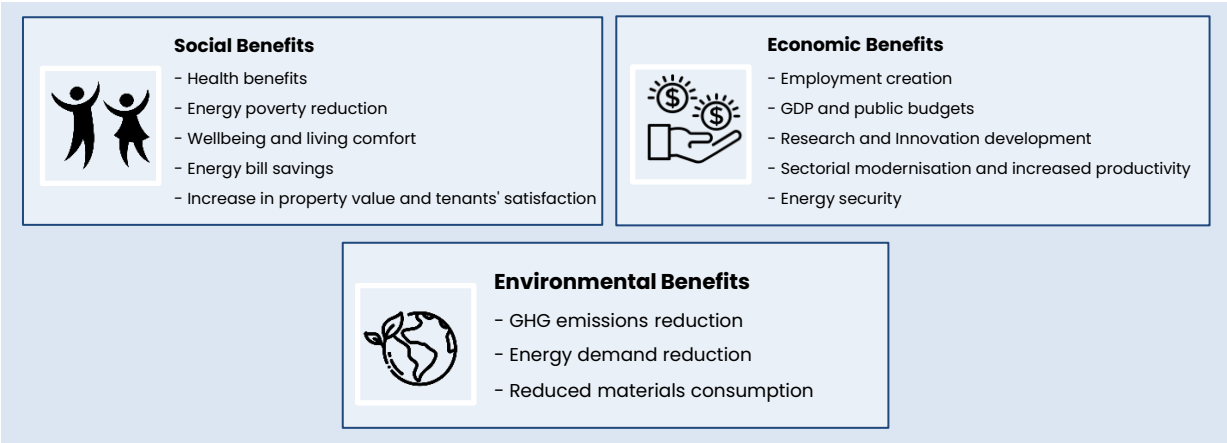

Figure 1 - Benefits of energy efficiency building renovation works

Environmental, health and economic aspects are main drivers of the retrofit practice, however, it is essential to acknowledge the relevance of stakeholders' awareness in this process. Knowledge on energy efficiency solutions and derived benefits in costs and comforts is necessary to unfold full potential of buildings' renovation movement. Motivational factors can play a decisive role in the strategy development; while some people can be driven by environmental interests, others might care more about economic savings or again indoor climate improvement.

Energy inefficiency's consequences on living conditions are linked to health problems, which, have also an impact on economic costs. It is estimated that every year, European societies face a cost of € 82 billion to cover just a handful of the illnesses caused by unhealthy buildings (H.N. Smith and K.E. Eriksen, 2018). This issue is commonly called Energy Poverty. The EU Energy Poverty Observatory describes it as «*a distinct form of poverty associated with a range of adverse consequences for people's health and wellbeing – with respiratory and cardiac illnesses, and mental health, exacerbated due to low temperatures and stress associated with unaffordable energy bills*». H.N. Smith and K.E. Eriksen again affirm that if just 2% of European homes were renovated with an emphasis on health every year, by 2050 we could reduce the number of Europeans who live in a damp and unhealthy home by 50 %.

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2. CONTEXT

2.1. PEER Project

The Porto Energy ElevatoR (PEER) is a European project led by the Porto Energy Agency (AdEPorto) and financed under the Horizon2020 program. PEER started in June 2021, and it is intended to last 3 years and it is in line with the goals and requirements defined in documents such as the National Energy and Climate Plan 2030, the Roadmap for Carbon Neutrality 2050, or the Long-term Strategy for the Renewal of Buildings, recently approved.

Main objective is to mitigate energy poverty in the northern region of the Douro River of Porto Metropolitan Area (AMP-ND) by improving buildings' energy efficiency for Social Housing, promoting renewable energy use, and integrating innovative financial schemes. The idea is that this/these model(s) could then be replicable for future projects. PEER aims also to develop the Porto Energy Hub (PEH), an online and physical One-Stop-Shop that will support the renovation programme of the AMP-ND.

Main actions of PEER consist of:

- Focusing on improving social housing conditions in the AMP-ND through renovation works which include envelope insulation, windows multiple glazing, effective doors, low-consuming lights and efficient heating and cooling systems;
- Aggregate renewable energy communities and energy storage allowing the development of production units for self-consumption;
- Mainstream innovative financial schemes.

Stakeholders involved would include low-income homeowners, public and private building owners, project developers, ESCos and financial institutions.

The expectation is afterwards to replicate the model to closest municipalities of the region and provide the development tools at national level.

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2.1.1. Porto Energy Hub

PEH is a One-Stop-Shop (OSS) that will be created within the project plan, with the objective to advice and support citizens and companies, but also other public and private entities that are willing to develop energy efficiency projects in the region of Porto. It consists of a physical space and an online portal facilitating collaboration and exchange amongst stakeholders and providing easy and quick access to tools and information needed to support investment and find best financial solutions.

Porto Energy Hub is planned to offer the following services:

- Proactive engagement of public and private intuitions and homeowners, through targeted communication and marketing tools;
- Elaborate energy renovation and financial plans for each project or bundle, according to the client's needs, to be implemented at once planed set-by step according to the financial means of the clients and the selected schemes;
- Coordinate the renovation process on behalf of the proponent (specially for homeowners, but also for public or private intuitions);
- Guarantee long-term and affordable financing schemes, which will be developed within PEER and are suitable for the proponents;
- Assure results and post-work monitoring of the work quality and energy savings, thorough follow-up actions and monitoring systems data analysis.

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3. OBJECTIVES

This document is part of Work Package 3 (WP3) "Benchmark, case studies and social diagnostic", where its objective is to collect best practices and success cases for energy efficiency rehabilitation measures and initiatives from past and current national and international, mostly European, projects. The benchmark study should guarantee that PEER builds upon existing sound and quality knowledge, investigate the conditions in which past programmes were applied and ensure that solutions proposed are pertinent to the context the project will be developed in. The successful experiences and the overcome challenges will be used as a basis for the development of the program, building upon other regions' bold strategies and used to organise workshops with stakeholders with final aim of fighting energy poverty.

Programmes investigated should share target groups similar to PEER project ones, shall include low-income homeowners, public and private building owners, project developers, ESCOs and financial institutions.

The most suitable initiatives will be selected to be applied at the regional context (well known by the Consortium). Case studies, models and scenarios identified will allow to analyse and deepen the knowledge on the technical and social processes that support the aimed energy transition. The analysis of the best practices will guide the recommendations to be made by the PEER project.

In this sense, guiding this analysis, the main issues were investigated and addressed:

- What similar projects (to PEER) exist in the international panorama?
- What barriers were encountered during project implementation?
- How were these issues solved?
- What practices should be followed and what should be avoided?

In addition, a first and simplified introduction of financial schemes, related to each study case, will be presented in this report, and later developed in deliverable D6.1 "Financing schemes best practice available in Europe". Financial schemes and business models delivered should be easily replicable. By using the best practices and lesson learnt of projects developed worldwide, these business strategies should have a

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standardized structure, assuring quality, reducing costs and risks, enhancing project's bankability and possible securement.

With the purpose of increasing citizens' and companies' awareness, share project-related information and connect the various stakeholders, the benchmark study will also include a section on OSS (One-Stop-Shop) development. The Consortium will search for examples of online platforms and physical spaces, gathering information about energy renovations, advising, and acting as connection between homeowners, companies providing the works and funding institutions. The Porto Energy Hub will be created on the base of their positive experiences.

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4. BENCHMARK ANALYSIS

This chapter presents the benchmark study, built on examples of energy communities, energy efficiency programmes and renovations projects, tackling energy poverty, that have been carried out at national and international (mostly European) level.

The importance of reviewing programmes that have already been developed, derives from the possibility to extrapolate best practices, lesson learned, but also overcome challenges to be implemented inside PEER, in order to conceive bold renovation schemes, integrating and adapting these success cases into this project. Nevertheless, new projects can be identified going forward.

For the analysis presented in the report, we have included 25 energy related projects. Of these, 23 took place within Europe, of which 2 Europe-wide (including Portugal) and 2 others, only in Portugal. The remaining 2 were in the United States of America and Argentina.

Figure 2 illustrates the worldwide distribution of the programmes investigated along

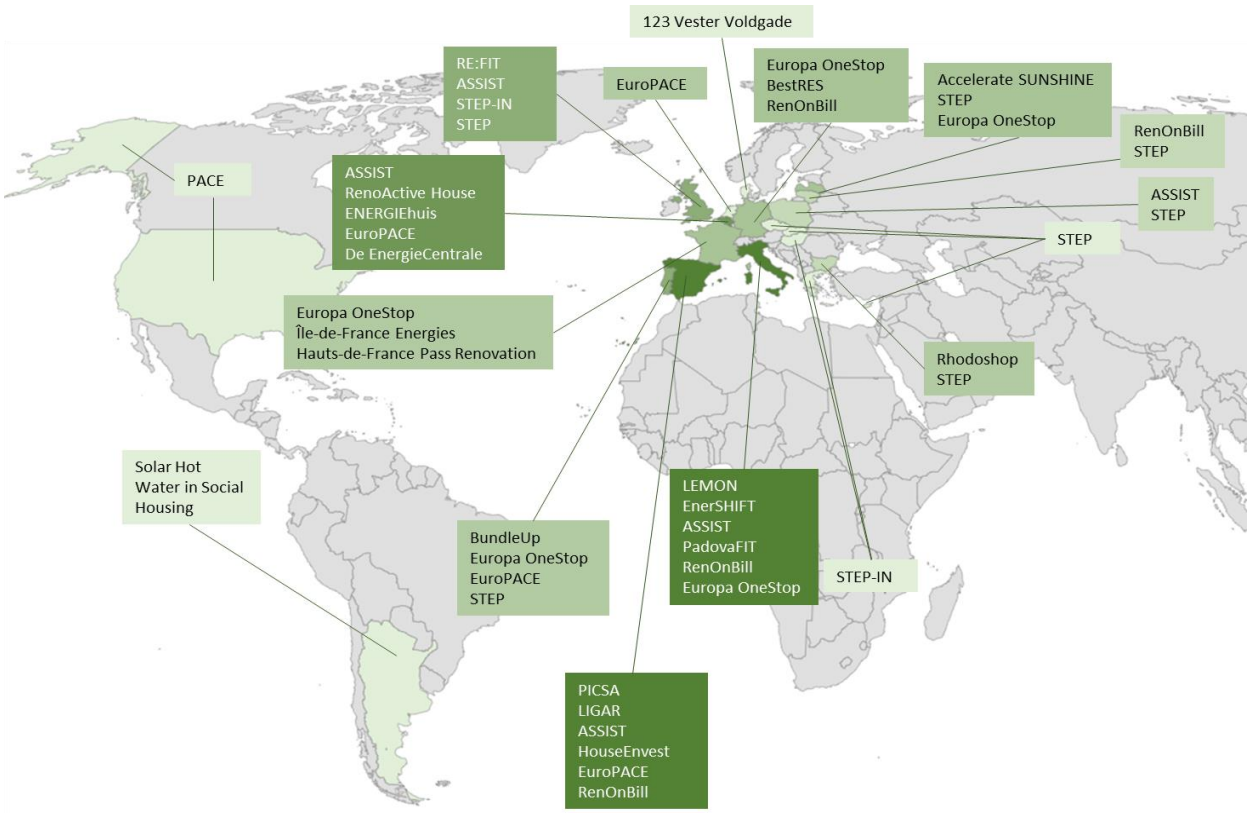

Figure 2 – Location of the 25 projects covered by the benchmark analysis – darker colours indicate countries where higher number of projects have been implemented within the projects included in the analysis.

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the study. A detailed profile of each project can be found in Annex 1.

The analysis of these projects tried to cover all aspects of an energy renovation programme, in order to present them in their entirety. Besides giving out a brief description, the study investigates the target group in focus, the project's reach, the energy efficiency (EE) renovation works, the financial schemes involved, and the main results obtained.

This approach allowed to take advantage of the most significant information collected to provide stronger and valuable foundation, ideas and lessons learnt to the PEER project. This analysis allows PEER, but also the PEH, to work towards the achievement of the set goals with limited, or no delays or events, mitigating risks and providing the chance to take preventive measures to avoid and/or overcome issues that may arise.

4.1. Characterization of the projects

All the projects included in the analysis shared the same overall goal: tackle energy poverty by enhance living conditions, increasing buildings' energy efficiency and improve sustainability and durability of solutions. However, the strategy set forward to achieve this object varied. This section provides a description of the different dimensions the projects present.

