



EuroPACE

Feasibility study for a financial instrument and a review of existing retrofit loan schemes

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1. Introduction

Deliverable Description: Task 2.4: Feasibility study for a financial instrument in the selected countries

For a financial instrument to be successful, one key issue is to determine the market spreads of the different financial sources available for the different segments. In the case of households, the affordability test will be designed and run by the EuroPACE program. The feasibility study will focus on the following topics:

- Current development of the market
- Analysis of the residential market barriers and how to mitigate them
- Market potential by technology/solution
- Financial alternatives and grants available
- Lending potential and initial pipeline
- Affordability tests for households

This research will focus on the top 3-4 countries emerging from the findings generated in D2.1 and D2.2.

This report reviews loan schemes existing in the four countries: Belgium, Netherlands, Portugal and Spain, identified as the being conducive environments for the implementation of EuroPACE, to understand other commercial options available to households locally. It also looks at the French Oktave and the German KfW schemes as examples of loan programmes EuroPACE can learn from.

Section 2 looks at the market failures in the energy efficiency retrofit sector inhibiting uptake by homeowners. Section 3 of this report summarises information gathered in Deliverables 2.1 and 2.2 of the EuroPACE research programme. These tasks carried out social, economic and legal reviews, relevant for household energy use and energy efficiency, to ensure the national characteristics are taken into account for selected countries. Sections 4 to 6 look at the details for the three countries: Belgium, Portugal and Spain. Section 7 to 9 details the case studies: Energiesprong, Oktave and KfW. The final two sections summarise the different case studies (Section 10) and draw conclusions for the EuroPACE work (Section 11).

1.1. The scale of the challenge

Over the last few decades, European governments have implemented many programmes to enhance the quality of housing and repurpose buildings for new social and technological challenges. In the 1950s and 1960s the focus was repairing damage from the war and improving sanitation. In the 1970s homes were upgraded to introduce district heating, and piped gas supply.

Energy efficiency has become a priority in the last twenty years. Initial efforts were focussed on *fuel poor* households especially in northern Europe where cold homes have been linked to high levels of excess mortality during winter months especially in elderly people. This initial focus on fuel poverty resulted in many programmes that were either free or highly subsidised for qualifying households.

But the costs of deep retrofits usually exceed €30k per home so the provision of *free* deep retrofit would be prohibitively expensive for the government to finance. Also, it provides savings to households living in the treated homes substantial in colder countries which represents a huge windfall benefit-in-kind and the distributional impacts of such transfers become an important public policy consideration.

But Government funding is not enough to meet the investment needed to roll-out deep, widely adopted retrofits across existing homes. Current annual investments in household energy efficiency are approximately €80 bn, this pales in comparison to the €281 bn that needs to be invested annually in energy efficiency in buildings and industry between 2012-2030.¹

The principle source of capital capable of mobilising trillions of dollars of investment is the debt capital market. Here huge pools of funds from pension funds and insurance companies, larger than the resources available to banks, can be mobilised by households. The flipside is the long-term loans are well suited to the long-term liabilities of pension funds seeking to provide retirement income across multiple decades. According to the European Mortgage Federation's Quarterly Review of European Mortgage Markets outstanding residential lending for Q2 of 2019 amounted to €7,075bn with gross lending in the most recent quarter €292 bn - in one quarter mortgage lending exceeding the amount that needs to be spent on energy efficiency spending every year.²

For these reasons entirely free treatment has typically been restricted to fuel-poor households or to cover relatively shallow retrofits, and private finance is now being considered for the deep retrofit of existing homes. But for a number of reasons, the rate at which private agents will spontaneously fund energy efficiency is far too slow to achieve EU's energy efficiency policy goals.

Public policy is being focussed on how policies and support mechanisms to attract low-cost private financing into the deep retrofits and addressing the market failures that beset consumer demand for energy efficiency retrofit.

1.2. The policy context

Improving the energy efficiency of existing buildings plays an important role in the EU's overall climate mitigation strategy. Buildings are responsible for approximately 40% of EU energy consumption and 36% of the CO₂ emissions.³ While newly constructed buildings are already highly energy efficient (and have to be near zero-energy by 2020) around three-quarters of the building stock is old and with low energy efficient.

EU policy makers recognise the importance of building performance in the effort to mitigate climate change. The Energy Performance of Buildings Directive (EPBD) was established in 2010, to help consumers make informed choices allowing them to save both energy and money. This was followed by the Energy Efficiency Directive (2012/27/EU). Under this EU member states must set up an energy efficiency obligation scheme which requires companies to reduce customers' energy usage by 1.5% per annum. This Directive can also be fulfilled through alternative policy measures, such as introducing CO₂ taxes, or financial incentives to increase uptake of energy saving technologies. The directive was amended in 2018. Member States have submitted their planned programmes to implement the directive.⁴

1 https://www.eib.org/attachments/strategies/eib_energy_lending_policy_en.pdf

2 <https://hypo.org/app/uploads/sites/3/2019/11/EMF-Q2-2019-final.pdf>

3 EU Commission (2019) EPBD Fact sheet

https://ec.europa.eu/energy/sites/ener/files/documents/buildings_performance_factsheet.pdf

4 Member States plans to implement the Energy Efficiency Directive can be found at

<https://ec.europa.eu/energy/en/topics/energy-efficiency/targets-directive-and-rules/obligation-schemes-and-alternative-measures#content-heading-0>

- This lists the major policies and the estimated energy savings of the different measures.

Only about 1 percent of the housing stock is built every year. Therefore, the EU's ambitious energy saving targets - annual reductions in energy use of 1.5%⁵ - cannot be met from new buildings alone. Energy efficiency retrofits need to occur swiftly, each year targeting several percent of the country's stock of homes, and they need to be deep: reducing heat losses through the building's envelope and replacing old fossil fuel based heating and hot water systems with modern, high efficiency ones. Where possible renewable systems based on solar, biomass or ground source-heat pumps (using renewables-powered grid electricity) can be used – though it should be noted that the retrofit of RE can often be expensive or impractical in existing buildings.

The report focusses on the four countries which were deemed best suited to on-tax financing feasibility (Task 2.1) and with suitable policies, incentives and programs for energy efficiency (Task 2.2): Netherlands, Belgium, Spain and Portugal. In addition to surveying the four countries, this report provides additional on three programmes which are considered to be successful: Octave (France), KfW (Germany) and Energiesprong (Netherlands and UK).

1.3. Pathways for stimulating energy efficiency retrofit

Most building owners improve a building's energy efficiency as a result of some other trigger or government policy. This is particularly acute in the rental market where landlords cannot usually charge tenants higher rents for homes with energy-efficient retrofits, so the tenants simply pocket savings in energy costs. The market for the renovation of residential buildings has evolved in response to the development of policies of the European Union and its member states rather than through market forces.

To understand the feasibility of introducing deep, city-wide energy efficiency programmes as desired by EuroPACE, we identify three main pathways for improvement which together constitute the market for energy efficiency retrofit, these paths may occur individually or in conjunction with one another.

- ⇒ *Path 1*: upgrading heating/cooling systems as a result of obsolescence or equipment failure;
- ⇒ *Path 2*: an addition or refurbishment of the building triggering application of higher energy efficiency standards which the building has to conform to; and
- ⇒ *Path 3*: owner or occupier of the building undertake an energy efficiency improvement project to enhance comfort or in response to policy measures.

An example of Path 1 - ensuring boilers or air conditioning units are replaced at the end of their lives with highly efficient new models - can greatly reduce energy use and the policy is easy to operationalise. But the scope for *deep* energy efficiency reductions from Path 1 are limited since merely enhancing heating and cooling systems will not tackle the huge and neglected options to enhance the building envelope: windows, floors, walls and ceilings which is the source of heat loss and gain from the building. One approach to reduced CO₂ is using heat pumps or hybrid heat pumps and more shallow retrofit, on the assumption that grid electricity will decarbonise.

Path 2 obliges owners to enhance building energy efficiency during major renovations.⁶ This obligation can be adjusted in a number of ways to make it more effective at reducing energy use, for instance:

- ⇒ triggering the enhanced standards through a modest sized renovation,
- ⇒ imposing improvements in energy efficiency the owner is obliged to make beyond just the area being improved, and
- ⇒ incentivising or regulating the improvement to go beyond the prevailing building codes.

But in practice it is politically difficult to ask homeowners to make improvements to their home beyond the space that is directly being redeveloped. Paths 1 and 2 should be fully utilised as these are the easiest point of intervention to make improvements to the building efficiency.

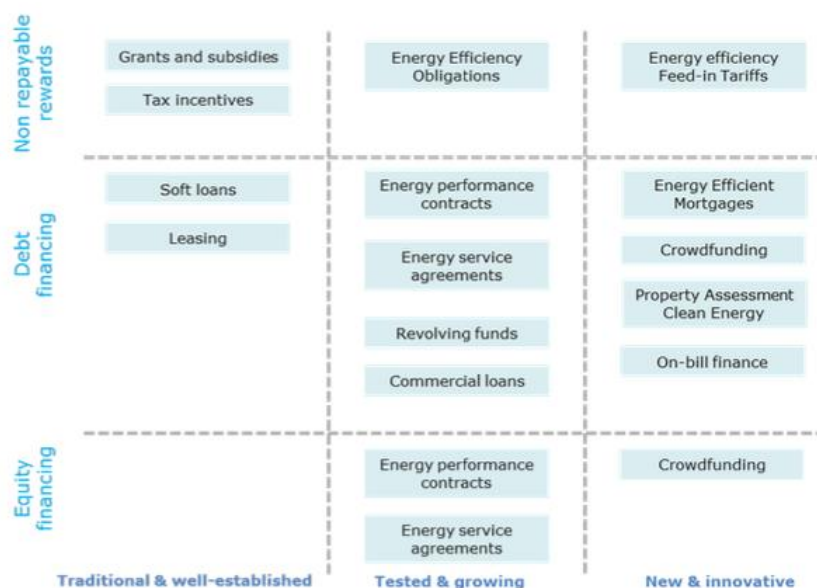
5 EU Energy Efficiency Directive (2012/27/EU) <https://ec.europa.eu/energy/en/topics/energy-efficiency/targets-directive-and-rules/energy-efficiency-directive>

6 https://ipeec.org/upload/publication_related_language/pdf/651.pdf

The focus of this report is on Path 3 i.e. the discretionary decision by building owners to install energy efficiency. These are programmes operated by governments to stimulate energy efficiency retrofits beyond the background rate from repairs and refurbishment to motivate building owners to invest. Path 3 has to overcome the well-known impediments to consumers undertaking energy efficiency projects that have been described in reports produced for other Tasks within the EuroPACE project.

Figure 1 sets out how government policy addresses these structural problems through different financial instruments (along the vertical axis), and in terms of greater novelty (X-axis). In addition, governments use different regulatory, energy prices and other measures (such as information and technical assistance).

Figure 1: The landscape of financial instruments currently financing energy retrofit in EU organised by market maturity and repayment vehicle



source: JRC Science for Policy Report (2019)

1.4. Existing schemes to improve household energy efficiency

The EU countries have implemented numerous programmes and policies to improve the energy efficiency of existing homes. A recent study (JRC Science for Policy Report⁷) reviews 129 instruments supporting energy renovations in buildings across the EU. Of these 61% were grants or subsidies, 19% loans/soft loans, 10% tax incentives and 10% a combination of instruments.

⁷ JRC (2019) “Accelerating energy renovation investments in buildings financial and fiscal instruments across the EU” https://publications.jrc.ec.europa.eu/repository/bitstream/JRC117816/accelerating_energy_renovation_investments_in_buildings.pdf

Figure 1 Financial instruments being used to support residential energy efficiency across EU

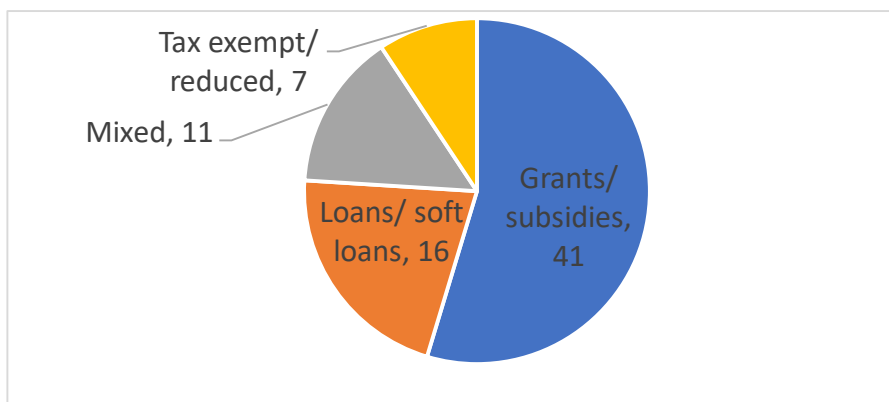


Figure 1 breaks down the 75 residential support schemes. The majority were grants or subsidies to households (41), but a large number were loans or soft loans (11).