4.1.1. Target groups

Communities involved in project's reach are in most of the cases socio-economically underprivileged populations, living in low income and elderly households, house cooperatives, social housing or multifamily apartment buildings. These dwellings would share energy inefficiency characteristics such as ineffective isolation and heating systems, one-layer glazing windows and doors, inadequate ventilation, and poor-quality indoor climate.

In other cases, beneficiary groups would be represented by municipalities or commercial public or private infrastructures.

When instead, the project would focus more on networking and training, target groups include service providers, policy makers and more in general renewable energy markets.

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4.1.2. Project's reach

Projects' reach covers knowledge dissemination and management, practical energy efficiency renovation works and development and application of innovative financial schemes.

EE rehabilitations have the aim to optimize energy performances and increase indoor air quality. In residential dwellings these would include the establishment of an efficient mechanical ventilation system (natural preheating and cooling air), thermal insulation of building's envelope, hydro insulation of base, replacement original windows with double or triple glazed ones and new insulated doors, structural improvement (balcony, roof cover and drainage), new heating and hot water system paired with the installation of thermal solar panels, increased window area for more natural light and dynamic sun-screening for reduced energy consumption. In commercial buildings rain-water recycling system for toilets and daylight-controlled LED lightning were also installed. In the case of municipalities instead, EE renovations involved streetlight replacement with LED luminaries.

Knowledge dissemination covers a wide range of initiatives to empower citizens and generate in-depth knowledge about energy poverty and efficiency. These measures would translate into training events and working groups for tenants, policy makers, municipalities and other professionals of the sector to raise awareness about energy efficiency and consumption, learn about improvement opportunities, but also shape future energy policies. Specifically for tenants, these seminars would address topics such as data interpretation, comparison among energy contractors' quotes, learning about having energy audit performed and benefits of EPC, monitor cost savings and help put in place low-cost energy efficiency measures. Information shared would be based on data collected before and after renovation works, during feasibility studies and from households' energy needs. The outcomes of these events would be essential to disseminate best practices, reports, and policy choices that can alleviate energy poverty and promote their replication across the EU. The creation of One Stop Shops along the project development, represents another effective approach to disseminate knowledge and gain confidence of citizens and stakeholders by giving free access to information, personalized advice and create strong and reliable connections.

Financial schemes are, in some cases, also covered by project's reach, alone or in combination with energy renovation and/or knowledge dissemination solutions. It is

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essential to mention that business models are a fundamental requirement of any energy refurbishment project – all projects need a financial scheme in order to be implemented. The reasoning here stands in differentiating projects whose purpose, among others, is to develop their own financial model, from those who only focus on knowledge dissemination and/or energy renovation. Without this component, projects only bring support and advice regarding funding opportunities, without implementing a detailed and personalized scheme fit to the needs of the project.

The different financial schemes will be further detailed in the following section, 4.1.3.

4.1.3. Financial scheme

Financial scheme is often the driver and main barrier of project development, due to the difficulties linked to accessibility and risk management. Three main sources of funding can be identified from the projects investigated: public, private and a mix of the two. Public funding fundamentally come from European Union's projects such as Horizon2020 programme or regional funds. Private funding can be provided by homeowners directly, by companies (e.g., utilities company), joint ventures (contractors, retailers, among others), but often consists in a Third-Party Financing system with the involvement of ESCos, which invest in the project, taking most of the risks and linking their profits with the energy savings. The mixed solution usually involves public private partnerships or semi-public authorities such as regional administrations, combined with EU funding and participation of financing institutions.

The financial scheme to apply might depend on the scale of the project – most of the times it does not exist one fit-all solution.

There seems to be no correlation between the type of target group and the implemented financial solution. Instead, under the analysis of financial schemes applied to project's reach, two different paths are highlighted:

- When project's reach covers the knowledge dissemination, funding usually comes from public sources.
- When the project focuses on EE renovation works, funding is often private or mixed.

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4.2. Energy renovation financing projects

The present chapter illustrates transversal analysis resulting from the literature review of the 20 projects investigated.

4.2.1. Awareness and Communication

Awareness and Communication are two separate concepts which if working together might lead to very successful knowledge dissemination.

Awareness represents the first step in acknowledging the existence of problem, in this case of energy poverty. From this, then comes the need to identify possible improvements in energy performances, deriving from simple measures, but having great impact on daily living conditions and life quality. The figure of building facilitator or auditors helps analysing building's characteristics, assessing the technical suitability of the dwelling to be included in the programme in question, and consequently perform simplified and free-of-charge energy audits to the building. Its role is to explain participants how the project works, and the results of the energy audit done on the building.

Communication is then the logic action following the acknowledgement of the issue. It allows not only to share about the urgence to fight energy poverty, but also to spread about obtained outcomes, risks to manage, barriers to address and lesson learnt to retain in order to diffuse and replicate the project on wider scale. This summarises quite successfully the scope of this benchmark report.

4.2.2. Stakeholders' engagement and Partnerships

Stakeholders are represented by one or more individuals that would take advantage from the implementation of the project. The benefits are not necessarily limited to owners and/or tenants whose homes undergo renovation interventions, but they extend also to professionals such as contractors, service providers and public and private entities who are equally involved in the project development. Stakeholders' implication is obtained through offering trustworthy, low risk and economic, environmental and socially advantageous solutions.

One step closer to positive results in this sense is to create a solid and reliable database, gathering all information concerning the buildings' functionalities and characteristics, allowing not only to develop personalised and calibrated solutions, but also

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to avoid inefficiencies and set the building for optimal operation after the renovation works. Evidence needs to be consistent with the reality and not to give false expectations to any of the involved parties. Long decision-making processes, especially in programmes involving multifamily or social housing with a large number of tenants, lead to increased risks and lowered trust between homeowners and financing institutions and/or ESCos. Business models need to be able to manage lots of different figures and develop simpler and more understandable procedures to accelerate the engagement process. Often, the presence of figures such as energy advisors, working on the ground in close contact with vulnerable costumers, helps in gaining their trust and engage with the targeted group.

At last, the creation of partnerships and networks has the ability to lead to a more efficient and smoother unfold of the renovation works and, more in general, of the project, and it also allows to the development of local economies by creating new job opportunities and taking advantage of local resources.

Municipalities and/or other public authorities supporting the search for contractors, help create a "competitive dialogue", and allow the owners the guarantee of transparency, technical quality, and financial soundness of the assignee. The competitive dialogue procedure makes it possible to best calibrate the interventions, through a transparent and negotiated process.

On the same line of thought, the subscription of a contract between residents/property managers and market operators aims at ensuring high standards for deep renovation of residential buildings and defined amounts of energy efficiency. Such subscription ensures standardised methods and procedures as well as quality, transparency, while leaving the space to local and cultural differences. All parties would then be reassured of the mutual, not only financial, commitment.

One-Stop-Shop solutions seem to have the highest potential to bring together all players involved in the renovation process, because of their holistic approach.

4.2.3. Financial support

As previously mentioned, financial support is the primary source of mistrust and risk of failure of the project. It is fundamental to ensure the cost-effectiveness of the renovation project and that all parties are capable to understand and are aware of the consequences of the economical commitment. The essential question then would be

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«Is the work worth the investment? ». Feasibility studies and pre-renovation work data collection allows the correct management and implementation of the project.

Furthermore, it is essential to reduce risks for ESCos and third-party financing (TPF) in case of private and mixed funding methods by ensuring tenants' commitment. As studied, the involvement of municipalities or governmental organisms gives a stronger and more trustworthy appearance to the project and lowers the risk, also by channelling private financing into energy efficiency investments.

Table 1 below presents the main characteristics of each of the investigated projects, including main lessons learnt and barriers identified during the unfolding of these programmes.

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Project's name	Year	Target group	Project's Reach*	Financial scheme	Main risks & lessons learned
NATIONAL LEVEL - Portugal					
BundleUp	2018-2021	Private and public sector for small and medium sized projects	FS	Mixed funding	NA
LIGAR	2017-2018	Socio-economically under-privileged populations	KD&M	NA	NA
INTERNACIONAL LEVEL					
STEP	2019-2022	Countries with the highest incidences of energy poverty	KD&M	Public funding	▪ Due to the COVID-19 pandemic, all training and advice was adapted to digital. Bridging the gap of digital outreach to the most vulnerable consumers was the biggest challenge faced so far. ▪ New set of policy recommendations adapted to the European Green Deal and considering the COVID-19 pandemic was established and will be shared to other H2020 projects for best practices.
RenOnBill	2019-2022	Homeowners or tenants whose properties have energy efficiency amelioration margin	KD&M + FS	Private funding	▪ Particular attention has to be made on the relation expense-economic saving of the renovation works.
HOuseEnvest	2018-2022	Multifamily houses	KD&M + FS	Mixed funding	▪ Barrier's analysis highlighted the underuse of support schemes.

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Project's name	Year	Target group	Project's Reach*	Financial scheme	Main risks & lessons learned
					▪ Long processes to establish a standardized development methodology of the studies caused delay to project kick-off. ▪ Key people leaving delayed the project ▪ Collective financing of projects in bundles, as well as the capacity to finance several small-scale private sector projects through crowdlending reached significant impact
EUROPA	2020-2023	Property managers and market operators. Focus on low- and middle-income families, elderly people and other vulnerable groups.	KD&M	Public funding	NA
STEP-IN	2018-2021	Low income and elderly households, social housing and fuel poor dwellings	KD&M	Public funding	Energy cafes were much appreciated by attendees and had great influence in changing energy consumptions behaviours of tenants, more over they reduce social isolation and increase social capital.
EuroPACE	2018-2021		FS	Mixed funding	Municipalities have a role in remitting loan repayments from homeowners to private investors.
ASSIST	2017-2020	Consumers, energy producers and suppliers and policy makers	KD&M	Public funding	Value of sharing resources and knowledge about energy consumption and efficiency.
RenoActive House	2017	Social housing	ER	Private funding	NA
Rhodoshop	2017-2022	Public buildings, municipalities	KD&M	Mixed funding	NA

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Project's name	Year	Target group	Project's Reach*	Financial scheme	Main risks & lessons learned
BestRES	2016-2019	Renewable energy markets	KD&M	Public funding	NA
EnerSHIFT	2016-2020	Public residential building tenants or co-owners	ER + FS	Mixed funding	NA
LEMON	2016	Public and private companies developing ER projects involving social housing	KD&M+ER+FS	Mixed funding	▪ Feasibility studies allow to properly calculate energy efficiency investment. ▪ The risk for ESCo can be reduced by setting-up a social fund feed with the provision coming from the work tender discount offered by the bidder. The social fund can support the investment of landlords, which will repay the investment through a monthly fee to fund owner. This can pay the ESCo and apply for incentives reimbursement.
ACCELERATE SUNSHINE	2015-2020	Public buildings, infrastructures and multifamily residential buildings	KD&M+ER+FS	Mixed funding	▪ Government policies discourage EPC. ▪ Small and medium municipalities are usually inadequately organized to manage and finance the renovation process. ▪ Individual owners of residential buildings often lack knowledge and financial resources to manage their collective property. ▪ Municipalities acts as facilitators between citizens and ESCos.
De Energiecentrale	2014-ongioing	Owners/tenants of individual dwellings as well as associations of co-owners and property managers.	KD&M	Public funding	NA

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Project's name	Year	Target group	Project's Reach*	Financial scheme	Main risks & lessons learned
PICSA	2014	Homeowners and housing cooperatives	KD&M + FS	Mixed funding	▪ Simpler procedures with fewer documentation and, clearer and more complete classification of actions facilitate the work. ▪ Carry out pre and post renovation work analysis of energy impact would help to better plan works and access post-rehabilitation benefits.
Padova FIT	2013-2017	Single families, condominiums, condominium managers, property owners, real estate agencies in Padua.	ER	Public funding	Project's replicability should take into account many factors: technical and technological, financial, social and regulatory – all specifics to the country/region of implementation
Hauts-de-France Renovation Pass	2013	Owners of rural houses and multi-family residential buildings	ER	Private funding	NA
Île-de-France Energies	2013	Co-owners of multifamily apartment buildings with EPC of E, F or G	ER + FS	Private funding	▪ Third Party Financing (TPF) is very long to implement because of the legal national framework and surety obligation. ▪ TPF solutions were found for the medium term (4 years), but not on the long term. ▪ Decision making process is very long in condominiums (3 years of studies, 2 years of works).
123 Vester Voldgade	2011-2013	Multistore office buildings owned by governmental Agency	ER	Mixed funding	▪ Start off the project by gathering all information concerning the buildings to develop a calibrated standardized model. ▪ Properly adjust building systems for optimal operation before handing them over to the users/owners.

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Project's name	Year	Target group	Project's Reach*	Financial scheme	Main risks & lessons learned
Solar Hot Water in Social Housing	2010	Tenants, owners and/or co-owners of social housing	KD&M + ER	Mixed funding	▪ Participation of these families in training sessions it is the key for further implementation of the program. ▪ Major issue would be to make solar water heaters and energy efficiency measures an integral part of the national housing program.
RE:FIT	2009	Local authorities, schools, universities, hospitals, leisure centres and museums	KD&M + ER	Public funding	▪ Project development costs are an investment risk which need paying. ▪ Identification of gaps in public sector data should be identified as early as possible and find the proxy´s of needed. ▪ Policy uncertainty and change – build flexibility into the program to allow adaptation.
PACE	2008	Residential and commercial property owners	ER + FS	Private funding	▪ Contractors can push for expensive loans with questionable savings. ▪ Underwriting does not ask for prior verification if the property owner can afford the loan or even understand the terms of the contract. ▪ Debt stays attached to the property and takes priority on existing mortgages.
ENERGIEhuis	-	▪ Socio-economically underprivileged populations ▪ Non-commercial legal entities and cooperative companies.	KD&M	Mixed funding	NA

Table 1 - Benchmarking projects and main characteristics

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Legend:

*	ER	Energy Efficiency Renovation Work
	FS	Financial Schemes
	KD&M	Knowledge Dissemination & Management

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5. ONE-STOP-SHOPS

5.1. What is an OSS?

The concept has been introduced with the revised Energy Performance in Buildings Directive (EU) 2018/844. One-Stop-Shop (OSS) are advisory tools where multiple services are provided and multiple needs are met in one location, helping homeowners, designers, and contractors to plan renovation works in all their aspects. These physical and/or online platforms are typically free-of-charge for customers and allow to connect with all interested parties - tenants, construction companies, funding institutions, and public organisations - providing services and solutions, and increasing stakeholders' awareness concerning the issue of energy poverty.

Most of energy efficiency renovation projects implemented in Europe – about $^{2}/_{3}$ of the investigated ones - have as common characteristics the development of a one-stop-shop. The main advantage is the possibility to effectively manage the whole project in a comprehensive way by creating and making available useful resources such as reliable and sound information, checklists, tools, process descriptions, catalogue of practical policies and measures, discussion forums, training material, contacts of accredited renovation work companies and dedicated services like accessibility to funding, incentives and other financial mechanisms.

In this context, the creation of the Porto Energy Hub represents the logic step to gain loyalty and ensure revenues, besides providing convenience, efficiency, and knowledge dissemination – making all this available to customers, service providers and institutional organisms and administrations.

5.1.1. What kind of models exist?

In Europe, 63 OSS have been identified – 15 covered by our analysis - working with different models of provided services. Models vary from giving tips and orientation to "all included" tailored solution services. The OSS can also be flexible about the involvement in the financial services it provides and role and responsibilities in the EE rehabilitation work outcomes and global stakeholders' experience.

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Figure 3 illustrates the distribution of these programmes around Europe, with referred projects and respective OSS.

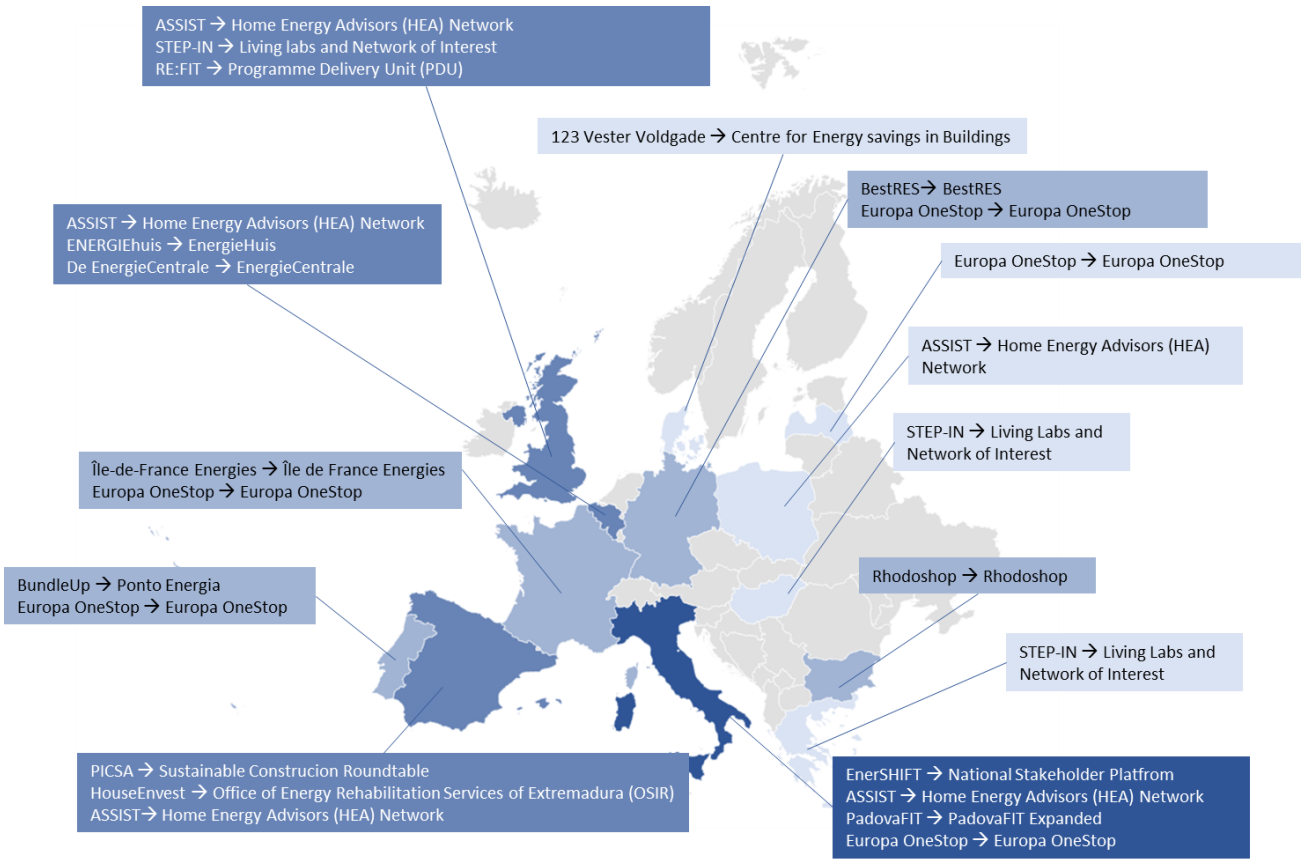

Figure 3 - Location of the 15 OSS identified during the benchmark analysis – darker colours indicate countries where higher number of OSS have been developed within the projects included in the analysis

The INNOVATE project[2] - born with Horizon2020 from the association of 13 organisations (municipalities, energy agencies, private companies and installers' cooperatives) from 11 European countries - has identified four types of business models for one-stop-shops to support energy rehabilitation works, as show in Table 2 below.

[2] Further detailed information on One-Stop-Shop´s and INNOVATE project: https://energy-cities.eu/wp-content/uploads/2020/07/INNOVATE_guide_web.pdf

Business model	Role and Responsibilities	Practical example of what the OSS offers to homeowners
Facilitation model	▪ Raise awareness on energy renovation benefits ▪ Provide general information on optimal renovation works ▪ First advice at the orientation stage	It advises on how to renovate the house and can provide a list of suppliers.
Coordination model	▪ Coordinate existing market actors (suppliers) ▪ Make sure all OSS services are offered to homeowners	It advises on how to renovate the house, push suppliers to comply with their commitment. The supplier remains responsible for the result.
All-inclusive model	▪ Offer a full renovation package ▪ Offers the supplier's product ▪ Bear responsibility on the result of renovation works and overall costumers' journey	The OSS is a contractor that sells the whole service package and act as costumer support in case of issues with suppliers.
ESCO-type model	▪ Offer a full renovation package with guaranteed energy savings to homeowners ▪ Offers own product ▪ Bear responsibility on the result of renovation works and overall costumers' journey	The OSS sells the renovation package and guarantees the energy savings for the contract duration. It is paid through the savings achieved.

Table 2 - Business models on OSS involvement proposed by the INNOVATE project

Most of the OSS investigated by our study fits the category of Facilitation models, by covering the role of advisors and information providers - Living Lab and Network of Interest (STEP-IN), HEA and VCSC (ASSIST), National Stakeholders Platform (EnerSHIFT), Sustainable Construction Roundtable (PICSA), HousEEnvest (OSIR), EUROPA, De Energiecentrale and Rhodoshop.

The German OSS, from the homonymous project - BestRES – identifies as a Coordination model, by focusing on energy markets cooperation and matching generation and demand of energy from renewable sources. ENERGIEhuis in Belgium are also examples of Coordination models OSS across the Flemish region, from advising to provide contracts network. Finally, the PDU from RE:FIT fits also into this category.

ESCO-type model is represented in our case by Île de France Energies project and OSS. This acts like a public ESCo to integrate the different steps of the process, compensating lack of initiative of private sector and reducing transaction costs such as (information, strengthening of the capacity of the homeowners, feasibility studies, quality control, follow-up, etc).

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5.2. Key aspects for a functional OSS

As the concept of an OSS exists since early 1930s and has been used widely since, it is possible to list some of essential features and strategies necessary for the development of a functional and valuable OSS. Specifically, successful approaches taken from past and current projects that can be used as best practices to be implemented in the creation of the Porto Energy Hub.

5.2.1. Communication and awareness

In general, the first step towards energy efficiency renovation is to address the general lack of knowledge and awareness. It is crucial to raise the citizens and organizations attention on the issue of energy poverty, to educate and facilitate on how energy efficiency can be easily implemented, the related benefits, in an economic and health perspective and the prospect savings in the medium-long term in energy.

First step should then be a market and desk study research on the target population and current living situation and, by collecting all this kind of information, OSS are the perfect tool to address this knowledge gap. Then is important to define an adequate communication strategy to reach a broader audience.

Experience from the STEP-IN project showed that the organisation of Energy Cafes and Living Labs gathering tenants, local experts and other stakeholders lead to positive changes in the behaviours toward energy use. These training sessions allowed homeowners to better understand energy consumption and saving techniques, realising the huge improvement in indoor climate, air quality and energy bills. Particularly appreciated by municipalities, the Home Energy Advisor (HEA) training programme promoted by ASSIST provides online free-of-charge courses on how to manage, provide advice, communicate and practice energy efficiency in buildings. These had great adhesion from the audience and such recognition led to a scale up version of the ASSIST project named SUITE. With the same purpose, but a different target, the Danish National Knowledge Centre for Energy Savings in Buildings, educates the construction sector about the potential and opportunities of energy efficiency practical implementation, ensuring that relative legislative actions are communicated to builders.

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On a similar level, but developed by professionals for professionals, the Sustainable Construction Roundtable in Andalusia, Spain, includes more than 70 experts from different disciplines, gathering knowledge and expertise on competitiveness, supply and demand, efficiency and renewable energy, innovation, employment, and legislation.

The Portuguese LIGAR project has trained several small "task forces" of local actors at the local level (for e.g., social workers, local cultural and/or social associations, community centres, scouts, others), for individual personal advice and practical support for the implementation of energy efficiency solutions to reach the more vulnerable and info excluded population.

Replicability is an essential component and most successful consequence of knowledge dissemination process. Perfect example is the PadovaFIT Expanded programme, developed after the concluded project of PadovaFIT. The Expanded version aims now to create and run a pilot of a One-Stop-Shop dedicated to home renovation services in the city of Padova (Italy), Timisoara (Romania), and to Smolyan and Vidin (Bulgaria). The concept is based on existing experiences of similar One-Stop-Shops motivating and supporting homeowners (demand side) as well as stimulating the supply sides, both technically and financially, to invest in energy efficiency. The identification of the enabling conditions and EU best practices should lead to financially sustainable, integrated home renovation service schemes, based on public and/or private finance, supporting citizens to target ambitious energy savings.