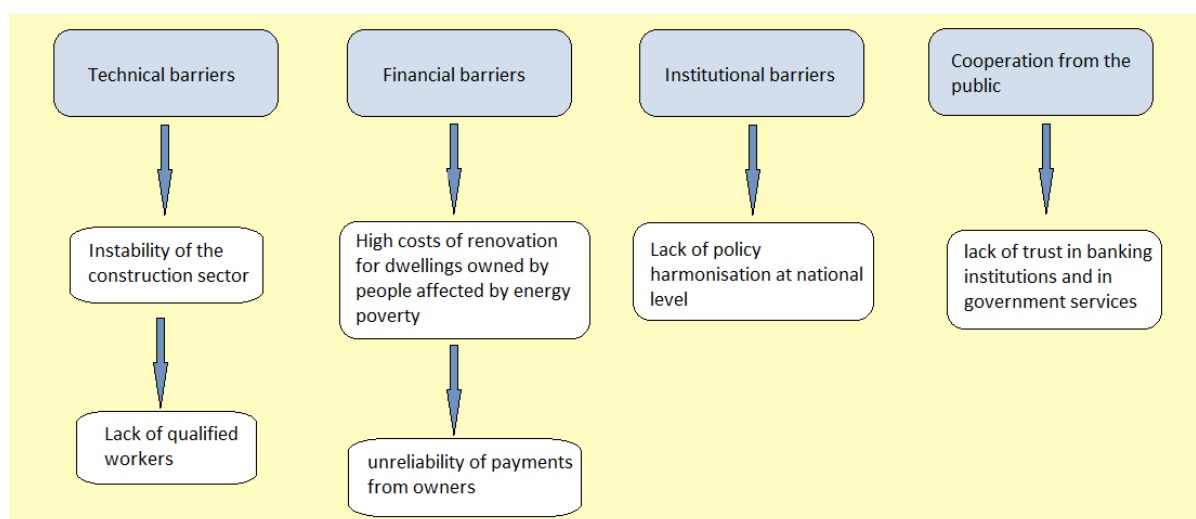
2. Market failures impeding commercial funding of energy efficiency

Table 2 provides a summary of the sorts of market failure that exist in energy efficiency retrofit. Retrofit programmes and the policy environment in which they sit need to address these impediments to investment to create a step change in the energy efficiency of the existing housing stock.

Table 1: Obstacles to residential building owners implementing energy efficiency and small RE schemes

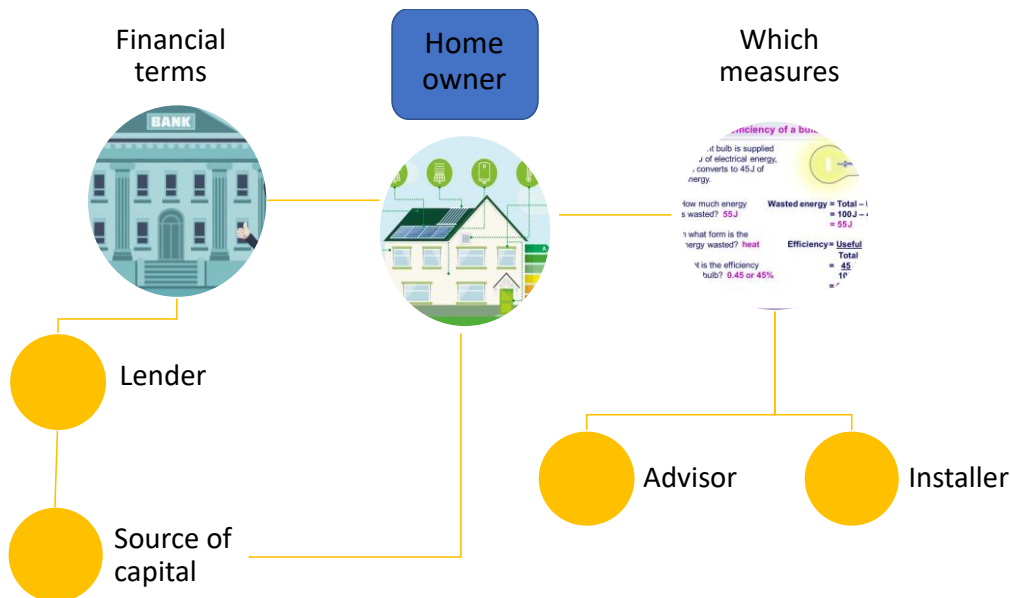
Market Failure / Commercial impediment	Policy response
Lack of savings: Poorer households cannot finance energy efficiency from their savings & unsecured debt is expensive.	Grant or subsidy provided by donor or government; Government loan; use of mortgage
Long pay-back: annual energy savings of deep-retrofit small relative to capital costs	Feed-in tariff for domestic renewable energy & Partial subsidy
High implicit discount rate: owners only install cheap, or high return measures	Calibrating the subsidy levels to retrofit ambition; Minimum improvements needed
Knowledge gap: effort needed to select multiple contractors to schedule work	One stop-shop/Delivery service to reduce the effort needed
Fragmented market: homes being treated are dispersed and energy solution bespoke	Bundling multiple homes for economies of scale & lower transaction/finance costs. Easiest in apartment blocks
Split incentives in the rental market: owner pays for investment but tenant benefits from investment	Regulatory minimum standards for rented property
Risk aversion: Uncertainty that measure will deliver the anticipated saving	Long-term warranties or Insurance to cover risks of equipment failure

Creating commercially attractive loan financed retrofit schemes *that are widely adopted* means addressing the above issues. A successful retrofit programme needs to meet the needs of debt-capital markets (for stable, low-risk yields) and create large-scale demand for retrofits. In effect, it must address the barriers outlined below:



In the reviews of energy efficiency retrofit programmes undertaken there are a number of different parties that might participate in the programme. Figure 7 shows the different actors involved.

Figure 2: Five key participants in a retrofit programme



- *Homeowner*: can either be an individual household, or an owner of multiple homes like a social housing provider. In order to obtain economies of scale it is important to aggregate many homeowners ideally entire streets or buildings with multiple households.

Financial terms

The success of the programme depends crucially on the cost of finance being low, to ensure that there is an attractive pay-back period for the package of measures. Cost of finance can be reduced by lenders supplying capital being shielded from default risks (by offering an asset for security, or someone else underwriting such risks) and the transaction costs of underwriting being pooled over larger loan pools.

- *Lender*: is the entity that enters into a contract with the homeowner to fund the measures. They will typically make key decisions about whether to lend money, at what rate of interest and the tenor of the loan. Such underwriting decisions could be based on the characteristics of the homeowner, or they could be independent of the characteristics if some other party is prepared to assume the risks of credit default.
- *Source of capital*: one or more entities might contribute capital to the lender. For instance, government might underwrite some of the risks borne by the lender, or they might pay a feed-in tariff straight to the owner to subsidise an investment in a home PV panel.

Selection of measures

Ideally homeowners should adopt a package of measures tailored to the local climate and the house's conditions. Deep retrofits encompass technologies like renewables, external/internal building fabric and changes to heating heating/ventilation systems and controls.

Homeowners often have little knowledge or interest in energy efficiency and may mistrust claims made by installers and have doubts about the technologies too. An effective retrofit policy has to overcome such impediments. In The householder's choice can be influenced by government offering specific grants, or subsidies for some

measures (like a feed-in tariff), or by establishing a trusted intermediary service to help homeowners navigate the many different options.

- *Advisor*: This role could encompass a number of different functions and can be undertaken cheaply with little tailoring using a web-based platform or in a more personalised fashion with face to face. The advisory function encompasses several different roles: advice selection of appropriate measures, selection and vetting of contractors and evaluation of the installation work to ensure it is fit for purpose.
- *Installers*: homeowners need to have confidence that the installer has competence and training in the measures being installed, that the work has the appropriate warranties to rectify any defects. This means installers should ideally be vetted and trained by a recognised body and their work insured.

2.1. Roles of different actors in the US PACE programme

The above parties aim to drive down the finance or simplify the adoption of retrofits to increase consumer uptake.

In any retrofit programme the precise constellation of actors will vary. In the case of the US Property Assessed Clean Energy (PACE) programmes the source of capital are usually mortgage backed securities (ABS) issued by the PACE provider. In a minority of cases municipal bonds are issued by city run programmes. The lender is repaid through a special assessment on the property tax. Property taxes tend to have a lower default rate than other loans; PACE's unique debt collection system reduces the cost of collection and credit risk relative to an unsecured loan. The eligibility for finance is based neither on the individual credit assessments (FICA scores) nor the homeowner's income, though the property owner does need to have a level of equity in the home to qualify. The rate of interest is not subsidised and is not determined by the borrowers FICA score.

In USA there are a range of incentives to encourage homeowners to improve their homes' energy efficiency: tax incentives, rebates, renewable energy production incentives and grants. These are provided by federal, state and local governments and utilities (as a mandated by the utility regulator).

The US Department of Energy issued a guidance document for states, municipalities and other interested parties: "Best Practice Guidelines for Residential PACE Financing Programs" which contains voluntary guidance for developing PACE programmes.

The provider is expected to define a list of equipment and installations that are eligible to meet the goals of a PACE programme. These are termed the eligible products list (EPL). Providers are expected to establish a schedule for refreshing this list and it is expected to make reference to nationally endorsed standards like the ENERGY STAR or WaterSense which are designed to ensure products are amongst the most energy or water efficient quartile of those on the market. This doesn't guarantee a particularly ambitious retrofit certainly not a near-zero energy use that some of the most ambitious European programmes are aiming for.

In the PACE programme guidelines, assessments are an option, but it is recommended that the homeowner undertake an energy audit by a suitably qualified independent assessor, as is the case in Olot. In many states these are provided for free either by energy utilities or the public sector. Guidelines also recommend various consumer protection disclosures setting out how PACE works, interest rates and fees, total costs and fees. It is desirable for energy consumption data is collected both before and after the measures are installed.

As is already the case in Olot, PACE administrators should establish minimum qualifications requirements and maintain a list of approved contractors. They are expected to inspect a small (5%) of completed projects to ensure contractors are correctly installing the measures approved for financing and take action against contractors who fail to do rectify mistakes.

3. Country assessments on readiness for EuroPACE financing

3.1. Belgium

Belgium aims to achieve an energy efficiency target of at least 32.5% by 2030, to achieve this, primary energy consumption will be around 39 Mtoe and final energy consumption around 33.1 Mtoe in 2030. Compared against the PRIMES 2007 baseline, which estimates primary energy consumption at 50.1 Mtoe and final energy consumption at 39.9 Mtoe in 2030, this implies an energy saving of 11.1 Mtoe, or 22 %, for primary energy consumption.

In the Flemish region, the draft Flemish Energy Plan 2021-2030 aims to achieve final energy consumption of 21.6 Mtoe in 2030. This implies a final energy saving of 4.5 Mtoe in 2030 compared with PRIMES 2007. Wallonia is committed to reducing its final energy consumption by 22.7 % relative to 2005, this reduction is greater than the EU average. In the Brussels-Capital region, the renovation strategy is essentially a strategy for 2050 with several energy targets, including a primary energy consumption target based on the terms of the energy pact, i.e. average energy consumption of 100 kWh/m²/year for the residential sector and energy-neutral buildings for the tertiary sector.⁸

Between 2010 and 2014, Belgium suffered a large number of bankruptcies in the construction sector (4.7% decline) and among companies in the architectural and engineering sectors (5.1% decline) which has depleted the pool of unskilled and skilled workers in the sector. There has also been a high level of vacancies with 20,000 positions unfilled amongst the construction trades.

Although Belgium suffers from a low level of national policy harmonisation across the different regions, this is not thought to materially affect EuroPACE. Consumers in Belgium have a low level of trust in the finance sector and only 7% of households finance their retrofit project through a loan. Building improvement policy (including energy efficiency policy) has regionalised. The main policies to encourage investment are a reduced rate of VAT from 21% to 6% for buildings more than six years old.

Brussels provides a 0% interest loan up to €20,000 for low income household (€30,000 earnings for single person, €60,000 for a couple). In Walloon Buildings older than 30 years qualify for a premium for renovation (0% interest) for up to €35,000 for homes with up to 3 rooms and with an additional €5,000 per room thereafter. Flemish regions provide grants for building roof interventions, external carpentry and technical installations (central heating, electrical installations and plumbing). The grant amounts to 20% or 30% (according to the beneficiary's income) of the approved invoices and cannot exceed €10,000,128.⁹

There are over 5 million residential buildings in Belgium. In 2015, the construction of new buildings represented 44% of the building stock, while renovated buildings accounted for 56%. There is a high degree of transformation of old buildings, office buildings or commercial buildings, into residential dwellings. What is also important is that Belgium is a largely urbanised country, with over 83% of the population living in urban areas. Furthermore, 62% of the building stock was built before 1970, and only 41% of dwellings have wall insulation, 36% have fully double-glazed windows, and 58% have roof insulation.¹⁰ These poor insulation rates show that the need for the renovation of the building stock is high. What is more, energy prices are among the highest in the EU and 20% of Belgians are experiencing energy poverty. About 22% of the total energy consumption of the country comes from buildings.