5.2.2. Close involvement

Other essential aspect to enhance energy renovation benefits is the establishment of a close connection between tenants and contractors. Once the relationship is set, it is fundamental to assure a good level of trust between the parties: for homeowners to be certain that energy renovation works will be completed and for companies in order have the guarantee of tenants' commitment and consequent payment.

RETROFIT Works, an English non-profit cooperative, is the perfect example of safe and trust-based relationship since it is owned by community-based organisations and local supply chains in charge of designing and hosting energy efficiency and retrofit schemes. This OSS has the scope to bring together people that have common interest in improving home's performances, by linking tenants or houseowners, building professionals and organisations seeking for high quality installations for themselves or their clients. The cooperative works on a membership fee payment system to cover

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costs linked to administration and development of renovation designs and financial schemes. This approach might discourage people that are first searching to access information.

A more trustworthy system could result from the involvement of public authorities in the process. It is the case of Frederikshavn, where the municipality acted as link between end users and service providers. Municipality's role is to provide further development of existing partnerships with the private sector to promote energy refurbishment in private property, as well as knowledge and information sharing to homeowners and other target groups.

5.2.3. Financial advice and support

Probably the main challenge related to energy efficiency renovation works is the economic aspect. Tenants are often afraid of the financial burden that might derive from such works. Offering the opportunity to learn about innovative financial schemes, accessibility to public funding or interesting/facilitated loans, should be an essential feature for a successful OSS.

Funding For Future (3F), for example, is a management company that operates national and regional private providing investments for multifamily, social housing and public buildings in cooperation with local partners across Europe. It links all main stakeholders of the building renovation sector, residents, service providers and investors.

Ponto Energia, a platform created by the Portuguese BundleUp project, focuses their services in overcoming the bureaucratic barriers and scale effects for finance finding, helping small and medium projects to thrive, based on a trust relationship with the promoters.

The HousEEnvest project identified as an obstacle, that sometimes, the financial support schemes are already in place, but are underused, indicating the importance of communication and confidence between the OSS and civil society.

5.2.4. Partnerships

The complexity of energy efficiency renovation projects can vary, but they all integrate different key aspects and areas of expertise. OSS help combine and organise these distinct features and manage to provide full support and knowledge to better assist

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the consumers. The OSS become focal points for partnerships, where renovation actors, clients and stakeholders meet their technical and financial needs, on a trust-based platform. This allows all parties to make informed choices about the combination of possible solutions in an efficient and time-saving manner.

An OSS can also benefit on their network entities. In the literature, OSS can largely benefit from local and regional authorities (such as municipalities) to support the project implementation.

5.3. Long-term financial sustainability

The unique and advantageous characteristic of one-stop-shops is their ability to bring together many different players involved in energy efficiency buildings´ renovation processes. The possibility to carry out an asset like PEH after the conclusion of the project, would allow the programme's achievements and results to persist, amplify and to be replicated and applied to other building types and/or regions, benefitting a larger proportion of the population.

In order to achieve this possibility, the OSS needs to be financially viable, independently from the project funds from which it was developed. Therefore, some longer-term options for one-stop-shops' financial sustainability are detailed below, based on literature review. The following section addresses their applicability to the national context and more specifically to the Porto Energy Hub.

The following possibilities for funding have been identified along the analysis of energy renovation projects and related OSS:

Public funding. Most OSS, as well as the programmes they are born from, are funded through public grants, either local authorities or international organisations such as the European Union. The downside of European programmes is that they have a limited budget destined to an end. Once this grant is over, the OSS needs to economically viable by its own means.

Public authorities, such as municipalities, willing to participate in a certain project, would probably and more likely have the resources to contribute to the sustenance of the OSS, to have access to the related services in exchange.

Private funding. Budgets can be provided by private funders, who retrieve indirect sale revenues from their participation. Partners could be represented by energy service providers, constructions companies or financial institutions.

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Blended funding. The OSS can be funded by public-private partnerships (public sector authorities, private contractors and homeowners) or semi-public entities. This solution can be used to attract a broader range of private entities, as the project financial risks can be reduced, due to the public share.

Crowdfunding. This practice is another form of support, by which a larger number of individuals, including consumers, sponsors, public authorities, and companies, can raise the money necessary to maintain the OSS.

Non-profit associations. These associations could play a role and participate in the financial viability of OSS, having the chance to raise money with less difficulties and covering a function of support for vulnerable consumers.

Fee payments. These can be paid by the supplier or by homeowners. The suppliers pay a commission fee to be integrated in the OSS network which would grant them access to clients and possible work opportunities. Homeowners pay this fee in exchange for the service provided, which guarantees privileged access to all OSS tools, support systems and connections. This fee does not necessarily have to come from the user directly, or the public authorities (whether is them pushing for the retrofit works), but it can be provided by a share of the achieved energy savings or through a slight increase of the energy bills (on-bill schemes). This fee can be applied to whoever wants to access the OSS services, database and tools, such figures might be represented by policy makers or energy providers looking to understand end-users needs.

Own financial scheme. Some OSS that specifically develop their own financial schemes, can also make a profit from the interest on the energy efficiency renovation works' loans.

It is essential to highlight that the type of financial support identified for an OSS would most likely vary according to the type of services provided (see section 5.1.1). For example, if the OSS only provides knowledge dissemination about energy efficiency renovation works - Facilitation Model - it would be less likely for financial institutions to get directly involved. On the other end, if the OSS takes a central role and is held responsible for the overall quality of work – All Inclusive Model - it can more easily liaise with financial instruments, partnering with banks or even offering its own developed innovative financial schemes.

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5.3.1. Applicability to the national context

PEH aims to maintain its activity after the European-funded project from which originated (PEER) reaches its conclusion.

The previous section mentioned some options to sustain such a complex work model, but these need to be addressed considering the Portuguese context so their applicability can be properly evaluated. Moreover, it should be considered that these financing options can be applied on their own or combined (blended finance), depending on the amount of funding which one will be able to secure.

Specifically, there are important regulatory restrictions that are often unique to each country that might exclude some of the existing options. Some considerations regarding the applicability of the funding options are provided below.

Public Funding. During project implementation PEH will be funded by the H2020 grant. After this, PEH could be eligible to obtain other sources of public funding, either with the Municipality support, as Porto Municipality is one of the largest and most relevant in Portugal, or by applying to available regional and European revolving funds. This is approach is not innovative but is common in Portugal and other southern European countries.

Private Funding. In the national context there has been an increase in green finance and the real estate prices have been increasing, representing an opportunity for private finance engagement, providing additional services with green building labels.

Crowdfunding. Even though there are some companies using crowdfunding for green energy projects, there is not a large cultural buy-in into this kind of funding solution, especially in comparison to other countries. This might be an important barrier to the application of this option.

Fee Payments. Fee payments is a complex solution that works better in markets where the consumers are well informed. In Portugal there has been a knowledge gap that might hinder the applicability of these solutions. In addition, there are some regulatory constraints in the implementation of these schemes, which might be an impediment to this option.

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6. LESSONS LEARNT

Leveraging on the previous analysis done over the case studies analysed and the examples of OSS, we have identified a number of key take-aways that will be taken into consideration during the implementation of the PEER project and, more specifically, PEH.

6.1. THINGS TO AVOID

Recording pitfalls from past similar experiences gives the opportunity to discuss and avoid unintended outcomes that may impact the success a project. From this analysis, most relevant obstacles and circumstances to avoid were identified by the project team and how the analysis done can help in mitigating some of these risks.

Technical & Processual

What to avoid	How to avoid
▪ Post renovation work´s energy consumption significantly higher than expected for an extended period. Many times, there are difficulties with the initial settings and calibration of systems	▪ Properly adjust building systems for optimal operation before handing them over to the users/owners
▪ Early delay in studies start date caused by the long process spent to define a general methodology to standardize the studies' development	▪ To prioritize the development of a methodology, with the use, as much as possible of standardized processes
▪ Project delays due to allocated people leaving	▪ Involve a broad team group in the process with access to all information through progress sharing tool
▪ Long decision-making processes that discourages potential customers	▪ Decision making process is decentralized and extended to the regions and localities

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▪ Digital gap for vulnerable consumers, especially with the conditioning that emerged after the COVID-19 pandemic, when communication materials became more digital	▪ Due to, training and communication materials tend to be more and more digital, but these may not reach all target groups. Dissemination strategy should include both physical and digital tools. ▪ Having an OSS with a physical presence in parallel with the online one
▪ Delays caused by mismanagement of renovation projects and funds by municipalities	▪ Invest in capacity building / training for the proper management of funds and projects

Public Engagement & Awareness

What to avoid	How to avoid
▪ Lack of interest in the EE renovation sector (not yet a mature market) by the end-users (e.g., social housing)	▪ Involve a broad network composed of a mix of public (for communication) and private investors (to leverage the budget and potential savings) ▪ Show real proof of investment vs gains vs savings ▪ Make use of existing community networks to provide energy advice
▪ Lack of interest in the EE renovation sector by investors leading to a lack of investment	▪ The OSS must provide information and connections to funding institutions, grants, private entities, energy agencies, private owners and investors ▪ Financial schemes with attractive returns for private entities
▪ Misleading information among stakeholders	▪ Using a simple standardised nomenclature, methodology and documentation to easy comprehension
▪ Underuse of support schemes	▪ Build powerful marketing arguments and business cases providing evi-

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	dence of energy efficiency, cost savings, improved living standards, extent of buildings' value and lifetime.

Lack of transparency and confidence

What to avoid	How to avoid
▪ The owner´s inability to pay the loan/ debt	▪ Renovation project should be undertaken only after full transparency of the conditions from the start
▪ Lack of private investments	▪ Public authorities, e.g., municipalities, should have an active role in remitting loan repayments from homeowners to private investors. This decreased the risk of payment default, thus attracting cheaper private funding.
▪ Misleading numbers on the actual energy saving margin	▪ Have a professional and trustful network of accredited renovation works companies
▪ Contractors or other parties can push for expensive loans putting into question the savings of the project	▪ Contractual framework between the three parties has to be established, giving all parties involved (e.g., owner, user/tenant and ESCO) a fair share of the costs and benefits

6.2. THINGS TO REPLICATE

In this sub-chapter are presented few insights collected during the analysis, that the team considers that add value to PEH and should be leveraged on. Divided into technical, financial and engagement categories, these can easy the project in the long run, namely PEH.

Technical:

- Start off the project by gathering all information concerning the buildings, and to develop a calibrated standardized model on actual measurements.

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- Collect feasibility studies, as these allow to properly calculate energy efficiency investment. General investment on building retrofitting is too uncertain and needs project design to be better assessed.
- Carry out pre- and post- renovation work analysis of energy impact, as these help to learn and come up with most suitable, sustainable, energy and environmentally friendly technical solutions and assess and helps validating the post-rehabilitation benefits.
- Perform energy audits, as these provide individuals and companies with valuable feedback on their energy consumption. Insert then a professional figure – building facilitator – with the role of explaining the results to programme's participants.
- Gather and present energy consumption data can help consumers change their behaviour and become more energy efficient. It is also useful for policymakers to effectively target, monitor and evaluate their measures and actions.
- Make use of locally manufactured materials, if available, as this will reduce the project´s costs.
- Use OSS and Municipalities to bridge connections between citizens and ESCos, as these are great facilitators.
- Simplify procedures and their access by developing a 100% online tool to apply for energy rehabilitation of buildings incentives.

Financial:

- Ensure key stakeholders assume responsibility to engage and convince homeowners about the benefits of energy conversion, highlighting the economic benefits they can draw from it (more earnings, business expansion/ business development).
- Combine retrofit works and maintenance in Energy Performance Contract, in order to assure buildings' energy performances and by consequence lower energy consumption.
- Bundle building renovation projects in one Energy Performance Contract (EPC), as this helps decreasing transaction costs and creating economies of scale.
- Consider crowdlending and collective financing of projects in bundles in order to fund several small-scale private sector projects.
- Use project payback to finance future operations.