⁸ https://ec.europa.eu/energy/sites/ener/files/documents/ec_courtesy_translation_be_necp.pdf

⁹ European Construction Sector Observatory Country profile Belgium (June 2018)

¹⁰ <https://ec.europa.eu/docsroom/documents/30662/attachments/1/translations/en/renditions/native>

The number of dwellings increased significantly more than the number of buildings, especially in the Brussels-Capital Region, which means that many existing buildings have been remade to create dwellings, therefore increasing housing possibilities for Belgians. This increase of dwellings due to the transformation of existing buildings shows a growing interest in renovation projects in residential buildings. Again, this demonstrates the potential of Belgium to implement EuroPACE, especially in the Flemish Region. It is clear that the Flemish Region has the highest increase in the number of dwellings, at almost 25% between 1995 and 2018. The number of residential buildings increased by almost 30% (44% for the Flemish region) alone between 2017 and 2018, to 23,844 buildings.¹¹

Renovation trends

In 2015, renovated buildings represented 56% of the building stock.¹² This trend can be explained by two elements: firstly, by an increase in the public's awareness on the importance of energy efficiency in the context of climate change, and secondly by the fact that in recent years, given that the construction of new buildings in urban areas is slower due to a lack of space, many initiatives have been taken by real estate investors and private companies to transform existing industrial, commercial, or office buildings into residential buildings. The aim of these initiatives is to create new dwellings, which goes in tandem with the needs of a growing population, makes use of unoccupied but viable buildings, and creates dwellings in unconventional buildings such as factories. The transformation of existing empty non-residential buildings into residential dwellings benefits from strong social and financial support from local authorities especially in areas where the buildings' occupation rate is low (highest proportion observed in Brussels and Antwerp), which attracts real estate investors and therefore develops the building stock and increases the occupation rate.

For example, in the Brussels-Capital Region, 644,235 m² of dwellings were created from the transformation of industrial buildings between 1997 and 2011, and 639,170 m² of dwellings were created after the transformation of office buildings between 2000 and 2015. In Antwerp, the amount of m² of residential dwellings created from this transformation is 199,500 (between 2007 and 2017). As far as office buildings are concerned, between 2000 and 2015, 956,428 m² of old office buildings in the Brussels-Capital Region have been transformed, among which 639,170 m² were transformed into residential dwellings (including student housing and retirement homes). In Antwerp, between 2007 and 2017, 344,000 m² of office buildings were transformed into 199,500 m² of residential dwellings (ING, 2018). Office buildings offer the best potential for transformation into residential buildings, as changes in the way of working, implying telework, remote work, and the use of co-working spaces, will lead to a decrease in the use of such buildings (ING, 2018).

A study initiated by the consultancy Essencia conducted among 2,500 Belgians and analysing renovation trends in the country showed that in 2013, 41% of homeowners pursued renovations in their dwelling, compared to 27% in 2011, and it is a trend that is forecast to increase in future years. The study also found that on average, Belgian homeowners spent €12,700 for the renovation of their dwelling, with investments in roof and exterior, as well as the installation of a solar boiler taking the largest part of the budget. This amount corresponds to almost 48% of the average yearly disposable income. However, and this is not good news for the potential implementation of the EuroPACE scheme, Belgians prefer to use their own savings to pursue renovations (77% of respondents did) than taking a loan (8% of respondents did), or when they do, they tend to borrow very little money.

When looking at the different policy measures implemented in Belgium to develop and encourage renovation initiatives targeting energy efficiency (presented in Chapter 5), we observe that the majority are of a financial or

11 Economidou M et al, Energy efficiency upgrades in multi-owner residential buildings - Review of governance and legal issues in 7 EU Member States, EUR 29094 EN, Publications Office of the European Union, Luxembourg, 2018, ISBN 978-92-79-79347-9, doi:10.2760/966263, JRC110289.

12 <https://ec.europa.eu/docsroom/documents/30662/attachments/1/translations/en/renditions/native>

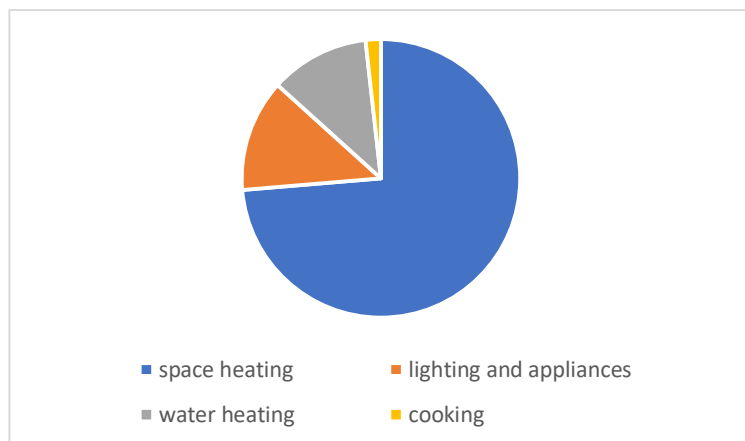
fiscal nature, followed by measures geared towards information and awareness raising campaigns. The significant amount of financial measures in all three Belgian regions – namely, tax reductions and premiums – is very positive for EuroPACE, as they can enable the implementation of EuroPACE by blending it with an existing measure. Over the past decades, many measures have been implemented to improve the energy efficiency of buildings. The Brussels-Capital Region is the leader at the national level, with stringent requirements for the energy efficiency of new buildings (close to those for “passive houses”, as discussed earlier in this report). However, the requirements are less strict for renovation, even though over the past few years renovation initiatives have been increasingly focused on energy efficiency. Respondents which took a loan to pursue their renovations spent an average of €31,000.

That being said, the transformation of existing non-residential buildings into residential buildings is an opportunity for the EuroPACE scheme, as the costs of eco-friendly renovation can be integrated into an on-tax financing scheme.

Average energy use per household

The graph below shows the breakdown of energy consumption by end-use in Belgium. It is evident that space heating is responsible for three-quarters of all energy consumption in residential buildings. Therefore, it seems that reinforcing insulation in order to limit heat loss would be crucial for the conditions of the EuroPACE scheme.

Figure 3: Energy consumption by end-use



Source: Enerdata, 2012

Tenure of home ownership

Significantly for EuroPACE, which is targeting home-owners, 71.4% of people are owners of their residential building, which is above the EU average of 69.3%. It is important to notice that the poverty risk of renters (36.2%, which is above the EU average) is about five times higher than that of owners (7.6%, which is under EU average).¹³

There are 5,153,019 residential buildings in Belgium, of which 3,749,752 are houses (terraced, detached, and semi-detached) and 1,403,267 are blocks of apartments.¹⁴

¹³ <https://library.e.abb.com/public/361df894b9115f1348257a23004fbac2/Belgium%20Energy%20efficiency%20Report.pdf>

¹⁴ https://www.mckinsey.com/~media/McKinsey/dotcom/client_service/Sustainability/cost%20curve%20PDFs/energy_efficiency_belgium_full_report.ashx

The Belgian housing market is growing significantly. The house price index grew by 6.4% between 2015 and 2017, raising some concerns of overvaluation. In turn, falling interest rates on mortgages and continuous wages growth have made housing investments more desirable. However, with the price growth rate outpacing income growth, household indebtedness has reached 60% of GDP. This is reflected in the large increase in outstanding residential mortgages, which stood at 217.1bn in 2016.

3.2. Netherlands

The Netherlands aims to reduce its greenhouse gas emissions by 49% by 2030 relative to 1990 levels. Its residential energy consumption has been falling by 3.2% a year since 2000. The country has successfully implemented some energy efficiency policies, such as the replacement of standard gas boilers with gas condensing boilers.¹⁵ But as this opportunity becomes exhausted more emphasis is being put on improving energy efficiency and deploying renewables.

Netherlands has a range of effective policies to reduce GHG emissions impacting on homes. These reflect obligations under EU Directives: building certification, appliance labelling, and tightening building standards. In consultation with stakeholders from employers, trade unions and environmental organisations, the government developed an Energy Agreement for Sustainable Growth in 2013. This Agreement established a National Energy Saving Fund with a budget of €600m Netherlands and €400m fund to assist insulation of rented homes. There is also a plan to increase the share of renewable energy use to increase to 14% by 2020, part of which will be installed by homeowners as heat pumps and solar roofs. Plans include disconnecting 100,000 homes from the natural gas grid by 2022, rising to 200,000 homes a year thereafter so all homes are independent of gas by 2050.

Consultation on a new agreement commenced in 2018. Plans include enhancing energy efficiency of 1.5m homes, new homes to be independent of the gas grid, municipalities to lead the initiative to make housing emissions free engendering a more district level approach to replacing gas with hydrogen or district heating, and the energy tax system to improve incentives for energy efficiency and CO₂ reduction.¹⁶

There are also funds available to assist homeowners implement ambitious energy efficiency retrofits. Homeowners can borrow up to €25k per home to achieve the 'very energy efficient' home standard, and up to €65k to achieve the net-zero standard (zero on the meter). No additional collateral, such as a mortgage right, is needed for an (VvE) Energy Saving Loan. The interest is subsidised and varies on the tenor of loan and whether an individual or housing association is borrowing:

Individual:	1.7% for 10-year; 2.1% for 15-year
Housing association:	2.0% for 10-year & 2.4% for 15-year.

There is a legal provision - Energy Performance Fee (EPV) – that allows housing associations to charge a fee to recover the costs of financing the loan.¹⁷

Incentive programs exist to assist landlords:¹⁸

- The Energy Performance Incentive Scheme for the Rental Sector (STEP) enables landlords to improve the energy performance of their rental properties.

15 <https://www.odyssee-mure.eu/publications/efficiency-trends-policies-profiles/netherlands.html>

16 <https://www.government.nl/ministries/ministry-of-economic-affairs-and-climate-policy/news/2019/06/28/climate-deal-makes-halving-carbon-emissions-feasible-and-affordable>

17 <https://stroomversnelling.nl/thema/financiering-en-waardering/>

18 <https://www.government.nl/topics/renewable-energy/central-government-promotes-energy-savings>

- The Energy Savings Fund for the Rental Sector (FEH) offers low-interest loans for landlords to make their rental properties more energy-efficient.

In the residential sector, the total number of buildings is about 10 million (for all types of uses) and the average renovation rate is 1% (while the demolition rate is 0.25%). These renovation and reconstruction trends are important parameters and opportunities at the same time for adopting energy efficiency measures in the building stock. It is estimated that in Netherlands major renovations (defined typically when more than 25% of the building envelope is renovated) will reduce a building's final energy demand for heating by 50-80% and can take place in all types of buildings (likewise new constructions).

Through national analysis of building stock characteristics (age, ownership, and others) and average income level, it is evident that the Netherlands is medium to high urbanised, with mainly privately-owned properties and with the majority of the building stock dating to the 1960s and 70s. Furthermore, about 900,000 households spend a relatively large share of their income on energy costs and, therefore, are vulnerable to the upcoming changes of the energy transition.

The overall target in the Netherlands is a fossil free (CO₂ neutral) built environment by 2050, which would require the retrofitting of approximately 200,000 dwellings per year. Although no up-to-date statistics are available for all retrofitted buildings, according to the Energiesprong (described in detail later). Foundation website live calculator, only 5,000 buildings have been retrofitted under this particular programme out of the 111,000 initially planned. Clearly, there are still several barriers in the Dutch building market that need to be overcome in order to achieve the renovation capacity and subsequently the energy efficiency and climate targets from the building sector. These barriers include lack of leadership, split incentives, lack of information/knowledge, technical barriers, economic barriers, and institutional barriers.

Access to housing

The Dutch housing market is traditionally associated with a limited supply due to the limited development space in major cities. The number of households has been continuously increasing, rising by 6.6% over 2010-2017, from €7.3m to €7.8m. Moreover, the share of total population in cities and greater cities grew from 43.7% in 2010 to 56.6% in 2014. In parallel, the mean net income experienced a 12% increase between 2010 and 2016, which is a 1.6% year-to-year increase, from €22,692 to €25,366, clearly above the EU-28 average of €18,837. These factors alongside low interest rates and tax relief for mortgage interest payments are boosting demand for dwellings and household spending power. This is contributing to the reheating of the housing market, which had weakened due to the 2008 crisis, negatively affecting construction as well as the general economy

Total housing loans to households have seen an increase, with the total outstanding residential loans growing from €655.7bn in 2010 to €664.4bn in 2016. This has also been stimulated by the mortgage interest rates, which have seen a decreasing trend since 2004.

Consequently, the housing market has begun its recovery since 2014, both in terms of house prices and dwelling transactions, signalling an improvement in demand. In fact, the house price index had dropped by 14.7% over 2010-2013, but started to increase strongly from 2014 onwards, reaching 2010 levels again this year. This was even more emphasized on in major cities such as Amsterdam and The Hague, where the price of existing dwellings grew by 17.2% and 9.1% in the first two quarters of 2017, respectively. The Netherlands are composed of 12 regions or provinces. Among those, the Randstad region (that includes Amsterdam, Rotterdam, The Hague and Utrecht) experienced the highest increases. Similarly, property transactions rose by 20.5% compared to 2015, reaching 214,793 units in 2016, which is the highest level since 2008, according to Central Bureau for Statistics (CBS). According to Bouwend Nederland, the steep price growth is expected to diminish, with prices starting to increase slower. This will ensure a more stable housing market in the long term.

As of 2016, natural gas is the major type of energy source used in Dutch households, accounting for 72% of the total final energy use. Electricity accounts for one-fifth of the final energy use. Around 5% of the final energy use originates from renewable energy sources. A small percentage of households are connected to district heating (3% of final energy use). The use of coal and oil-based products have been phased out almost completely.

Odyssee (2018) also indicates the breakdown of the household energy consumption by end-use in dwellings of several EU countries. In 2015, on average, 38.8 GJ was used for space heating per dwelling (0.926 toe), 9.5 GJ for electrical appliances (0.226 toe), 7.5 GJ on water heating (0.178 toe), 1.4 GJ for cooking (0.0332 toe), and finally 0.058 GJ on air conditioning (0.0014 toe).

Owner-occupation as % tenure

The residential building stock is mostly driven by home ownership, where 69.0% of population own their home and 31.0% rent as tenants, whereas the home ownership rate has been steadily increasing since 2010 and the rent tenancy decreasing proportionately. The same trend holds for the population earning above 60% of median equalised income, with 74.4% of the population owning of a dwelling and 25.6% renting one.

The rental properties are either owned by a social housing association (30%) or other private owners (13%). It is important to recognise that social housing associations in the Netherlands (Woning corporaties) are, in the end, also private non-profit organisations with a legal task to give priority to housing households with lower incomes.

Detached home

In the Netherlands, almost 65% of the housing stock consists of single-family homes, whereas the rest are multi-family ones. Although gradually decreasing, the share of the dwellings built before 1985, generally considered as less energy efficient, is still about two-thirds of the total building stock.

The private ownership of dwellings increased from 48 to 59% in the period 1994-2015. Furthermore, single-family houses are predominantly privately owned, whereas multi-family houses are for the most part owned by social housing associations (Woon, 2015).

Indebtedness

Household indebtedness rooted in residential mortgages remains the second highest in Europe, threatening financial stability and posing a burden over Dutch public finances because of tax reliefs for interest payments for homeowners. The housing price index has increased with 13.7% since 2015, due to traditionally constraint supply, increasing disposable income and low interest rates. There are no signs of a price bubble. This does however signal an improvement in demand.

3.3. Portugal

Energy Efficiency is being implemented through the framework of the National Action Plan for Energy Efficiency 3 covering the period 2017-2020.¹⁹ The target is to reduce energy consumption relative to 2007 levels by 20% by 2020. This sets out legislative, regulatory and financial instruments to enhance the country's energy efficiency.²⁰ The energy efficiency loan programmes available to home owners are set out in chapters 5 of this report.

Portugal's building energy efficiency policy includes a building energy efficiency certification system that was first introduced in 2006 (Decree-law 78/2006, Decree-law 79/2006 and Decree-law 80/2006, all from 4th April) which first introduced the Energy Performance Certificates (EPCs), minimum technical performance standards for

19 https://ec.europa.eu/energy/sites/ener/files/documents/pt_neeap_2017_en.pdf

20 <https://www.odyssee-mure.eu/publications/national-reports/energy-efficiency-portugal.pdf>

building fabric and energy using equipment like boilers, chillers and other energy using apparatus and grants to support building owners investment in high cost measures under the Energy Efficiency Fund's regular Calls for funding support. In terms of building certification, Portugal implements the EU Energy Performance in Buildings Directive through the Energy Certification of Buildings, Decree-Law 118/2013. This is supported by 14 further Orders and 6 Ordinances which set out further detail on implementation e.g. methodology for calculation, allowances for renewable energy, etc. The country also accesses EU funds to subsidise, and from the EIB to provide credit lines for energy efficiency loan programs.

Residential construction suffered considerably from the effects of the crisis, with the number of new dwellings falling from a peak of 114,000 in 2001 to a bottom low of 6,785 in 2014. However, following the end of the bailout package in 2014, new residential construction started to recover, with 11,344 new dwellings being completed in 2016, and 14,200 (so a 25.2% increase between 2016 and 2017). The number of houses sold hence grew by 12.4% and is driven by external demand (57% of houses sold were sold to foreigners).

Also, home ownership in Portugal reached 75.2% in 2016, relatively constant since 2010, and above the EU-28 average of 69.2%. It increases to 77.0% for the population earning over 60% of the median income. Moreover, the housing cost overburden rate was at 7.5% in 2016, below the EU-28 average of 11.1%. Likewise, the overcrowding rate was at 10.3% in 2016, well below the EU-28 average of 16.6%, while the severe housing deprivation rate reached 4.9% in 2016, in line with the EU-28 average of 4.8%.

Despite the high ownership rate, only 2% of the housing stock is rented through social/supported leases, compared to the EU-28 average of 10.9%. Moreover, 58% of Portuguese aged between 18 and 34 are still living with their parents. This indicates a lack of affordable solutions for youth, but also households whose income does not allow them to buy a property, yet do not qualify for social housing. In this respect, better availability of affordable housing could help alleviate this situation. To address these issues, the government set up several programmes that provide financing for the construction of social rental dwellings.

Average energy use per household

The annual energy consumption per dwelling is equivalent to 0.65 tonnes of oil (toe), or 0.83 toe after scaling the former figure to the EU average climate. What is more, both in the EU28 and in Portugal, the consumption per dwelling presents a downward trend, especially since the recession of 2008-2009. But the favourable energy consumption of the average Portuguese dwelling is related to lower needs for space heating when compared to other EU member states, thanks to the higher overall temperatures of its mild Mediterranean climate in relation to the EU average. Thus, in Portugal, the largest share (38%) of energy consumption is associated with cooking. Space heating is the second largest end-use (25% of total consumption), followed by water heating (20%) and electric appliances (18%). Energy efficiency appliances and systems for these sectors are needed first and foremost to begin the energy efficiency residential revolution.

When it comes to the main energy source for domestic heating, it largely depends on the size of the building. In half of the buildings with only one or two dwellings, wood in fireplaces is the main source. However, in multi-family buildings with at least three apartments, electricity might amount up to 75% of the total amount. Solar thermal and other domestic hot water (DHW) systems based on renewable energies covered only 0.2% of the dwellings' needs for heating in 2011. Some evolution of this indicator is expected because these kinds of systems became mandatory in new or fully rehabilitated residential buildings from 2006 onwards (Decree-law 80/2006), and it is expected that their share is far more significant today.

Owner-occupation as percent tenure

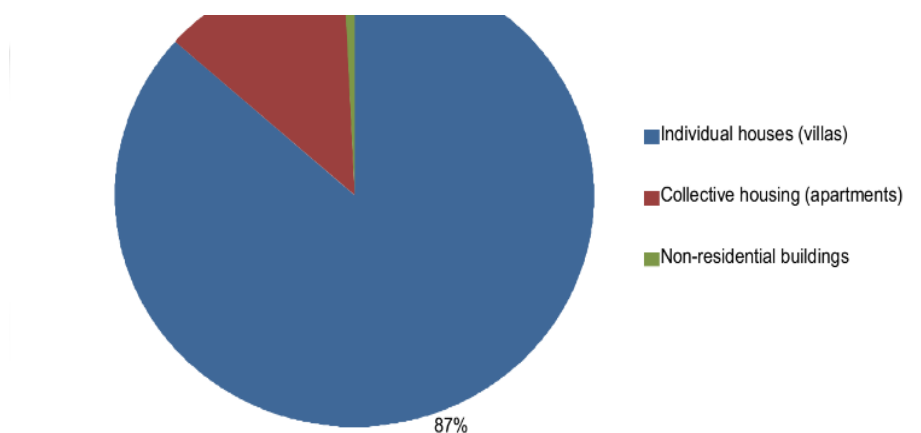
In 2011, Portugal had a total number of 5.9 million dwellings, houses; apartments where one family could live permanently. The number of permanently occupied dwellings is 4 million (67.9% of the total), noting once again that secondary residences (19.3%) and unoccupied/empty dwellings (12.5%) are frequent.

The relative importance of secondary residences and empty dwellings is a distinguishing feature of the Portuguese residential building stock. Beach villas and other seasonal residences are very common, but the figure of 1.1 million, or 19.3% of the total number of dwellings, is extraordinary for the EU as is the figure for idle dwellings, that is, not in use (735,000 or 12.5%).²¹ The high number of homes not in use is associated in part with housing for selling or renting (37.4% of the cases), typically new or quasi-new houses that have become difficult to deliver due to high housing prices (especially in central Lisbon and Porto). Owners of this part of the building stock might not be interested in its modernisation before retrofitting their first residences, but these buildings might be relevant targets once primary residences have been taken care of.

According to the last census, Portugal has around 3.5 million buildings, mainly private residential buildings comprised of one dwelling (3 million or 87% of total, see Figure 4). This means that single-family houses (villas) are far more common than multi-family buildings. This feature is related to rural settlement preferences, typical across the country (Portas, Domingues & Cabral, 2013). Even Porto and other district cities like Coimbra, Aveiro, Braga, Viseu, Évora, or Faro have many buildings “with rural patterns”, meaning that single-family buildings are more frequent than multi-family ones. Typically, owners and residents of single-family houses are not as administratively overburdened as residents of multi-family buildings when pursuing home retrofits, as no voting is required in order to commence works.

Source: Statistics Portugal, 2011

Figure 4: Distribution of the building stock by type of building, 2011



As a result of preference and the tradition of building single-family villas, large apartment blocks with 10 or more dwellings are relatively rare: there are only about 80,000 of them (2.2% of total), as reported by Statistics Portugal (Census 2011). As expected, they are more abundant in densely populated areas, but, even in these areas, as already mentioned, single-family houses are the most common type of building.

Indebtedness

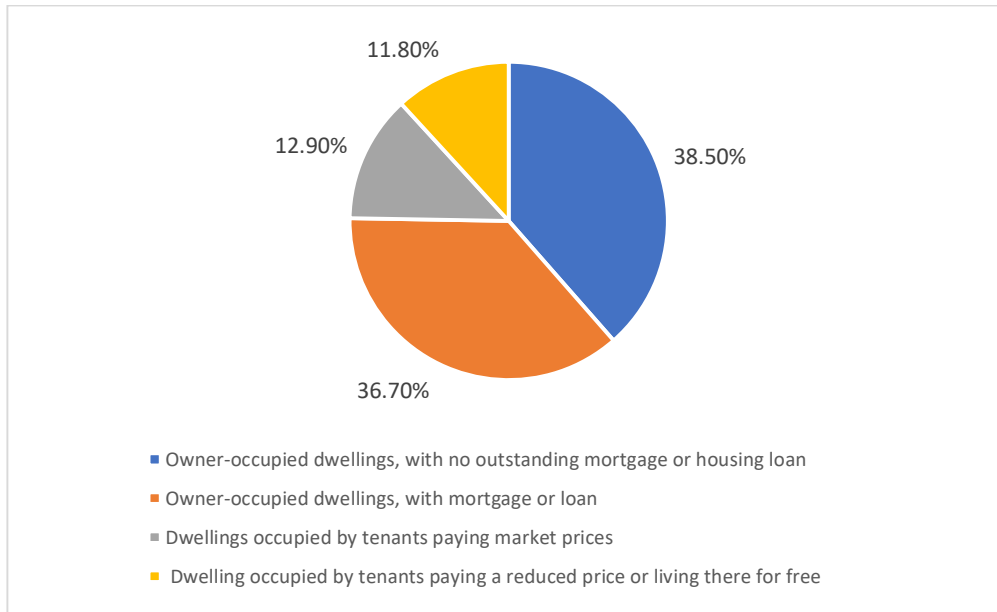
According to Eurostat,²² only 38.5% of dwellings are owner-occupied, with no outstanding mortgage or housing loan; 36.7% are owner-occupied, but with mortgage or loan; 12.9% of the dwellings are occupied by tenants paying market prices; and 11.8% of dwellings are inhabited by tenants paying a reduced price or living there for free (see

21 Oliveira, J. A., Roca, M. N. O., Roca, Z. (2015), Economic Effects of Second Homes: a Case Study in Portugal, Economics and Sociology, Vol. 8, No 3, pp. 183-196.

22 Eurostat housing statistics (online data code: ilc_lvho05a)

Figure 5). The fact that approximately 36.7% of households are already indebted is a rather negative discovery, as these households might be less interested in pursuing EE investments, particularly those which, similarly to loans, have to be repaid in specific amounts and by specific deadlines.

Figure 5: Distribution of permanently occupied dwellings by tenure status



source: Source: Statistics Portugal (INE) -Population and Housing Census, 2011

The distribution of permanently occupied dwellings by age and tenure status suggests that in 2011 private-owned housing with a mortgage (currently 36.7% of the total of permanently occupied dwellings – see more recent data from Eurostat above) was typically constructed after 1981. Conversely, private housing without a mortgage is a tenure status more frequent among older houses. This evidence can be explained either by the maturity (pay-back period) of mortgage lending, which is typically 30 to 40 years in Portugal at the beginning of the loan, or by the housing policy after the revolution of 1974.²³ In fact, the acquisition by each resident of their own house instead of renting has been favoured since this time, which has motivated the increase of home-ownership rate in Portugal.