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- Expose evidence to the government authorities about related benefits in order to push for future incentives and financing.
- Adapt the financial scheme and business models to the different projects´ scales.
- Involve municipalities or other public organisations as guarantee for financing institutions and greater ease in obtaining loans.
- Enhance public-private collaboration to facilitate the application to incentives by citizens and companies. The first are free to choose their contractors and the second help disseminate the programme.
- Develop a standardized catalogue of available energy efficiency improvement measures with defined funds.
- Ease citizens' access to such programmes by designating collaborating companies to take care of the application process and administrative complexity burden. This makes easier and more successful the final application of funds.

Engagement:

- Mobilise municipalities to play a key role in tackling energy poverty, given their local knowledge of their populations and housing stock, democratic accountability and ability to represent the interests of local citizens.
- Encourage the engagement of actors in direct link with vulnerable consumers – professionals working on the ground would ensure end-users trust in the project.
- Involve public authorities to strengthen the link and assure safety for all involved parties.
- Train and inform building retrofit users beforehand, as the actual long-term savings depends on tenants' behaviours. Tenants' training aims to make them understand how to save money on energy efficiency and improve living conditions.
- Provide training sessions for policy makers, including topics related to financial instruments, presenting technical and economical choices, advantages, critical points and risks.
- Adapt and differentiate the training approach to the target population. Energy cafes of STEP-IN project were much appreciated by attendees and had great

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influence in changing energy consumptions behaviours of tenants, more over they reduce social isolation and increase social capital.

- Liaise with public authorities, as these have the power to initiate and facilitate the energy efficiency renovation movement, by creating connections and positive engagement within interested parties and enable energy investments.
- Scale-up the project with public authorities´ support, as these have the power to replicate valuable renovation projects and suitable business models in their regions and municipalities.
- Build a specific communication channel between the owner and the platform/service provider is important to engage with the client and maintain contact.
- Disclose documents (i.e. contract templates) in a platform accessible to all stakeholders – this increases trust and transparency.
- Provide reliable and sound information for the citizens (target group) with full disclosure. This is essential to engage homeowners' interest towards energy refurbishment.
- Provide free of charges and unbiased energy advisory (e.g., OSS service) – this will enhance receptiveness.
- Assure regular contact among all stakeholders, to ensure that logistics and project management run smoothly.

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7. CONCLUSIONS

The research and collection of worldwide cases available in this report demonstrates that many different activities and projects are already taking place and PEER can use these to leverage on the positive outcomes and be cautious about the possible red flags similar projects have shown. Especially under the H2020 scope, the overall idea is that these best practices and approaches are disseminated among projects, so each one can be improved and replicated across Europe on a continuous development and expansion.

One key factor is the behavioural change that needs to occur, both in the target population, and in the Energy Efficiency markets. This market is not yet mature, meaning that parties involved, including public entities, may not lead the projects in the best possible way, as solutions provided may not be economically efficient, and may lead consumers to misleading results, creating a lack of trust in such solutions. This sometimes occur due to lack of knowledge from the parties involved, therefore it is crucial that PEH provides all stakeholders access to specific training. Training and qualification schemes should ensure that worker qualifications keep pace with the technical complexity of buildings and building components.

On the consumer side, engagement and acceptance is key to delivering energy savings by behavioural change, thus the communication strategy needs to be well-tailored. On this topic, the use of OSS has proved to be seen as an important bridging contact between interested parties and a large benefit for the consumer. It is crucial that PEH sets up an appropriate method and, due to the digital gap verified in the more vulnerable population, this should be a combined approach with both digital and physical components.

It is important that an OSS has a trustful network of partners working with them, so when these are presented to the client the process can run smoothly, with no unexpected events and in a trust-based relation. For PEH, this implies setting a robust relation with the municipalities, social housing entities, technical implementers and financing organisations. Constant communication among stakeholders is essential for

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the projects' success and it is recommendable that one specific channel is maintained between the OSS platform and the client, and, preferably, the same contact person.

Regarding the solution for each targeted group of end-users, financing schemes need to be customised to the regional scale and it is variable, according to the project's scales. There is no "one-solution-fits-all", business models and funding schemes may have to be adapted to match the needs of different projects. A further analysis on the financing schemes that have been used and which ones will be proposed under this project will be further developed in deliverables D6.1 "Financing schemes best practice available in Europe" and D6.3 "Integrated financial schemes for the selected projects".

Public authorities have the power to scale-up and replicate valuable renovation projects and suitable business models in their regions and municipalities, but these municipalities are usually inadequately organized to manage and finance the renovation process, so they can leverage on their EE potential by making use of OSS support. On one hand, PEH should give necessary support to these and, at the same time, leverage on the opportunity and partnerships to scale-up the project and its visibility.

During the whole process, is crucial that PEH shows itself a trustworthy partner to the consumer and to the stakeholders. Full disclosure in every communication, contracts, conditions and methods is important. The standardization of the procedures and documentation brings transparency the procurement process and should be disclosed (e.g., contract templates) in a platform accessible to all stakeholders, to avoid any mislead.

According to the EU commission, OSS are accelerating the building refurbishments, bridging the gap between the supply and demand side (Economidou, M., et al. 2019). Both private and public sector can benefit from the pooling capacity of an OSS, making easier building engagement between renovation actors and clients. One-stop-shops will continue to be advocated by the European Commission for its development and replication and the work carried out in PEH will contribute for this renovation route.

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Porto Energy Hub

Energy Efficiency for all.

ANNEX 1 – CASE STUDIES

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

National level

BundleUP

Portugal, 2018-2021

Figure 4 BundleUp OSS Ponto Energia

BundleUp is a funded EU project, under the H2020 scope, with an overall budget of € 999 437,50 and gathers 8 partners, including five local energy agencies. The BundleUP will promote the clustering of energy efficiency projects in the public and private sectors, providing them with the necessary scale to achieve investor interest. The necessity has arisen from the high potential identified by building owners, local energy agencies and ESCOs in energy saving projects, but many these do not always manage to reach the implementation phase due to two very strong barriers: i) lack of size to attract professional investors in this type of project and ii) restrictive public procurement procedures with high costs of preparation and adaptation to each project case.

Target group	Private and public sector for small and medium sized projects
EE solutions	The BundleUp portfolio includes public lighting, buildings and solar power projects.
EE financial scheme	▪ Analysis of the applicability of crowdfunding to projects in the Public sector; ▪ Blending of funding for public and private small-scale energy efficiency projects; ▪ The project created an online marketplace for project promoters and ▪ investors in the energy efficiency sector
Results	▪ Development of standard energy efficiency procurement and contracting templates (EPC tender, EPC contract, Solar PV tender, Solar PV contract); ▪ Implementation of 44M€ of public and private projects ▪ As of March 2020, 35 projects were funded with considerable impact: in solar power, the project has so far installed a total 1,87MW and an energy production of 2,8 GWh/year. While in public lighting/buildings, the projects funded will enable savings of about 4.567 tons of CO2/year, by cutting energy waste by 14,8 GWh/year. ▪ Creation of the Ponto Energia platform, which enables the match between ▪ municipalities projects, installers and potential funders (such as ESCOs, funds, ▪ crowdlending, etc.).
OSS	Ponto Energia

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

LIGAR

Portugal, 2017-2018

Figure 5 LIGAR logo

LIGAR – Eficiência Energética para Todos! is a project carried out and funded under the scope of the energy efficiency promotion plan, the PPEC (Plano de Promoção da Eficiência no Consumo de Energia Elétrica), with an overall budget of € 149,000. This is promoted by the national regulatory energy agency in Portugal which grants, on a bi-anual basis and call for tenders, several funds to tangible and intangible measures to improve energy efficiency in Portugal. LIGAR was an intangible project awarded by this initiative, aiming to develop inclusive strategies to combat energy poverty.

Target group	Socio-economically underprivileged populations and infoexcluded
EE solutions	▪ Raise awareness of energy efficiency ▪ Help reduce energy costs and energy consumption by teaching how to efficiently use the available resources ▪ Promote behavioural change on daily energy using routines ▪ Mapping and characterization of the most vulnerable population to the energy poverty condition ▪ Define and disseminate strategies to be followed in communicating with the target audience
EE financial scheme	NA
Results	▪ Target audience was mapped and characterized: definition of the methodology for Energy Poverty mapping and selection of 10 priority areas to implement outreach actions ▪ User´s guide "Energia para poupar" on how to save costs and energy; ▪ Digital informative platform "LIGAR – Eficiência Energética para todos" for public sharing of information on efficient energy consumption (available here https://ligar.adene.pt/). ▪ Local challenges "Teu bairro, tua energia": development of dynamics aimed at mobilising local communities for the efficient consumption of ▪ Local agents "Brigadas de energia": creation and training of local agents working on the field to assist and advise target population with energy efficiency solutions and solutions implementation
OSS	NA

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

International Level

EUROPA

Several European countries, 2020-2023

Figure 6 Europa logo

The EU-funded EUROPA aims to develop a set of technical specifications, procedures and standard contractual arrangements to ensure guaranteed energy savings from the deep renovation of residential buildings. The mission is to simplify and make more transparent the home renovation process. Pilot projects are ongoing in the above referred countries, but European partners are 9. The approach focuses in two main axes: creation of OSS´s and integrate it with an Energy Efficiency Subscription model. Stakeholders are offered technical assistance and financing options as well as facilitation and/or coordination of the renovation process.

The programme was developed in Portugal, Italy, Germany, France and Latvia.

Target group	Buildings: property managers and market operators (professional craftsmen). Focus on low- and middle-income families, elderly people and other vulnerable groups.
EE solutions	The OSS includes: ▪ Proactive engagement of homeowners ▪ Energy renovation financial planning ▪ Support, facilitation and coordination of the renovation process ▪ Energy Efficiency Subscription: contract between homeowners and market operators. Set of technical specifications, procedures, and standard contractual arrangements to ensure guaranteed energy savings from the deep renovation of residential buildings.
EE financial scheme	▪ Matchmaking service: match the right service providers with the right financial scheme ▪ Energy renovation financial planning: tailor-made plans to help stakeholders get involved in the whole process ▪ Overall European budget of € 1,916,425
Results	NA
OSS	EUROPA (name to be confirmed for each country)

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STEP

Several EU countries: Bulgaria, Cyprus, Czech Republic, Latvia, Lithuania, Poland, Portugal, Slovakia and the United Kingdom, 2019-2022

Figure 7 STEP logo

Solutions to Tackle Energy Poverty (STEP) is a project is a H2020 project, with an overall budget of € 1,999,485. It aims to develop a simple, innovative and replicable model of measures to address energy poverty, by facilitating behavioural change through trusted, tailored advice provided directly to consumers in or at risk of energy poverty and by implementing low-cost energy efficiency solutions in energy poor households. Partners involve a group of eleven consumer and research organisations from across the EU that are putting together a set of solutions to help people who face energy poverty.

Target group	Countries with the highest incidences of energy poverty.
EE solutions	▪ Training – to get consumer groups and frontline organisations to partner up on energy poverty advice to energy poor consumers. ▪ Advice - to help energy poor consumers save energy and improve their living standard. Carry out information campaigns, provide national trainings on how to save energy, monitor cost savings and help put in place low-cost energy efficiency measures. ▪ Policy- to disseminate best practices, reports, and policy choices that can alleviate energy poverty and promote their replication across the EU.
EE financial scheme	NA
Results	▪ National networks of partnership agreements; ▪ Trained staff; ▪ Information and best practices dissemination on EE practices and available support schemes; ▪ Society awareness;
OSS	NA

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

RenOnbill

Several European countries, 2019-2022

Figure 8 RenOnBill logo

RenOnBill is a European project promoting On-Bill Schemes (OBS) to finance energy efficiency retrofits. Its overall objective is to scale up investments towards deep energy renovations of residential buildings by promoting the development and implementation of OBS which use energy bills as repayment vehicle for the works. OBS has been in use for more than 30 years, particularly in the USA and Canada, where it significantly drives the building renovation market. Specifically, the programme will:

- Define the residential building market context for OBS to enable replication and disseminate knowledge through the insights gained;
- Engage key stakeholders through national stakeholder platforms;
- Develop tools to address the renovation financing demand and assess and bundle investments based on a transparent methodology;

Countries in which the programme has been implemented include Germany, Italy, Lithuania, and Spain.