3.4. Spain

Spain experienced one of the highest price increases prior to the economic crisis, with house prices rising by 197%, resulting in a housing bubble. The housing bubble exploded together with the economic crisis, leading to a dramatic decrease in housing prices and construction activities until 2013. However, this downward trend started recovering in 2014 onwards. The housing price index increased by 11.1% in 2017 in comparison to 2015, driven by a 12.9% increase in the price of new dwellings and a 10.8% growth in the price of existing dwellings. These increases are accentuated in urban areas. In addition, the number of transactions for dwellings increased by 17.9 % year-on-year, during the third quarter of 2017. However, residential investment remains below the pre-crisis level, and the stock of houses for sale remains high in some regions.

²³ Real Property Law – Portugal, p. 2, available at:

<https://www.eui.eu/documents/departmentscentres/law/researchteaching/researchthemes/europeanprivatelaw/realpropertyproject/Portugal.pdf>

Several actions have been adopted by the government to address the housing shortage and the issue of affordability and renting. However, access to social housing is limited, and less than 0.01 % of GDP is devoted to housing-related social protection, which in 2017 decreased by 19 % from 2016 in nominal terms. The housing cost overburden rate stood at 9.8%, slightly below the EU-28 average of 10.4% and in line with the 2010 level (9.7%). Likewise, the severe housing deprivation rate stood at 0.3% in 2017, which is well below the 2.2 EU-28 average. Last, the overcrowding rate in 2017 stood at 5.1%, below the EU-28 average of 15.7%. All in all, these indicators seem to suggest that housing quality in Spain scores above the EU-28 average.

In Spain, the building policies for energy savings and efficiency are expressed mainly through the following regulatory and legislative measures:

- Building Technical Code, 2006 (17).
- Regulation for Buildings' Thermal Installations, 2007 (16).
- Regulations for Building Energy Efficiency Certification, 2007 (16).
- State Plan for Housing and Renovation, 2009-2012 (18).
- Plan 2000ESE (Energy Service Companies)

Aside from regulatory and legislative measures that are directly connected to the improvement of energy efficiency within the building sector, the policies over the objectives of energy savings and efficiency are expressed mainly through the Energy Savings and Efficiency Strategy 2004-2012 (E4) and through the Energy Efficiency Action Plans (PAEE 2008-2011 and PAEE 2011-2020), presented by the IDAE. The following table demonstrates the total investment in energy efficiency measures within the building sector and its projected savings

Average energy use per household

The average consumption of a Spanish household is 10,521 kWh a year, with a predominance of fuels in terms of final energy, 1.8 times higher than electric power consumption. 62% of the electric consumption is related to household appliances, and to a lesser extent, to cooking, heating and hot water services.²⁴ According to a study by the IDEA, 47% of the consumption is for heating purposes.

Housing tenure

The Spanish housing market is characterised by a high rate of home ownership. Majority of the population owned its dwelling in 2017 (77.1%), considerably higher than the EU-28 average (69.2% in 2016), whereas only 22.9% were tenant, out of which 8.5% rented the dwelling at reduced price or for free.

A high percentage of households in Spain - 70% - live in blocks of houses and 92% of the households are freehold properties. Although there are not big geographical differences, the incidence of blocks of houses in the Northern part of the country is slightly higher than the average, accounting for 74% of the whole. Most of the Spanish houses are freehold properties; this rate is lower in the North, reaching 98% for single-family houses. The number of houses owned is higher than the rented ones, mostly in single-family houses in all climate zones. The average house has 8 rooms, including bathrooms and kitchen, a figure higher for single-family houses, especially in Continental and Mediterranean areas.

With respect to the average surface of a Spanish household, it is 102.4 m², and actually reaches 140.2 m² in single-family ones. Single-family houses have a larger average surface, above all in the Continental zone. 49% of Spanish dwellings have been built between 1979 and 2005, thus they are over 30 years old. According to the type of dwelling, most single-family houses have been built in the last 30 years, so their building structure is newer than housing blocks. Thus, dwellings before 1979 accounted for 49% of housing blocks, and only 33% for single-family houses. Regarding climate zones, the oldest dwellings are found in the North Atlantic zone, while the most modern

24 https://ec.europa.eu/eurostat/cros/system/files/SECH_Spain.pdf

ones are the single-family ones in the Continental area. In summary, the oldest houses have less surface area and a smaller number of rooms, and are located in large habitats, while new dwellings display a higher percentage in small habitats.

Indebtedness

The annual mean net income decreased by 3.1% between 2010 and 2017, reaching €16,390. That being said, it has been constantly increasing since 2014. This overall reduction in the mean net income may explain the significant decrease in residential loans in Spain. Those constantly decreased from €680.2bn in 2010 to €544.5bn in 2016 (20.0% decrease). However, new credit to households for house purchases is growing. This trend is supported by decreasing interest rates on mortgages. These declined from 4.3% in 2010 to 1.2% in 2017, which stimulated slightly the residential market.

4. Country Study: Belgium

The Belgian population is projected to reach 12.4 million people by 2040, most of this growth will be experienced in the Brussels-Capital and Antwerp regions, but the population's stable and dynamic growth is also occurring in the other regions. The number of households in Belgium grew by 1.5% between 2010 and 2016, and it is expected this will increase from 4.8 million in 2016 to 5.5 million in 2040 (ING, 2018). Belgium's real estate market has experienced strong and stable growth, and was largely unaffected by the financial crisis, the sector presents ample opportunity for schemes aimed at improving living conditions and decreasing energy bills.

At the start of 2018, there were 4,911,973 private households in Belgium, of which 30.9% were one-person households, 48.3% were households with 2-3 members, 18.7% were households with 4-5 members, and 2.1% were households with 6 members (UN, 2018). The highest number of one-person households are found in the Brussels-Capital Region with 547,679 households, or 46% of all households. 2,792,444 private households, of which 32% are one-person households, are found in the Flemish Region, and 1,571,850 private households are found in the Walloon Region, of which 36% are one-person households.

A 2015 survey conducted by Energy Efficiency Watch showed that Belgium was ranked 13th out of 28 countries in terms of positive policy progress in the context of energy efficiency compared to three years before.

Additionally, 77% of the interviewed experts believe that Belgium's energy efficiency policies were not sufficiently ambitious, notably due to financial challenges. As far as the specific policies are concerned, policies regarding energy efficiency requirements for new buildings were rated as 96% effective and those for renovated buildings as 87% effective. However, policies regarding energy taxation were assessed as "not effective at all" by the respondents. Despite that, policies regarding funding support for the renovation of residential buildings were assessed positively, despite renovation rates remaining (Energy Efficiency Watch, 2015).

The moderate progress of energy efficiency policies in the context of residential buildings was also found to be satisfactory in terms of requirements regarding the potential implementation of EuroPACE. Moreover, an on-tax financing scheme was found to have been complementary to the already varied policies offered by the Belgian regions.

Overall, the Belgian real estate market is relatively stable, since it was unaffected by the economic crisis. House prices experience steady growth, access to mortgage credit is easy, and household indebtedness is rather low.

4.1. Loan programmes

There was a national concessionary loan programme scheme operating until 2012 but this was reviewed and restricted to households on low incomes and regionalised and distributed through local entities.

4.2. Brussels-Capital Region

There are four premiums offered by the Brussels-Capital Region for the improvement of energy efficiency:

The Brussels Green Loan: This loan concerns all construction works aimed at improving the insulation of roofs, walls, or the ground; and the installation of high insulated windows, mechanically-controlled ventilation, condensing gas boilers, thermal regulation or gas convectors. This loan is available at 0% interest, limited to €20,000, for households with incomes below €30,000 for a single person or €60,000 for couples. The loan can be blended with other financial schemes.

Energy Efficiency Credit: This credit concerns all renovation initiatives aiming at improving insulation, ventilation, heating, and RES. It is available for owners of housing units which are more than five-years old. It is a mortgage loan of 0-2% interest and is limited to €25,000.

Premium for Renovation 2016.

The premium is available for buildings over 10 years old, and can be likened as a subsidy for renovations focused on improving the energy efficiency of buildings (audit, evaluation, insulation, ventilation, hot air generator, condensing boiler, gas air heater, efficient gas convector, heat pump, or solar water heater). In 2018, this premium was modified and is now only available for buildings aged 30 years old or above. Additionally, the premium is capped at €35,000 with an additional €5,000 per room when the dwelling has more than three rooms.

HomeGrade: HomeGrade is an instrument developed by the Brussels-Capital Region to promote energy efficiency and responsible energy use. It aims to provide effective support to households when acquiring a dwelling (renting, selling, occupation, construction, renovation), by offering information and advice, in addition to technical, administrative, and financial support for households.

As from the 1st of January 2019, a new premium on gas heating has been implemented in the Brussels-Capital Region, offering €100 to households investing in the professional review of their dwelling's gas heating system. Moreover, the amount of the premium for roof insulation was doubled compared with 2017 and the premia for external wall insulation and for the replacement of the boiler has increased. The new measures also include a premium for building extensions and a simplification of 67 administrative procedures. On average, the premia offered in the Brussels-Capital Region reimburse 20% of costs aiming at energy efficiency for residential buildings, up until 12 months after having received the construction bill. Payment can be expected within eight weeks.

4.3. Walloon Region

Energy efficiency and building renovation policies in the Walloon Region are defined under the fourth axis of the Walloon government's strategic economic restructuring plan, also known as 'Marshall Plan 4.0'. Out of the total budget of €2.9bn, Axis 4, aims to support energy efficiency, energy transitions and the circular economy, with a budget of €1.1bn. The Walloon Region offers the following support for energy efficiency investments:

Green Certificates: Green certificates have been implemented to support households that choose RES to produce the energy of their dwelling.

Energy Premium: The Energy Premium was implemented in January 2019. It provides financial support to households with income under €97,000 per year that are aiming to make energy efficient renovations and improvements, notably roof, wall and ground insulations. Elements using RES such as a solar-based water-heaters, heating pumps, or biomass boilers must be used. The building must be over 20 years old and other conditions, notably the occupation of the building, must be respected. The amount of subsidy varies according to the type of renovation and whether it is made by the owner or by a contractor. For example, roof insulation renovation made by the owner are subsidised at an amount of €6 per m² for surfaces up to a maximum of 150 m².

Wall and ground insulation renovations can only be pursued by a contractor. A heating pump for hot water is subsidised at €750 and a solar boiler at €1,500. Another amount is provided according to the household's income. In 2017, the Walloon government adopted the "Walloon Strategy for the 2050 energy renovation of buildings", aiming at renovating more than one million dwellings in Wallonia by 2050.

4.4. Flemish Region

In 2015, similar to the Walloon government, the Flemish government launched the "Renovation Pact 2050" in cooperation with the construction sector. The Renovation Pact 2050 aims to improve buildings' energy efficiency

to make every dwelling in Flanders energy efficient by 2050. The Flemish Region offers the following support for energy efficiency investments:

Reduction in property tax and gift tax for energy-efficient residential buildings: Established in 2009, this measure grants a 10-year reduction in property tax for new buildings which have improved their energy efficiency. After 10 years, property taxes return to their initial rate (similar to EuroPACE following the pay-back period).

Woonbonus: The Woonbonus or Housing Bonus is a tax reduction of 40% implemented in 2005 and addressed to principal residences as well as secondary homes. For mortgages contracted after January 2016, the Housing Bonus (addressed to the principal residence) has been merged with two other tax reductions (tax reduction for long-term savings, addressed to the secondary home and tax reduction for ordinary interest, also addressed to secondary homes) to create the Integrated Housing Bonus. This Housing Bonus is available for mortgages taken for a duration of over 10 years.

Flemish Renovation Loan: The Flemish Renovation Loan offers 0% interest and is designed for the renovation of a residential building (primary residence) with the aim of improving energy efficiency for the energy poor.

As of February 2019, it has been targeted at priority groups consisting of households with an annual gross family income of less than €18,363.39. This threshold increases by €3,399.56 per family member who is not the applicant. It is also available to families with a joint taxable income that is less than €30,640 a year; and owners are renting through a social rental office.

The loan is available for renovations and improvements such as roofs, the insulation of walls or floors, high insulation windows, ventilation systems, efficient heating systems (heat pump, among others), solar panels, solar water heaters, energy efficient home appliances and energy audits. The renovations must be conducted by a contractor.

The Flemish Region also provides financial support for renters, granting subsidies to low-income families moving from a non-energy efficient dwelling to a higher energy level dwelling. The grant is a monthly subsidy amounting to one-third of the rent as well as additional premia. One month's rent is added for low-income families who have been on a waiting list for social housing for more than four years.

5. Country Study: Portugal

Portugal has implemented a number of energy efficiency lending programmes to fund investment in different segment of the market. Homeowners apply for funding through private sector banks which receive co-financing support from the Portuguese government, European Investment Bank and EU Commission funds.

The following programmes will be reviewed in this section.

Name	Beneficiaries	Capital provider
Casa Eficiente 2020	homeowners and apartment owners	European Investment Bank (EIB) & local private sector banks
IFRRU 2020	urban renewal of disadvantaged areas	EIB and the Council of Europe Development Bank (CEB) & local banks
Linha BPI/BEI Eficiência Energética	larger EE projects in buildings and industry (>€40k each)	EIB, EU Commission Horizon 2020 & local bank BPI
Energy Efficiency Fund (FEE)	homeowners and tenants	Portuguese government

Of these programmes, the Energy Efficiency Fund is not a loan programme but a grant scheme that subsidises energy efficiency measures reducing the amount the building owner needs to borrow.

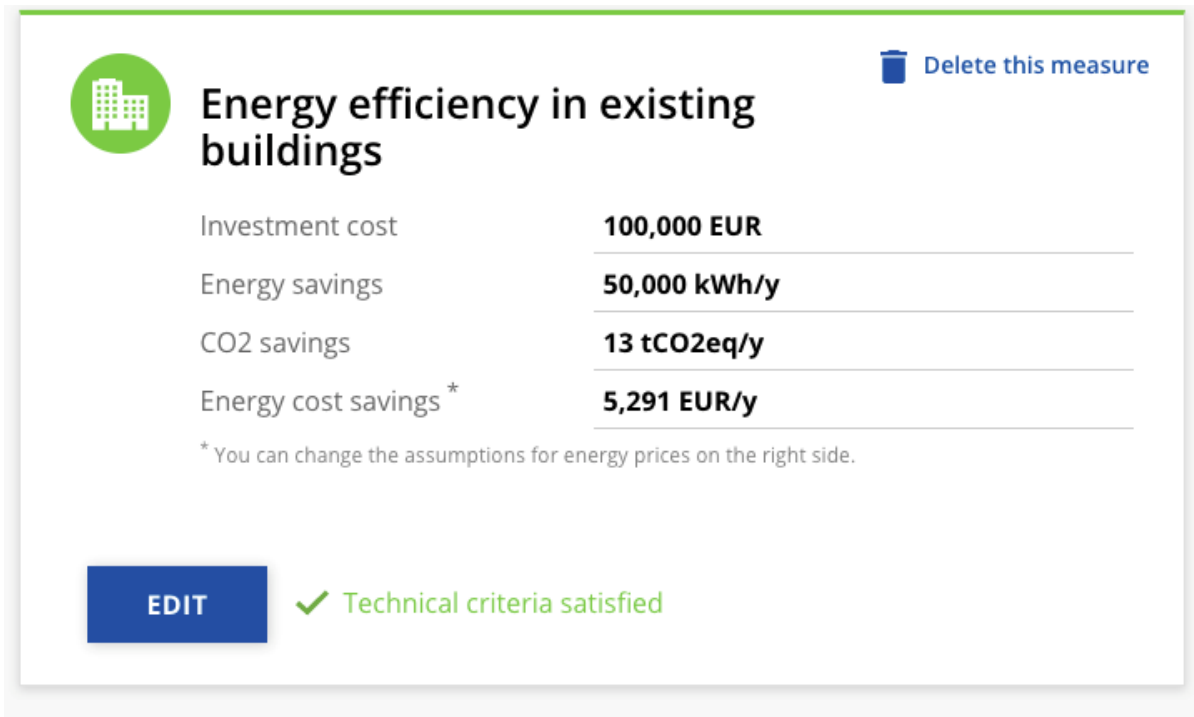
The Portuguese government's **Casa Eficiente 2020**²⁵ (“**Efficient Home 2020**”) programme is managed by the Portuguese Confederation of Construction and Real Estate. Applicants can live anywhere in the country and must own the building or apartment being renovated. The programme’s budget is €200m for the period 2018-2021. It is co-financed by the European Investment Bank and private Portuguese banks *CGD*, *Millenium BCP* and *Novo Banco* to support homeowners’ (or rentals) energy retrofit activities in the building or dwelling. As well as energy efficiency, funding can be used to improve water efficiency and solid waste management. However, lending has been much lower than desired for reasons discussed below. There have been just 400 applications the first six months of operation from June 2018 borrowing €300,000²⁶ from a three-year budget of €200m.

In terms of building emissions reductions options, the programme can be used to improve the building envelope: glazing, shading; building services: lighting, ventilation, lifts; install renewable energy systems: heat pumps, biomass boilers, PV and other systems like storage and EV charging facilities. The scheme requires the homeowner to use a registered contractor which is found on the portal. A screen shot from the portal is shown below.

²⁵ <https://casaeficiente2020.pt/faqs/#1246>

²⁶ <https://www.publico.pt/2019/01/14/economia/noticia/banca-condenar-casa-eficiente-fracasso-1857660>

Figure 6: Example of future savings on portal



The programme provides online simulation software allowing homeowners to estimate the expected savings upon the implementation of the energy efficiency measure, a database of potential service providers who present budgets for the proposed intervention and compiles the financial indicators that allow the financing institutions to evaluate and decide upon the loan. The financing conditions are agreed case-by-case by the lending bank.

IFRRU 2020

IFRRU 2020 is a financial instrument that provides funding for urban renewal within designated municipalities to revitalise cities. This includes spending to rehabilitate buildings - including enhancing their energy efficiency and enhance space used by disadvantaged communities. The available government resources are substantial €1.4bn, generating an investment of €2.0bn. This funding is not just for building energy efficiency but for the renovation of the building also. However, the fund stipulates that to be financed the measure/s to implement must improve the building energy class by two classes. Portuguese banks implementing this instrument: Santander Totta, BPI, Millennium BCP and Popular.

It has so far rehabilitated 262 housing units and built 503 new housing units.²⁷ The projects have typically been budgeted at between €200,000 to €5m, with the IFRRU fund contributing half of eligible expenditure. Annual carbon savings are estimated at 4,400tCO₂ equivalent.

Linha BPI/BEI Eficiência Energética

Linha BPI/BEI Eficiência Energética²⁸ aims to address the limited access to adequate and affordable commercial financing for energy efficiency investments by companies (including companies owning homes). The scheme was launched in 2017 with a credit line of €50m. It covers not just retrofit of *buildings* but energy efficiency programmes for other end uses like industrial energy efficiency, outdoor and public lighting and combined heat

²⁷ https://ifrru.ihru.pt/web/guest/projetos#OPERA%C3%87%C3%95ES_APROVADAS

²⁸ <https://pf4ee-webcheck.eib.org/pt-pt/bpi>

and power systems. The value of the loan has to be between €40,000 and €5m per project. The main focus of the *building* spending has been the installation of rooftop solar PV.²⁹ Financing conditions are agreed case-by-case. The funding is provided through and administered by the local bank BPI co-funding is provided by EIB. However, take-up has been limited. According to the bank's annual report €2.4m of loans had been placed by the end of 2018.³⁰

In common with the Casa Eficiente 2020, BPI has set up a self-assessment tool to evaluate whether an investment project qualifies for support. It provides a straight-forward diagnostic check of the project's costs and carbon saving to ensure it meets the scheme's criteria.³¹

Energy Efficiency Fund

Energy Efficiency Fund subsidises the implementation of energy efficiency measures for different end-users of energy, including residential.³² These support high-cost measures like insulation of roof and facades, window replacement and domestic hot water. The application for funding relies on the EPC to identify the energy efficiency measures, since the expected financial savings calculated in the EPC help determine the award of the co-financing.

This programme invites applications for funding on an irregular basis. Residential building owners were asked to make funding requests in 2012-2015 (Call 03), from 2015 (Call 10). The grant being made available were modest totalling just €1.7m and €0.4m respectively and the building owner was expected to provide €2.1m and €0.6m respectively.

The level of subsidy provided is generous but the total expenditure on the programme highly limited. For instance, Call 25 (commencing in June 2018) for Buildings had a budget of €3.1m which was exhausted in just five months.³³ The Call provided owners of a residential house up to €15,000 and a flat up to €7,500, with further limits to each underlying measure of €3000 for wall insulation, €1500 for floor and roof insulation and €1500 for windows paid at up to 50% of costs. The small budgets for the programmes mean resources can be fully exploited after just a few hundred home treatments.

5.1. Source of finance for the programmes

Portugal's energy efficiency loan programmes are co-financed by the EIB and private sector banks on commercial terms and use the EU Commission's programme budgets to provide concessional finance. The government provides subsidies towards specific technologies and for different types of beneficiary through the Energy Efficiency Fund.

Casa Eficiente2020 is co-financed by EIB and Portuguese banks. The two parties each contribute €100m to the programme budget. **Linha BPI/BEI Eficiência Energética** is supported by the EU wide Private Finance for Energy Efficiency (PF4EE) instrument. PF4EE is a collaboration between the EIB and the European Commission aimed at addressing the limited access to adequate and affordable commercial financing for energy efficiency investments. As well as the EIB credit line of €50m, the EU's PF4EE programme supports the scheme with cash collateral for a risk sharing facility (RSF) and also funding for financial intermediaries energy efficiency experts (expert support

29 <https://pf4ee.eib.org/partner-banks#accordion-portugal>

30 <https://web3.cmvvm.pt/sdi/emitentes/docs/PC72421.pdf>

31 <https://www.bancobpi.pt/en/corporate/financing/credit-lines/bpi/eib-energy-efficiency-line>

32 Adene (2018) "Energy Efficiency trends and policies in Portugal" <https://www.odyssee-mure.eu/publications/national-reports/energy-efficiency-portugal.pdf>

33 <http://www.pnaee.pt/avisos-fee/aviso-25>

facility – ESF).³⁴ The budget for these two line items in Portugal in 2017 was €4m paid to BPI. The loans can have terms of up to 20 years and can meet a maximum of 75% of the overall project costs.

IFRRU 2020 receives EU funds from the EIB and the Council of Europe Development Bank (CEB). Private sector partners were selected through a tender procedure. Three financial management entities: Santander Totta, Banco BPI and Millennium BCP were selected to supply the financial products (loans or guarantees) through which urban rehabilitation operations are financed.

The IFRRU 2020 thus has a financing capacity of €1,400m which, with match funding, gives rise to investment of €2,000m. Single or multiple owners of buildings in Urban Rehabilitation Areas (ARU) that are at least 30 years old can apply. Buildings can be industrial sites or social housing. But housing units need the agreement by all owners. The municipality must also be approached for their opinion of the project prior to submission.

5.2. Credit underwriting decisions

For the three lending schemes, the rate of interest charged is set by the commercial bank which is the direct lender of the monies and the conduit for the public sector monies. The public funder does not specify the rate or the discount to standard rates that should be offered.

In the case of the **Casa Eficiente2020** the lending terms offered by the bank are more generous when secured on the home mortgage in terms of a) lower interest rates & b) longer repayment periods. EIB does not take on the end customer credit risk, this is borne by the financial partner.

The size of loan has to be in the range €2500-20,000 without mortgage guarantee and €5000- 50,000 when the loan is combined with the mortgage and hence secured on the property.

The rate of interest is set by the bank and is essentially a 0.25% discount on the reference rate (Euribor 12 month indexed rate) + spread between 2.250% to 3.500%. The current interest rate for a secured loan is 4.6%; without the mortgage guarantee it is 9.7% APR.³⁵

The cost of the finance for the energy efficiency loans, especially if without the mortgage guarantee, is seen as unattractive and take-up loans has been low. Matos Fernandes, Minister of Environment and Energy Transition the scheme was “not going as it should” to a parliamentary enquiry³⁶ arguing that banks should offer more attractive interest rates. The scheme has also been criticised for its insistence on using approved contractors and the set-up costs and commissions being charged by the lending banks. In January 2019 one of the banks CGD announced a reduction in the interest rate with the spread starting from 1.05%. **Linha BPI/BEI Eficiência Energética** receives a portfolio level guarantee from EIB.

5.3. Assessment of the different design features of the scheme for the EuroPACE project

The Portuguese examples reviewed here had only limited success in achieving either scale or depth of retrofits. Portugal, partly as a result of austerity measures imposed as a result of its fiscal deficits, has been in a poor position to subsidise the installation of energy efficiency retrofit measures, or support small-scale RE. Portugal has relied on private sector banks to roll out domestic energy efficiency retrofits with EIB funds and EU subsidy reducing the cost of capital slightly.

34 <https://www.eib.org/en/products/blending/pf4ee/index.htm>

35 Example of conditions applied currently <https://ind.millenniumbcp.pt/pt/Particulares/Credit/Pages/Programa-Casa-Eficiente-2020.aspx>

36 <https://www.publico.pt/2019/01/22/economia/noticia/matos-fernandes-admite-casa-eficiente-nao-correu-necessario-corra-1858998>

6. Country Study: Spain

In Spain, the PAREER II programme for the energy rehabilitation of existing buildings aims to encourage and promote the implementation of reform actions that favour energy savings, the improvement of energy efficiency, the use of renewable energies and the reduction of CO₂ emissions in existing buildings regardless of their use and the type of owner. The programme was set up in order to meet the objectives set out in the 2014-2020 National Action Plan, while simultaneously boosting sectoral growth and employment. In collaboration with the Ministry of Energy, Tourism and Digital Agenda and the Institute for Diversification and Saving of Energy (IDAE), PAREER II was launched.