Target group	Home- and apartment-owners or tenants of residential buildings with energy efficiency amelioration margin
EE solutions	▪ RenOnBill will then develop a tool to structure the residential sector's energy renovation demand, by assessing risks and investments. ▪ It will finally test the results on the three partner utilities, for which tailored business models will be developed. ▪ RenOnBill's four focus countries are Germany, Italy, Lithuania and Spain, chosen to capture to an extent the differences that can be encountered when replicating on-bill schemes across wider Europe.
EE financial scheme	OBS is one key innovative way of financing energy efficiency: OBS brings the up-front costs of energy efficiency upgrades down to zero by simply adding a periodical line item to a customer's utility bill, which serves as the repayment vehicle. OBS can only be proficiently implemented if there is close cooperation between energy utilities and financial institutions.
Results	NA
OSS	NA

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

HOusEEnvest

Spain (Extremadura), 2018-2022

Figure 9 HouseEEnvest logo

The analysis of the Extremadura's building stock provides that the 60% of the buildings, have an average age of over 40 years, meaning they were not built under criteria of energy efficiency. Energy Efficiency Investments in multifamily houses, or HousEEnvest is a project under the H2020 programme´s initiative, with and overall budget of € 1,798,733.75 funded by UE. Gathers 9 key representatives necessary for the project implementation. Aims to demonstrate the viability of the designed financing scheme, focusing on a regional market with investment higher than 35 M€ that can be quickly replicated into a larger potential market of 113 M€.

Target group	Multifamily houses in Extremadura
EE solutions	Integral energy renovation in buildings.
EE financial scheme	Thanks to the HousEEnvest project, a new financing scheme has been created for the energy renovation of housing in Extremadura, which has materialized in the constitution of the Housing Energy Efficiency Guarantee Fund for Extremadura (GEEVE Fund). There are several requirements to get these loans and specific project requirements to be met, but characteristics of the Loans: maximum amount: up to € 800,000 per project and recipient; duration: to be determined by the financial intermediary, based on the calculation of the estimated theoretical savings; possibility of including a 1-year capital grace period; interest rate: to be defined in the Business Plan.
Results	▪ Approval of the financing scheme as part of a law (11/2019, of April 11): GEEVE Fund; ▪ Office of Energy Rehabilitation Services of Extremadura (OSIR in Spanish) has been launched. Here citizens may request different services related to energy renovations for all types of dwellings (financial advice) and multifamily houses (technical, financial, contractors…).
OSS	Office of Energy Rehabilitation Services of Extremadura (OSIR) – only for residential building or condominiums.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

De Energiecentrale

Ghent, Belgium, 2014-ongoing

Figure 10 De Energiecentrale

De Energiecentrale has been Ghent's One-Stop-Shop for stimulating and guiding energy-efficient interventions in existing and new Ghent homes. The goal is to make it as easy and affordable as possible for all Ghent's citizens to renovate their house or apartment.

The more energy-efficient dwellings, the lower city's CO_2 emissions.

The programme proposes free of charge home or online energy consultations, followed by a step-by-step personalized renovation guide in case the costumer decides to proceed with works, but provides also information concerning energy loans, group purchases and energy premiums.

Target group	Owners of individual (rental) apartments as well as associations of co-owners and property managers.
EE solutions	▪ Free advice and renovation support for all possible collective and individual energy-efficient investments: insulating roof, facade or floor; replacing windows; replacing collective or individual heating; green roof. ▪ Installation of measure devices, making visible the gas and electricity consumption before and after a renovation. ▪ Consumption scan with accessible tips or a no-obligation renovation advice at home. ▪ Step-by-step renovation guidance for your house, apartment or even entire apartment building.
EE financial scheme	▪ Advise on existent financial schemes and premiums for the Flemish region. ▪ Energy loans: i) owner before 2021: loan up to € 35,000 at 0% or 1.25% with repayment term maximum of 20 years; ii) became an owner in 2021: interest-free renovation loan from your bank (with a Flemish subsidy). ▪ Advise on different premiums per work renovation type.
Results	▪ € 30 M in investments (between 2014 and 2019) ▪ 660 extra jobs in the construction sector ▪ € 1,220,000 per year was saved on energy bills - 5,800 tons less CO_2 emissions per year ▪ 4900 energy scans
OSS	Energiecentrale

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

STEP-IN

Several EU countries, 2018-2021

Figure 11 STEP-IN logo

STEP-IN was born in the context of H2020 with the goal to develop skills and knowledge to improve energy efficiency and living conditions. It was launched in June 2018 and ended in March 2021. Partners of the programmes were mainly organisations from different European countries and varied expertise.

Target group	Low income and elderly households, social housing and fuel poor dwellings or using inefficient heating system in several European countries. Completed projects include cities of Manchester (UK), Nyirbator (Hungary) and Metsovo (Greece).
EE solutions	Living labs, energy advisors' consultations and working groups helping raise citizens' awareness about energy efficiency and consumption, but also shaping future energy policies.
EE financial scheme	Overall budget – EU contribution € 1,999,990.
Results	Results differ depending on the geographical location. In general, they include: ▪ improved living conditions; ▪ up to 8% of savings in energy bill and energy consumption; ▪ better understanding of energy expenses and changes in tenants' behaviours towards energy consumption. In Greater Manchester 15% of households are estimated to be fuel poor, above national average of 11%. The living lab was operated by the Greater Manchester authority and the University of Manchester. 450 households accepted energy advisors' visits and 225 dwellings adapted to proposed measures. *Nyirbator is a town of* 12,000 inhabitants and 7% of unemployment rate in the east of Hungary. During winter period air pollution rates are particularly high due to the use of rubbish and waste burning to heat households. 36% of the visited households took part in the impact assessment, and of these 37% noticed improvement in quality of life, arrears, or housing problems. In Greek mountain area about 40% of dwellings report that inability to keep their home adequately warm, 75% are forced to reduce other basic needs in order to cover the energy needs, 20% have arrears on energy bills, and 25% mention health problems related to inadequate heating at home. 150 households accepted energy advisors' visits and 300 adapted to proposed measures.
OSS	Living Labs and Network of Interest.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

EuroPACE

Several European countries, 2018-2021

Figure 12 EuroPACE logo

EuroPACE is a collaboration across four European countries (Spain, Italy, UK and Poland) that aimed to disseminate energy efficiency and generation technologies, making them accessible to most European households. The programme is an on-tax scalable financing mechanism which took inspiration from US PACE, previously discussed. The programme enclosed a comprehensive analysis identifying a roadmap for EuroPACE adoption in EU28 countries and selected the top four: Belgium, the Netherlands, Portugal and Spain.

Target group	Homeowner willing to implement energy efficiency renovation works.
EE solutions	The project addressed several fundamental challenges to Energy Efficiency investment through (i) a Market-Based Approach by deploying private capital as up-front financing to homeowners, i.e. reduce reliance on grants and subsidies, (ii) de-risking EE investment according to which the long-term repayments obligation is tied to a property and not its owner - municipalities would be the conduit for the repayment via the property tax bill, in the end (iii) technical assistance provided by trained energy service contractors to tenants and owners.
EE financial scheme	European funds cover with € 2,375,490. Differently from US Pace, EuroPACE provided a 'safe conduit', meaning that municipalities had an active role in remitting loan repayments from homeowners to private investors. This decreased the risk of payment default, thus attracting cheaper private funding.
Results	By 2025, the EuroPACE industry should generate measurable impact in the three key areas (i) Economy: over 45.000 jobs and € 5bn of capital in local economies across the EU27, (ii) Society: over 300.000 homes retrofitted and improved, and (iii) Environment: energy saving of 3.5 MWh/year equating to CO_2 savings totalling 1.8m tons. EuroPACE will account for just 4.6% of the European renovation industry by 2015 giving way to huge growth potential.
OSS	NA

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

ASSIST (Support network for Households Energy Savings)

Several countries in the European Union, 2017-2020

Figure 13 ASSIST logo

ASSIST was funded by the European Commission under the H2020 programme and developed over 3 years, starting in 2017, in 6 European countries including: Italy, Spain, United Kingdom, Poland, Belgium and Finland.

Its objective is to tackle energy poverty by developing a holistic model that integrates the multidisciplinary and multi sectorial dimension of this issue. Through a two-way approach ASSIST manage to engage consumers on the energy market and change their behaviour towards energy consumption, and address policy makers into the design of an energy poverty framework.

Projects steps include:

- Training of interested parties (consumers and services' providers)
- Networking (social, institutional and energy sector)

Action of specifically trained operators – households energy advisors – meaning on ground operations.

Target group	Consumers, energy producers and suppliers and policy makers.
EE solutions	▪ Generation of in-depth knowledge about energy poverty; ▪ Home Energy Advisor (HEA) figure which provide vulnerable consumers with increased/qualified/trustworthy/specific advice; ▪ Policy orientation through households' energy needs and energy inefficiency measures.
EE financial scheme	European funding – € 1,649,370
Results	▪ Increased awareness and knowledge about energy efficiency and consumption; ▪ Money saving for vulnerable consumers; ▪ Creation of the European Vulnerable Consumers Steering Committee (VCSC); ▪ HEA networks creation, to help communities raise awareness and implement energy efficiency.
OSS	Home Energy Advisors (HEA) Network and European Vulnerable Consumers Steering Committee (VCSC)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

RenoActive House

Brussels (Belgium), 2017

Figure 14 One Active House's attic before and after conversion

RenovActive House is a public-housing renovation project on the concept of "Climate Renovation" developed by VELUX (Danish energy-efficiency renovation company). RenoActive's goal is to create quality social housing with improved indoor climate and air quality, good energy performances, promoting health and sense of wellbeing, and appropriate visual and acoustical comfort. The project is based on a system of seven flexible and scalable elements, which can be implemented individually or in any preferred combination, in order for it to be affordable and available to the majority of the public. The Active House, named after the RenoActive project, is developed out of materials with focus on re-use, avoiding ecological damage and minimizing environmental impact.

Target group	Social housing in Brussels' region.
EE solutions	An example of RenovActive in Anderlecht, in the Brussel's Capital Region, included (i) attic conversion to add space, improve ventilation and gain light from above (ii) increased window area for more natural light (iii) staircase shaft for daylight and ventilation (iv) dynamic sun-screening (v) hybrid ventilation system (vi) improved thermal envelope to optimize energy performance.
EE financial scheme	The cost for the RenovActive concept corresponds to the budgetary framework of social housing organizations in Brussels and the requirements established under the Energy Performance Building (EPB) rules. Considering 50 such renovations, the cost for reproducing RenovActive is less than the Social Housing budget frame for reproduction. The project is fully financed by VELUX but building material manufacturers have lent their expertise and kindly provided supplies. The standard cost-price of these materials was considered to determine the final cost of the renovation.
Results	Benefits of the RenovActive concept include energy bill reductions by up to 50% after renovation, high levels of indoor comfort, more daylight, better health and fewer allergy symptoms reported by occupants, optimal temperature control, with temperatures in the home staying between 21-26°C.
OSS	NA

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

Rhodoshop

Bulgaria, 2017 –2022

Figure 15 Rhodoshop logo

Rhodoshop project is an initiative under H2020´s scope, with an overall budget € 470 550 funded by EU and main partners are the main partners are: Sofia Energy Centre (coordinator) and Association of Rhodope Municipalities (host organization). Comprising 6 pioneering municipalities from the Rhodope Region (Banite, Devin, Zlatograd, Nedelino, Smolyan and Chepelare) aiming to assist the local authorities in building technical, economic, legal and administrative expertise for energy efficiency measures by creation of One-Stop-Shop for investment projects implementation. The Rhodoshop model is replicable in other Bulgarian regions as well as at European level thus contributing to increase of investments in public building and street lighting re-furbishment and for local job creation.

Target group	Public buildings, municipalities
EE solutions	Energy efficiency measures in public municipal building and street lighting improvements
EE financial scheme	The OSS service provides the identification of suitable financing solutions for realization of energy savings in Rhodope Region (EPC, Energy efficiency funds, bank loans, national funding sources, etc.).
Results	Within its 48 months pilot phase Rhodoshop PDU (Programme Development Unit) will mobilize € M 7.067 investments for energy efficiency improvements in 32 public buildings and 0.660 MEUR investments for refurbishment in street lighting networks in 31 settlements of Rhodope Region. The energy savings re-sulting from the action are assessed to 11.276 GWh/year.
OSS	Rhodoshop

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

Best RES (Renewable Energy aggregatorS)

Germany, 2016-2019

Figure 16 BestRES logo

The project was founded in 2016 by Horizon2020 EU Research and Innovation programme and involved 11 organisations from 9 European countries (United Kingdom, Germany, France, Belgium, Austria, Portugal, Spain, Italy and Cyprus).