The actions subject to assistance must improve the total energy rating of programme endowed with €200m. In terms of increasing building energy efficiency options, the programme funds projects that aim to attain the following:

1. Improvement of the energy efficiency of the thermal envelope.
2. Improvement of the energy efficiency of thermal and lighting installations.
3. Replacing conventional energy with biomass in thermal installations.
4. Replacing conventional energy with geothermal energy in thermal installations.

Additionally, following renovations, the respective buildings have to have increased by at least 1 letter measured on the scale of carbon dioxide emissions (kg CO₂/m² year), with respect to the initial energy rating of the building. This improvement of your energy rating can be obtained by performing one type of or a combination of several of the abovementioned actions.

The programme is designed for a wide range of beneficiaries eligible for the aid. These can be:

1. Owners of existing buildings (either private or public, no restriction on use)
2. A community of owners of residential buildings for residential use. In the case of Spain, this particularly applies to dwellings that are part of a condominium, which are buildings that share communal spaces such as; lifts, swimming pools, pathways, gardens etc.
3. Owners who collectively own buildings, but have not granted the title of constituting horizontal property, or condominiums.
4. The operating companies, lessees or concessionaires of buildings
5. Energy services companies

6.1. Source of finance

PAREER II has an allocated budget of €204m originating from the National Energy Efficiency Fund. It has been running since 2018, although deadlines for submitting aid applications has finalised the transaction of aid is still ongoing till 31 December 2020 provided sufficient budget is still available.³⁷ This is part funded by the European Structural Fund's ERDF, in addition to co-financed contributions from the energy efficiency obligation system to comply with their respective savings obligation, state budgets or any other resource intended to finance actions of energy saving and efficiency within the Operational Program for Sustainable Growth³⁸. The main body that grants the funds is still IDAE. Considering the ERDF's role, the programme aims to help Spain anticipate and adapt to global changes in the fields of energy, urban development, water, and transport. It aims to contribute to the fulfilment of the Europe 2020 "resource efficiency" flagship initiative, by bringing major economic opportunities,

37 <https://www.idae.es/ayudas-y-financiacion/para-rehabilitacion-de-edificios-programa-pareer/programa-de-ayudas-para-la>

38 file:///C:/Users/CBI%20212/Downloads/Spanish%20Energy%20Efficiency%20Fund%20-%20Miguel%20Rodrigo%20(1).pdf

improving productivity, driving down costs and boosting competitiveness. This support in particular regarding sustainable growth will help recover the competitiveness of Spanish economy through a more sustainable resource efficient model. This programme is the major Spanish programme as regards the ERDF (€5.5bn contribution). About 18% of the total budget is allocated towards sustainable and integrated urban development.³⁹

The average spending on each project/proposal are about €248,000. Most projects/proposals are based in the following regions: Basque Country, Galicia Asturias and Navarre and aim to improve the energy efficiency of the thermal envelope.⁴⁰ As of April 2018, the programme had exceeded its budget of €204m and would require at least an additional €66m to fulfil reserved applications. Supplementary budget is not expected to be made available until mid/end 2020.⁴¹

Overall, the measure has been well received but it is not without its critics. The forecasted allocation of all programme funding has not easily been achieved as the programme has exceeded its allocated budget. The timing between the registration of the application and the award of the grant/financing is around 6 months. There were 1,122 applications, 242 of which have been approved and 185 rejected, with a total committed budget of around €110 million – €56 million for grants and €53 million for financing, with €89 million remaining. The main reason for applications being rejected has been the failure of applicants to provide the "documentation required in the correction phase". To a much lesser degree, non-compliance with requirements is a secondary reason.

Table 2: Number of approved applications per group

Beneficiary	Approved applications	Committed budget (%)
Community of neighbourhoods	188	89%
Energy Service Companies (ESCOs)	9	4%
Hotel owners	8	5%
Owners of residential buildings	37	2%

Source: European Commission⁴²

Data shows that the vast majority of beneficiaries are communities of neighbours (owners). IDAE and its representatives regret that there has been a lack of complete projects presented to date. This means that one of the Programme's objectives is not being met.

6.2. Credit underwriting

The programme extends loan based on the following conditions:

- 1) The interest rate will be equal to Euribor + 0.0%
- 2) The maximum loan repayment term will be set at 12 year, which includes an optional 1-year grace period
- 3) Borrowers are liable for a loan guarantee. This can be in the form of bank guarantee, surety insurance contract or cash deposit that will be accepted by IDAE in the General Deposit Box of the Ministry of Economy, Industry and Competitiveness for an amount of 20% of the total loan amount.

39 https://ec.europa.eu/regional_policy/en/atlas/programmes/2014-2020/spain/2014es16rfop002

40 <https://mejoresedificios.com/se-agotan-los-fondos-pareer-ii-idae-rehabilitacion-energetica-nueve-dias/>

41 <https://www.escalaarquitectura.es/2019/06/seguimiento-expedientes-IDAIE.html>

42 <https://ec.europa.eu/docsroom/documents/30289/attachments/3/translations/en/renditions/native>

Furthermore, the loan can be extended with an additional aid until the maximum aid is reached. This may be on a so-called social criteria. Extended loans based on social criteria are meant for actions carried out in residential buildings that have been legally qualified under some public protection regime, either by the body of the corresponding Autonomous Community or actions carried out in residential buildings located in the Areas of Urban Regeneration and Renovation in accordance with the State Plan for the Promotion of Housing Rental, Building Rehabilitation and Urban Regeneration and Renovation 2013-2016. Alternatively, energy efficiency actions that raise the energy rating of the building to obtain an energy class “A” or “B”, on the CO₂ emission scale, or increase the starting energy rating by two letters can also apply for loan extension. The last set of projects that are eligible for an extension are integrated actions that simultaneously perform the combination of two or more types of action discussed in the previous sections.

Table 3: Overview of loan amounts

Type of action	Maximum amount money delivery without counter pressing	Additional aid by social criteria, energy efficiency or integrated action	Maximum reimbursable loan amount
	BASE aid		
Type 1. Improvement of the energy efficiency of the thermal envelope	30%	Depending on the use of the building, for the type of action. Up to the limits of the State aid regulations or ERDF co-financing rate in the Autonomous Community where the project is located	60%
Type 2. Improvement of the energy efficiency of thermal and lighting installations	20%		70%
Type 3. Replacing conventional energy with solar thermal energy.	30%		70%
Type 4. Replacing conventional energy with geothermal energy	30%		70%

Source: IDAE⁴³

6.3. Considerations for successful implementation

The success of PAREER II, and similar initiatives, depends on the provision of long-term loans at a low-cost. There are various key factors that influence the financial structure and that have a strong impact upon the amount and forms of state participation within the renovation sector:

1. *Cost of Finance for Long-term Energy Savings:* The character of the renovation sector is determined by whether consumers can fund deep renovations over the long-term at low cost (e.g. 5% for 20 years) as opposed to only having access to short-term finance at unsecured lending rates (e.g. 9% for 5 years);
2. *Energy Prices:* The future evolution of Spanish energy prices, especially those (like gas) which have the most significant impact on the cost of home heating, is a critical determinant of the returns for deep renovation measures;

43 <http://www2.mfa.gr/infofiles/Investment%20incentives.pdf>

3. *CO₂ Value*: The ability for the household (or funder) to financially perceive the value of the CO₂ emissions savings commensurate with deep renovation actions can materially impact renovation rates, especially as prices rise over the 2020-2050 horizon;
4. *Technology Curve for Renovation*: It is likely that as sector momentum builds, firms that are serving this new market will find economies of scale, process efficiencies and labour savings as they renovate hundreds of thousands of Spanish homes per year as opposed to a few buildings.

The impact of low-cost, long-term financing for energy savings is fundamental and easy to illustrate: a deep renovation of an average Spanish home (E6 Mix for 81m² living space) saves 83% of the energy demand, or about €684 annually on the domestic energy bill. Financing gained at 9% for 5 years allows a capital available from future energy savings, for up-front investment of only €2,660. The same energy saving, with 20 years financing and an interest rate of 5%, would suppose an initial investment capacity of approximately €8,530. In a world where the cost of deep renovation for the average Spanish home is estimated at over €14,000, there will clearly be very little deep renovation if consumer finance is only offered at 9% for 5 years. ⁴⁴

⁴⁴http://awsassets.panda.org/downloads/challenges_and_funding_opportunities_for_the_energy_efficient_renovation_of_spain_s_resi.pdf

7. Energiesprong

The Energiesprong (“Energy spring”) was developed in Netherlands in 2012 as a means of delivering “net-zero” retrofits to multiple social housing units simultaneously. It incorporates four major changes to delivering energy efficiency:

- **High-performing “net-zero” package:** combines new building facades, solar PV, ground/air source heat pumps, and “energy hub” which integrates an inverter, hot water store, heat exchanger, and optionally a battery (to help balance the load generated by the solar PV between day and night);
- **Off-site manufacture & mass customisation:** the energy efficiency measures are manufactured off-site using drones and laser measurement to ensure tailored installation. These are currently made by hand, but once volumes grow the idea is use factory manufacture;
- **Scale:** clients should own multiple, contiguous homes to reduce design and mobilisation costs and in the longer-term benefit from economies-of-scale in off-site manufacture;
- **Tariffs:** gas and electricity tariffs are replaced with an ‘energy plan’ a single payment to cover guaranteed internal temperature of 18°C / 21°C in the bedroom / living room; the hot-water ‘allowance’ and debt service costs. Extra energy charges are incurred for using more than planned water or heat, and non-heating power consumption.

Energiesprong has been extended to UK, France and Germany. Partners in different countries source production locally, and there are significant differences in the technologies combined to produce the “net-zero” solution. For instance, in UK’s Nottingham solution there is integration with district heating using heat pumps to produce the piped hot water. In order to achieve the deep cuts in emissions multiple state of the art retrofit measures are combined: whole roof PV, insulated facades and triple-glazed windows craned into place, replacement of gas heating with heat-pumps and gas cookers with induction. The photo below shows a line of homes with new facades and roofs. The second house from the left did not participate in the scheme revealing the pre-treatment look.

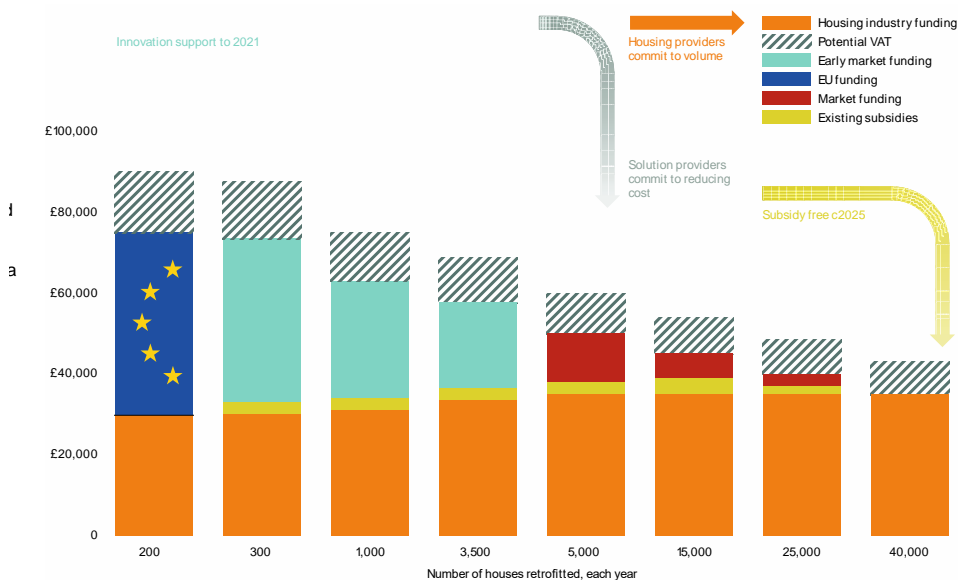


In an analysis reported by the NGO Green Alliance⁴⁵ Energiesprong forecast the unit costs of the installation will fall from the current level of £70,000 per home to £50,000 once off-site manufacture can be automated in the UK. This automation is thought to become viable once 40,000 homes per year are being treated and economies-of-

45 Green Alliance (2019) “Reinventing retrofit: How to scale up home energy efficiency in the UK” London

scale kick-in. The assumption is the reduction in unit price will allow the investment to be funded without public subsidy and make further deep-retrofit self-financing through debt service charges and avoided costs alone. The figure below shows how the composition of different funding sources could contribute to the market's development.