BestRES goal is to develop business models for the integration of renewable energy sources by aggregating distributed generation from renewable sources and combining this with demand side management and energy storage. This integration cannot be achieved by single individual domestic or commercial consumers, therefore the role of renewable energy aggregators who act on behalf of consumers. "Renewable energy aggregators are legal entities that aggregate the load or generation of various demand and/or generation/production units and aim at optimizing energy supply and consumption technically and/or economically."

Target group	Renewable energy markets
EE solutions	Improve the role of renewable energy aggregators in future electricity market design. In a first stage, the project focused on a benchmarking analysis of existing European aggregation business models taking into account technical, market, environmental and social benefits. In the second stage, BestRES developed improved business models, replicable in other European countries, considering market designs and with a focus on competitiveness and LCA. These have then been implemented practically or virtually, with real data, and monitored in the following target countries: United Kingdom, Belgium, Germany, France, Austria, Italy, Cyprus, Spain and Portugal.
EE financial scheme	EU funding - € 1,994,813
Results	▪ Development of new renewable energy business models that allow aggregators to successfully participate in the market; ▪ Development of a regulatory system that encourages investments in renewable energy sector; ▪ Increase hosting capacity of transmission grid and ancillary services; ▪ Renewables are better integrated in the market and depend less on public support scheme; ▪ Aggregators offer balancing services to grid operators, avoiding grid congestion and frequency variation; ▪ Energy prices are reduced since renewable can compete with other sources on the market.
OSS	BestRES

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

EnerSHIFT

Liguria region (Italy), 2016-2020

Figure 17 Social housing – Via Linneo (Genova)

EnerSHIFT project was funded under the EC Horizon2020 Research and Innovation program of 2015. The project promotes public residential building energetic requalification through innovative financial models in the region of Liguria, in the north-west of Italy. The idea is to create a triple win solution, to equally share benefits amongst tenants, co-owners and, ESCo, not only from the point of view of energy savings, but also jobs creation and increased awareness to fight energy poverty.

Target group	Public residential building tenants or co-owners of four provinces in the region of Liguria (Genoa, Savona, Imperia, La Spezia). EnerSHIFT has promoted the rehabilitation of 76 buildings, for the benefit of 3,050 dwellings.
EE solutions	Renovation works include thermal insulation of outer walls and roofs, replacement of outer doors and windows, replacement of heating systems paired with the installation of thermal solar panels, insulation of the distribution network, installation of thermostatic radiator valves and heat metering systems.
EE financial scheme	Most of the upgrading interventions are implemented through the self-financing mechanism typical of Energy Performance Certificate (EPC) contracts. Separated public tenders were called for concession of energetic services and renovation works. Funding came from Liguria region, Regional Operating Program (POR FESR 2014-2020) and Agenzie Regionali Territoriali per l'Edilizia (ARTE). The EPCs enable to carry out energy efficiency interventions without the need for financial investment by the owners of the property. The costs are usually borne by those who carry out the works, an Energy Service Company (ESCo) or a credit institution, and after offset by part of the energy savings obtained.
Results	The project ended in 2020 with the signature of contracts for energy renovation. First results show energy savings of 11.6GWh/year, against the expected 15.1Gwh/year, meaning 2,370 tons of unreleased CO2.
OSS	National Stakeholder Platform

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

LEMON – Less Energy More OpportuNities

Region of Emilia-Romagna (Italy), 2016

Figure 18 LEMON project stand at Ecomondo Exhibition

In Emilia-Romagna region, the north-east of Italy, the Social Housing companies (ACER) manage in total 78,703 dwellings in 6,404 buildings, whose energy demand ranges from 80 to 450 kWh/m2 per year and average energy cost ranges from € 600 to € 2,500 per year. The Lemon project, developed under Horizon 2020, aims to offer technical, financial and organisational assistance to public and private companies for tenders' application in the context of energy renovation of social housing in the region.

Target group	Public and private companies developing energy renovation projects involving social housing in Emilia-Romagna.
EE solutions	Works include energy audit, feasibility studies, business plans for energy investments on social dwellings, engagement of regional stakeholders, to share outcomes and gather support to further implementation of the project, training events for tenants and policy makers together with the outcomes' evaluation for replicability. Practical renovation works cover: thermal insulation, windows replacement, centralized heating systems substitution.
EE financial scheme	The investment plan foreseen two different financial programmes to be implemented: works contract and EPC contract. The project took advantage of several financial tools: ▪ *Grant from the state* - law 80/2014; ▪ *Grant from Emilia Romagna Region co-financed by the European Regional Development Fund (ERDF);* ▪ *Urban regeneration Programme* - grant managed by the Emilia Romagna Region; ▪ *Ecobonus* - tax and Vat exemption; ▪ *Conto Termico 2.0*, financial tool that incentives interventions for energy efficiency improvements and thermal energy production from renewable sources. ▪ *Third Party Financing EPC*, debt finance managed by ESCo; ▪ *National Energy Effiency Fund* debt finance managed by ESCo.
Results	In total 626 dwellings have been included in Lemon programme, among them 149 are in the province of Parma and 477 in Reggio Emilia province. The investment programme should reduce by 4.039 MWh/y the energy consumption and avoid 794 tons of CO_2 per year.
OSS	NA

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

ACCELERATE SUNShINE

Latvia, 2015-2020

Figure 19 One of ACCELERATE SUNShINE renovation projects

Nearly all apartments in Latvia are privately owned. Due to lack of awareness, technical knowledge, limited availability of funds, high risk perception and fear of debt financing, building's maintenance is not seen as a priority. ACCELERATE SUNShINE is a continuation of the SUNShINE project to support EPC and demonstrate viability of home retrofit through suitable project building, municipal partnership, and financial engineering.

Target group	Public buildings and infrastructures and 1950s-1980s Latvian multifamily residential buildings with multiple private owners.
EE solutions	Accellerate SUNShINE has targeted four smaller municipalities and created campaigns raising awareness, encouraging citizens to renovate their homes (local working groups bringing technical, legal, financial, and social advisory). Renovation works include thermal insulation of building envelope, hydro insulation of base, replacement original windows with triple glazed ones and metal door with new insulated ones, roof and basement ceiling insulation, structural improvement (balcony, roof cover and drainage), new heating and hot water system, ventilation system repairs.
EE financial scheme	Financed by the European Bank for Reconstruction and Development, the Latvian Baltic Energy Efficiency Facility (LABEEF) is a facility created in 2016 to support ESCos that implement renovation measures in multifamily buildings-based EPC. ESCos, which are usually not able to support long-term debt, enter into a forfaiting agreement with LABEEF, before a deep renovation project, for selling its future cash flows (receivables). Once works are completed and results verified, the forfaiting transaction is executed, the ESCo cleans up its balance sheet from debt and continues to guarantee energy savings for the entire EPC term (20 years). Total investment of SUNShINES projects amounts of € 25.5M, of which € 1.6M comes from EU funds (H2020). Accelerate SUNShINE supports EPC with a pipeline of projects worth € 27 M and guaranteed savings over 27GWh/year. EU funds amount to EUR 1,577,140.
Results	Energy savings equal to 1,300 MWh per year. Accellerate SUNShINE created clearer procedures for the implementation of retrofit works in small and medium municipalities. Municipalities created a legal framework that accompanies tenants in the home retrofit process supporting energy audits, technical surveys and renovation works.
OSS	NA

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

PICSA – The Sustainable Construction Programme in Andalusia

Andalusia (Spain), 2014

Figure 20 Renovation works in the framework of PICSA project

PICSA, regulated by the Decree-Law 1/2014, is a government's tool, combination of economic measures (subsidies and incentives) and other actions such as regulatory, training and fiscal, that seek, through energy saving and efficiency, and renewable energy, to promote the energy rehabilitation of buildings, improve the competitiveness of companies of the construction sector, create skilled employment and reduce energy poverty. More than 8,300 partners, mostly SMEs participate in the programme, creating a public-private partnership with the Andalusian Energy Agency.

Target group	Citizens and communities of homeowners and housing cooperatives.
EE solutions	The programme considers three main actions: ▪ An incentive scheme, managed by the Agency, to encourage sustainable energy rehabilitation of buildings; ▪ A financing scheme, promoted by the JEREMIE (Joint European Resources for Micro to Medium Enterprises) Revolving Fund, destined to partner companies to revitalise them and strengthen this branch of the construction sector; ▪ A one-stop-shop named Sustainable Construction Roundtable.
EE financial scheme	Total project's investment amount to € 242 M, of which € 131.2 M were the EU's European Regional Development Fund contribution, € 32.8 M came from regional funds and the remaining € 78 M were from private investments. The investment return was calculated to be of about 5-6 years. In addition, PICSA started a fund (€ 50 M) from the JEREMIE initiative, for local construction companies, able to bid up to € 2 M each, which also support their access to EU financing.
Results	Estimated CO_2 emissions' reductions are about 85 M tonnes corresponding to 36,000 toe (tonnes of oil equivalent) per year. More than 60% of the companies have created new jobs positions, counting about 170,000 new employments. Economic savings accounted for € 280 M combining companies, citizens, and other entities.
OSS	Sustainable Construction Roundtable

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

PadovaFit

Italy, 2013-2017

Figure 21 Padova FIT and Padova FIT Expanded logos

Padova FIT is an IEE (Intelligent Energy Europe) project financed by the European Community that has as its objective the energy requalification of the private building stock in the city. PadovaFit has the aim to incentivize private investments to renovate homes and ameliorate energy efficiency - CO_2 emissions related to residential construction in the city of Padua amount to 30% of total emissions, reason of the radical interventions to put a stop to the waste of natural resources, pursuing policies to reduce greenhouse gas emissions. The programme was born in Italy (Padua) and was then further developed in Bulgaria (Vidin and Smolyan) and Romania (Timosoara) with Padova Fit Expanded one-stop-shop.

Target group	In the municipality of Padua: ▪ single families; ▪ condominiums; ▪ condominium managers who select interested condominiums; ▪ property owners; ▪ real estate agencies.
EE solutions	▪ Energy savings in electrical systems with more efficient technologies (pumps, lamps, boilers). ▪ Energy savings in thermal systems: total and partial renovation of heating systems. ▪ Installations from renewable sources (photovoltaic and solar thermal). ▪ General upgrading (structural measures).
EE financial scheme	European funding accounts for € 1,504,596
Results	▪ Reduce energy poverty in the city of Padua; ▪ Support the requalification of buildings for residential use in the city of Padua, in particular condominiums; ▪ Energetically requalify about 200 condominiums in the city.
OSS	PadovaFit Expanded (2019-2022)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

Hauts-de-France Pass Renovation

Picardie region (France), 2013

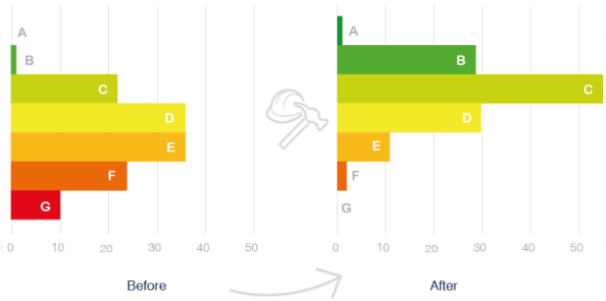

Figure 22 Energy label and evolution before and after PSEE renovation work

The Public Service for Energy Efficiency (PSEE), named Hauts-de-France Pass Rénovation since January 2020, is a pilot project launched by the former Region of Picardie in France. The Region benefits from the ELENA technical assistance mechanism (European Local ENergy Assistance), funded through Horizon 2020 Energy Efficiency, through which it develops local sustainable energy projects.

Target group	Owners of rural houses and multi-family residential buildings. More than 6,500 dwellings have benefited from this public service since 2014.
EE solutions	Replacement of electric radiators and windows, improvement of ventilation system, thermal insulation of roofs and all external parts.
EE financial scheme	The PSEE is the first French public operator to set up a third-party financing mechanism, developing on an all-inclusive financial solution for energy renovation of private period properties. Through public fund, the Hauts-de-France Pass Rénovation advances the costs related to energy renovation works, which later the beneficiaries pay back in whole or part through financial savings on energy bills. Average loan is about € 43,000. At finished works, the owner repays the public body an amount less or equal to the post-renovation energy savings (the key to this being a substantial reduction in final energy consumption of 40 to 75%). This advance on energy savings is granted at a rate of 2.5%, given over a maximum period of 15 years, for equipment, and up to 25 years for building insulation works. Financing part is covered by ELENA-ADEME-FEDER subsidies (€ 4 M) covering overheads, Picardie Region (€ 8 M) covering initial renovation projects and European Investment Bank loan (€ 35.5 M).
Results	This economic model allows important reductions on energy consumption from 40 to 75% and increased energy savings of residential buildings to fight energy poverty, it supports local economic expansion, job creation and innovation in the construction sector. In numbers: 1721 subscription/contract signed, € 40 M invested in works, 40% energy efficiency on average per renovation project, 1072 housing units, 860 local craftsmen and enterprises along with PSEE, 3099 thermal diagnostic, 6470 contracts processes by the office.
OSS	NA

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

Île de France Energies (Energies POSIT'IF)

Île de France region (France), 2013

Figure 23 One of the buildings that underwent the Île de France Energies renovation process

Île-de-France Energies, former Energies POSIT'IF was created in 2013 by the Île-de-France region, as a public-private partnership. This regional company is specialised in energy renovation for condominiums with more than 50 units, aiming to reduce at least 40% energy consumption. It is one-stop-shop covering all aspects of energetic renovation projects in residential buildings of the Île de France region; from audit to work program design, financing plans, support, site supervision and performance monitoring. The goal is to stimulate investments in renovation projects and support high standards in thermal retrofitting with at least 40% of energy savings.

Target group	Beneficiaries would be co-owners of multi-family apartments buildings with EPC of E, F or G (230 to 450 kWh/m2 year consumption), which in the region represents 47% of total residential houses.
EE solutions	Île-de-France Energies covers 5,6M housing units of which 73% are collective buildings. The OSS acts like a public ESCo to integrate the different steps of the process, compensating lack of initiative of private sector and reducing transaction costs such as (information, strengthening of the capacity of the homeowners, feasibility studies, quality control, follow-up, etc.).
EE financial scheme	Two operational businesses are proposed. The first one the dwellings participate in the developing plan, including financial arranging, and the project's implementation stays in their hands. The second one expects the OSS to take care of financing and development/operation plan. The financial scheme consists in a Third-Party Financing (TPF) system, where money is directly loaned from the OSS or a financing institution. At the same time the company can assist on accessing to other funds or grants. The OSS acts as intermediary between the homeowners and the technical parties. These firsts pay a monthly fee, which takes into account the energy savings, to Île de France Energies for the project management and any related service.
Results	NA
OSS	Île-de-France Energies

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

123 Vester Voldgade

Copenhagen (Denmark), 2011-2013

Figure 24 123 Vester Voldgade's façade - before (2010) and after (2013) renovations.

In Denmark, household's energy consumption related to heating per square meter dropped of 17,5% from 1990 to 2015 thanks to energy savings. 123 Vester Voldgade is Scandinavian's largest renovation project for certified passive house, transforming a multi-story office building. The project enrolled between 2011 and 2013, involving a 1938's edifice of 6 floors for a total surface of about 7,000 m2. Primary reasons for carrying out the extensive energy renovation project were poor energy performance and indoor climate.

Target group	Multi-store office building owned by the Danish Building & Property Agency, state's property enterprise and developer.
EE solutions	Based on the German "Passivhaus" model (maximum 15 kWh/m2 for heating), renovations included the establishment of an efficient mechanical ventilation system, recycling rainwater system for toilets, daylight-controlled LED lightning, natural preheating and cooling of ventilating air through vertical wells 25 meters deep. The basic heating system was not changed, the building still relies on the (steam) district heating provided by HOFOR.
EE financial scheme	The project was financed by the government general maintenance budget (€ 1.03M), by tenants' contribution (€ 190,333) in return of all energy savings, and an investment made by the Agency itself (€ 1.87 M). Pay-back time is estimated of 6 years for windows elements and 10 years for LED lightning.
Results	Electricity use has increased due to new larger mechanical ventilation systems, pump for solar heating system and for vertical boreholes, but also 50% growth in the number of occupants and amenities. Renovation works reduced operating costs by 76%, by decreased water and energy consumption and improved indoor climate; the energy class moved from F to A1. Total energy savings per year would be € 28,725, meaning a simple pay-back time of 47 years.
OSS	Danish Knowledge Centre for Energy Savings in Building

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

Solar Hot Water in Social Housing

Buenos Aires (Argentina), 2010

Figure 25 La Perla neighbourhood, Buenos Aires

The Forum for Social Housing and Energy Efficiency or Foro de Vivienda Social y Eficiencia Energética (FOVISEE) promotes the installation of solar water heaters in Argentina. One of their projects, Proyecto 100 and follow-up 10 casas por + energia, took place in La Perla, a district of Buenos Aires, where 33 solar systems were installed in social housing. These kinds of housing are usually not connected to a gas grid and must buy bottled gas and water is heated on the stoves due to the lack of boilers. If electric water heaters are present, the energy costs are even higher and often they cause safety problems.

Target group	Tenants, owners and/or co-owners of social housing.
EE solutions	First phase involved retrofitting the houses of ten families in the social housing area of La Perla to improve energy efficiency. The program gave much attention on raising awareness of tenants, by teaching them how properly use and save energy in their homes. The installed solar systems are natural circulation systems, designed to provide 70 to 80 % of annual hot water demand. Some houses were also equipped with new curtains and mosquito nets, so that windows could be open more frequently, assuring tenants' privacy and lowering electricity use, but also improving indoor climate.
EE financial scheme	This latest phase, involving another 23 houses, whose residents received the training on the benefits of set-up solar system heating systems, was financed by utility company Edenor and the German embassy. The other project partners are CIHE (Centro de Investigación Hábitat y Energía), IDUAR (Municipality of Moreno) and INTI (National Institute of Industrial Technology). FOVISEE is working on a micro-credit concept, so families could afford their own solar systems. The organisation is also applying for funds from global programmes.
Results	Residents have reduced their electricity and gas expenses by half. The installations, with a lifetime of 25 years, supply between 70 and 80% of the hot water needs throughout the year, with a conventional water heater only having to be used for the remaining 30%.
OSS	NA

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

RE:FIT

United Kingdom, 2009 – Current

Figure 26 RE:FIT logo

The Re:FIT programme is a procurement initiative for public bodies wishing to implement energy efficiency measures and local energy generation projects on their assets, with support to assist you in the development and delivery of the schemes. These measures improve the energy performance of assets. As a result, carbon emissions can be reduced, substantial guaranteed annual cost savings achieved, and income generated. The framework uses a robust, flexible and tested Energy Performance Contracting approach. Initially developed by the Greater London Authority in 2009, use of the framework is growing, with dedicated teams now supporting organisations across England and Wales.

Target group	Public entities: the programme helps by enabling organisations, such as local authorities, schools, universities, hospitals, leisure centres and museums, to implement retrofit projects and achieve large financial savings.
EE solutions	Wide range of energy efficiency measures and renewable energy projects, from the provision and installation of new equipment, optimising the existent one, provision of related services, maintenance, solutions designing and financing. Typical works include - equipment: Variable Speed Drive (VSD) on pumps and fans, heat recovery, insulation to pipe work, radiator reflector panels, PC control (automatic overnight computer shutdown), voltage optimisation, Building Management System (BMS) controls; lighting retrofit, relighting and controls; building envelope: draught proofing, cavity wall insulation, loft insulation, secondary glazing; energy production: district heating, photovoltaic panels, solar thermal, combined Heat & Power (CHP).
EE financial scheme	RE:FIT appoints an energy service company (ESCo) to undertake energy efficiency works in buildings. The ESCo guarantees a set level of energy savings, which offers a financial saving over the period of the arrangement. The risk associated with the delivery of energy savings is passed onto the ESCo rather than the owner of the building. This is known as Energy Performance Contracting (EPC) and there is framework of 16 pre-qualified providers. Under RE:FIT there is no sharing of any of the guaranteed energy savings and energy generated, unlike other schemes within the market, meaning all achieved efficiencies are kept by the client.
Results	This project is already in its fourth edition. Over £180 million of works has been procured across more than 1,000 buildings saving in excess of 52,000 tonnes of CO2 and £10m of energy costs each year. The current pipeline is over £91 million and growing. Since 2014, total capital expenditure on completed projects under the Re:fit programme totals £23.8m, making financial savings per annum of over £5m and carbon savings (per annum, not adjusted for decarbonisation) of 10,000 tonnes (tCO2).
OSS	The RE:FIT Programme Delivery Unit (PDU)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101033708

PACE (Property Assessed Clean Energy programmes)

United States of America, 2008

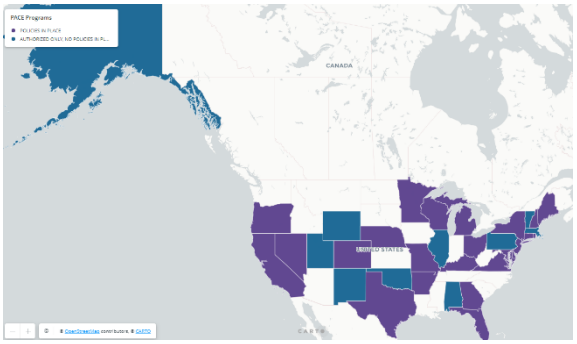

Figure 27 Countries in which PACE is authorized or policies are in place

PACE is financing mechanism for energy efficiency and renewable energy improvement on private commercial and residential properties. PACE programmes are usually authorized by state legislation and may be administrated by municipalities or through public-private partnerships.

Target group	Residential and commercial property owners.
EE solutions	All sort of energy efficiency house renovations except for portable items (lightbulbs, certain appliances, etc.). Home improvements might include installation or renovation works on heating and cooling systems, hurricane and storm protections, solar panels, roofs, windows and doors, water conservation and other energy efficiency ameliorations.
EE financial scheme	The PACE mechanism allows the property owner to upfront the costs of home renovation and pay them back over a set period of time (usually 20 years) through voluntary assessment, usually as an addition to property tax bills. The debt is so attached to the property and not the individual and may transfer with property ownership. Normally PACE loans are first priority liens, meaning that they jump ahead existing mortgages.
Results	NA
OSS	NA

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ENERGIEhuis

Belgium (Flanders Region)

Figure 28 Energy Houses in Flanders Region

ENERGIEhuis (Energy House) is a municipal institution or a collaboration between different municipalities, promoted by the Flemish government, that guides people through the various measures for energy investments and renovation works at their houses. There are 19 Energy Houses, almost one per municipality. It is designed to help in the whole process: assessing how energy efficient is your house, providing information about how one can invest in energy efficiency and renewable energy and how to obtain the financing for it.

Target group	▪ Priority group: persons who are entitled to an increased reimbursement from the health insurance fund; households who are entitled to a Heating Allowance through the Social Heating Fund and with an annual gross taxable income that is less than or equal to € 19,566.25; persons who are in debt mediation and who cannot pay their heating bill; people attended by Social Welfare; protected costumers; families with a joint taxable income of a maximum of € 31,870; ▪ Non-commercial legal entities and cooperative companies.
EE solutions	Tips and advice the renovation for energy efficiency and solar panels; Requesting quotes from contractors and compare them; Interpreting data: solar map; Energy Performance Certificate (EPC); results of an energy scan; having an energy audit performed; compare energy suppliers finding the best option and price.
EE financial scheme	▪ Energy loan: for priority groups - 0% loan with a maximum amount of € 15,000 that must be repaid over a period of 10 years; for non-commercial legal entities and cooperative companies (schools, hospitals, non-profit organizations, etc.) can apply for a maximum of € 15,000 at an interest rate of 1%, to be repaid over 10 years. ▪ Premiums for anyone who invests in energy-saving measures can count on financial support, when there is substantial improvement of the energy performance of a house or apartment and/or collective renovations projects. ▪ Interest-free energy loan+: when receiving a house with poor energy performance from 2021 or after an inheritance, is possible to take out an energy loan+ up to € 60,000 (depending on the anticipated energy label), with the loan granted interest-free from the start and if after 5 years the proposed result obligation is not achieved, the interest benefit will be compensated to a higher interest rate.
Results	N/A
OSS	EnergieHuis

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Porto Energy Hub

Energy Efficiency for all.