Figure 7: Energiesprong projection finance sources and fall in unit cost of treatment package in UK

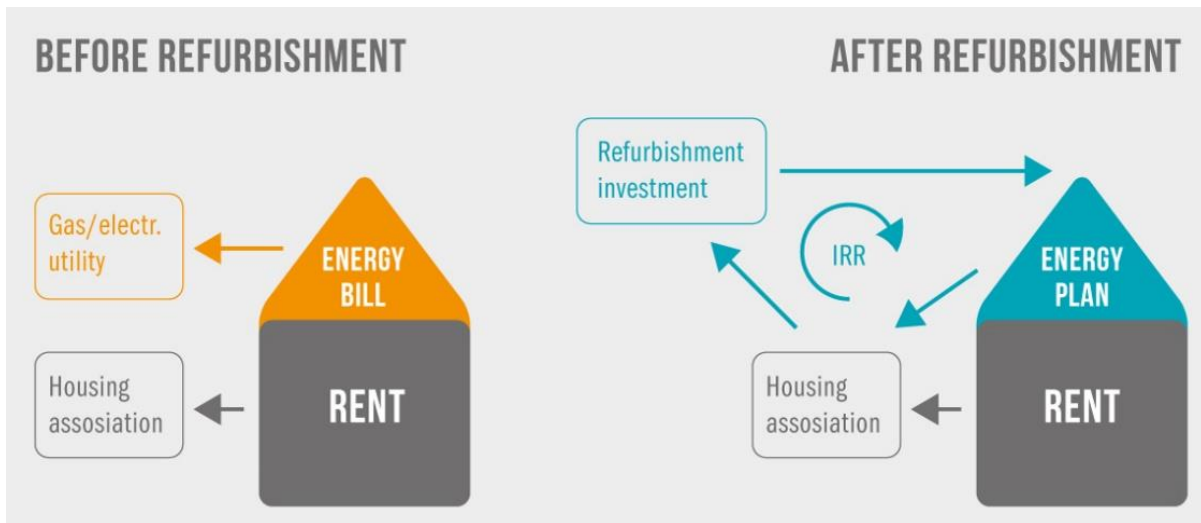


Source: Green Alliance

Roles and responsibilities of the different parties

- **Household:** home's tenant rents the home from the owner and is responsible for payment of the energy plan through their energy bill. This covers the debt service costs.
- **Owners:** the social housing provider is the project sponsor and responsible for planning, commissioning and securing funding for investment. The cost of finance of the project depends crucially on the funding avenues available in that country.
- **Solution provider:** companies responsible for supplying energy efficient facades, energy modules and RE systems. Systems have long-term warranties (up to 30 years)
- **Funder:** funds are provided through a mixture of grants (variously from EU's ERDF, NEW's E=0⁴⁶, and national government) and borrowing (from owners' usual source of borrowing)

⁴⁶ European Regional Development Fund; North East Europe E=0



Recruitment of homes

Only properties owned by the social housing provider are currently being treated. This means that homes that have transferred to private ownership, for instance through UK's right to buy policy, cannot currently borrow money through the social housing provider.

The Energiesprong approach is best suited to homes that do not have a conservation designation, which are relatively uniform in their construction to avoid the need for bespoke solutions and which do not have lots of external obstacles to attaching external insulation (pipes, conservatories etc.).

Choice of countries to expand Energiesprong

National characteristics of the different countries also make a difference. In order for a *mass-production* model to be viable there needs to be a market of 40-50,000 homes to be treated per year. This means that small countries, or medium sized EU countries with a high degree of variations in regulations between regions, like Belgium, do not lend themselves to early deployment. The economics of net-zero retrofits means that it is best suited to homes with substantial heating need in Northern Europe where the annual value of savings is maximised. In southern European countries heating bills are lower making the financial case for the deep retrofit harder to justify. The third country characteristic is a high degree of concentration in home ownership with a single entity able to deploy across hundreds of units, for instance, with large social housing providers, or local government owning the homes.

Net-zero retrofits are harder to justify in countries where district heating, with low carbon heat sources is being used to decarbonise the housing stock. For instance, in Denmark there are high penetrations of efficient district heating using combined heat and power, from gas, coal, biomass and refuse. This national strategy is in opposition to net-zero retrofits which reduce the viability of the heat network by reducing the off-take of hot water. These considerations will apply equally in determining the suitability of a country to the Europace funding model.

7.1. Sources of finance & financing structures

In the UK, Energiesprong is being implemented by social housing providers provision by local government owned *Arms-Length Management Organisations* (ALMOs). ALMO's allow local government to fulfil its duties to house vulnerable household whilst keeping accounting separation from the rest of its duties.

At present funding has been from existing resources but expansion of the programme will be funded by the parent local authority through the Public Works Loan Board (PWLb) itself a part of the UK Government Debt Management

Office. This allows UK local authorities to borrow at a rate linked to the UK Gilt bond rate.⁴⁷ The blended cost of the borrowing for Nottingham City Homes is 2.7% based on the different tenors of loans the ALMO plans to take out.⁴⁸

Social housing is also provided by private not-for-profit organisations termed Registered Social Landlords (RSL). RSL's cannot access funds through the PWLB and must raise finances based on their own credit ratings.

In the Netherlands, the Energiesprong Network is known as Stroomversnelling. This year's main development regarding the network's financiers is that the Nationaal Energiespaar Fonds (NEF) introduced a new loan with a term of 30 years. The NEF is funded by the national government, Rabobank, ASN bank and the Council of Europe Development Bank (CEB), granting loans to housing associations to carry out specified projects that fall in two categories; ZEP ("very energy efficient package" up to €50,000 per apartment) and ZEP + NOM "zero on the meter" (€65,000).⁴⁹ Further details can be found on their factsheet.⁵⁰

In general, an Energiesprong/Stroomversnelling renovation is financed by future energy saving costs plus the budget for planned maintenance and repairs over the coming 30 years. Consumers' energy plan cost is set at a level to hold the plan plus energy cost the same as the average pre-plan energy cost. For housing associations, tenants pay the housing association an energy service plan which is the equivalent of their previous energy supplier bill. The housing association can use this new income stream to partly fund the renovation works. Typically, legislation needs to be amended to allow such a conversion of the monthly energy bill into a monthly energy service fee for the housing association. The average energy bill for a Dutch household amounts to €2,200 per year, which equals to the amount that will be saved annually after renovations take place.⁵¹

Funding criteria are more stringent for the 30-year loan as compared to a 10-15-year loan, requiring projects to carry out additional renovations. Credit ratings are based on the housing associations and not individual tenants/owners. Housing associations must consist of 10 or more individual apartments. Furthermore, Energiesprong has received support from: members of Stroomversnelling, Ministry of Interior and Kingdom relations, Innovation programme Horizon2020/Transition Zero and Interreg North-West Europe/ E=0.⁵²

The business case for the investment

In order to make the financial case the social housing provider takes a 30-year perspective of the costs and revenues from the investment. At the moment this business case rests on a high degree of public subsidy and the low cost of finance enjoyed by ALMOs. The economics of the programme are expected to improve as the off-site production costs fall with volume to replace the public subsidy.

The investment costs is currently around £70k per home. Around £30k of the 'revenue' from the investment arises from the discounted future receipts from energy plans payments by the tenant and the avoided costs of planned repairs and maintenance of the new energy systems. The solution provider is responsible for the repair and maintenance of the equipment they supply.

47 <https://www.dmo.gov.uk/responsibilities/local-authority-lending-pwlb/interest-rates/>

48 per com Nottingham City Homes

49 <https://www.energiebespaarlening.nl/over-ons/>

50 <https://www.energiebespaarlening.nl/wp-content/uploads/2019/01/Factsheet-VvE-30-Jaar.pdf>

51 <https://transitiepraktijk.nl/nl/experiment/example/energiesprong>

52 <https://energiesprong.org/country/the-netherlands/>

The level of the energy plan charge is set by the social housing provider. As a result of the occupants being in fuel-poverty, they underheated their homes. The heating bills averaged £1000 per year and ranged between £600 and £1800. This average is lower than the modelled cost of maintaining the home at a comfortable temperature. As a result of the under-heating the actual reduction in energy use, hence cost savings, following the investment is less than implied by the 80% improvement in the home's energy efficiency as the occupants are enjoying warmer homes.

7.2. Cost of credit and the management of credit risk

Because of the high unit capital costs of the scheme, the financial viability of Energiesprong is highly influenced by the cost of capital charged the building owner pays on the debt, and also the unit costs of gas/electricity. The cost of capital to social housing providers differs markedly between countries depending on the local policies to support them.

The social housing provider borrowing money for energy efficiency loans has a responsibility to manage the risks to ensure repayment can be made to the creditors. The loans sit on the balance sheet of the social housing provider and the cost of the financed is determined by the credit-worthiness of the owner and is unrelated to the credit-worthiness of the tenant. There are a number of distinctive risks in undertaking the construction and operating the property that need to be allocated:

- *Cost/time overruns* – risk borne by solution provider. Duration of on-site work is reduced to a few days, so the costs of finance associated with delay are trivial;
- *Technology failures* – long-term warranty covering failure of equipment & extensive monitoring of building's comfort & consumer behaviour to ensure fair usage by customer. The warranty periods on the equipment stretch much longer than the likely longevity of many construction firms. Interviewees indicated that with very long term-warranties the solution provider is forced to design and construct the product to minimise common failures like perishable seals, unnecessary moving parts;
- *Consumer default* – repayment is collected from the metered energy supply, so failure to pay could result in disconnection from energy. Housing provider provides debt advisor / financial inclusion advice to avoid this eventuality by extending credit & advice.
- *Interest rate increases* – the local authority blends different tenors of debt to maintain a fixed and low medium-term interest rate
- *Credit scoring* – the provider is seeking to reduce fuel poverty and does not use credit scores to allocate credit or set individual interest rates. The energy charge *reduces* the overall energy costs and increases disposable income reducing the risk of falling into arrears.

Current limitations

Currently well suited for 1950-1970s homes where conservation concerns are minimal & the external façade is easiest to affix.

Social housing providers, as a result of right to buy, have gaps in ownership in a parade of homes. PWLB loans cannot be granted to private owners of homes and who have to find the capital costs for themselves. Programme managers for the say that the price of the home increases by 20% following the Energiesprong conversion, providing the owner £16k-£20k offset to the owner of their home.

To date the UK's financial incentives for energy efficiency and RE have not greatly supported Energiesprong conversions. Feed-in tariffs have are now closed, and even the export payments of 5p/kWh has been replaced by the less generous Smart Export Guarantee.

7.3. Lessons from the Energiesprong Programme for the EuroPACE

Energiesprong has a number of useful features that are of relevance to EuroPACE. It achieves scale by working with owners of multiple homes by using standardized solutions that can reduce costs, rather than trying to market

the product to individual homeowners. It sets its partners a near-zero target, an extremely demanding requirement, with a large number of measures that are simultaneously introduced. Many of the risks of the ambitious program of changes are transferred to the contractor through long-term warranties on the technologies.

The initiative is popular with tenants because retrofits are carried out quickly (within one week), with no net additional cost to tenants, they deliver comfort and they are visually appealing. Tenants can even preview how the retrofit might look, with the use of 3D glasses. This increases resident buy-in. Energiesprong is also successful because it provides a win-win model for everyone: the tenant has a warm dry home with a new kitchen and bathroom; the owner has a maintenance programme; and the contractor has a new source of income.³²

The programme has a couple of limitations. Firstly, the financing is currently reliant on the properties' owner securing favourable terms. Since social housing is generally supplied by local government or well capitalised not-for-profit organisations access to cheap capital is not a problem. This does not necessarily translate to individual homeowners. Secondly, for a deep retrofit to be commercially viable the pre-renovation energy costs have to be high. This means the economics of the programme works best in northern European countries where the cold winters drive up energy bills. It is less well suited to Mediterranean countries with lower energy bills.

8. Oktave

Oktave operates as a one stop shop connecting contractors, building professionals and financing organisations (banks). The service offers a holistic combination of technical support and financing of projects. It supports individuals in three pillars of energy renovation: project definition, renovation and financing.

Oktave provides households with technical advice to design and implement energy renovations; support to set up the financing plan for the works, which combines existing grants, tax rebates and commercial loans. It can be regarded as a complementary financing facility. The renovations are financed in the form of a debt attached to the property. Reimbursements rely on the perception of a contribution which can perhaps be collected through local taxes⁵³. In this context support includes connection with banks for loans, which could be zero-interest loans, or with third parties / ESCOs. For households without repayment capacity, the renovation plan is adapted so that the contribution may at most equal the expected energy savings. For the craftsmen, Oktave offers trainings.

Oktave was implemented in close co-operation with local refurbishment platforms set up by the partner local authorities, which implement a large part of the local activities. It however has no established partnerships with banks but arranges offers from banks and ESCOs instead⁵⁴.

Oktave endeavours to fulfil these objectives by:

1. **Providing access to referenced professionals** based on their training and experience in efficient energy renovation.
2. Providing **personalized support** by independent energy efficiency advisors on all technical, financial and administrative aspects of the renovation project;
3. Offering **indirect third-party financing**, in partnership with associations supporting the access to homeownership in the Grand Est and banking institutions. An advance fund also makes it possible to pre-finance the assistance of owners who cannot advance the large sums of money required for renovation work.

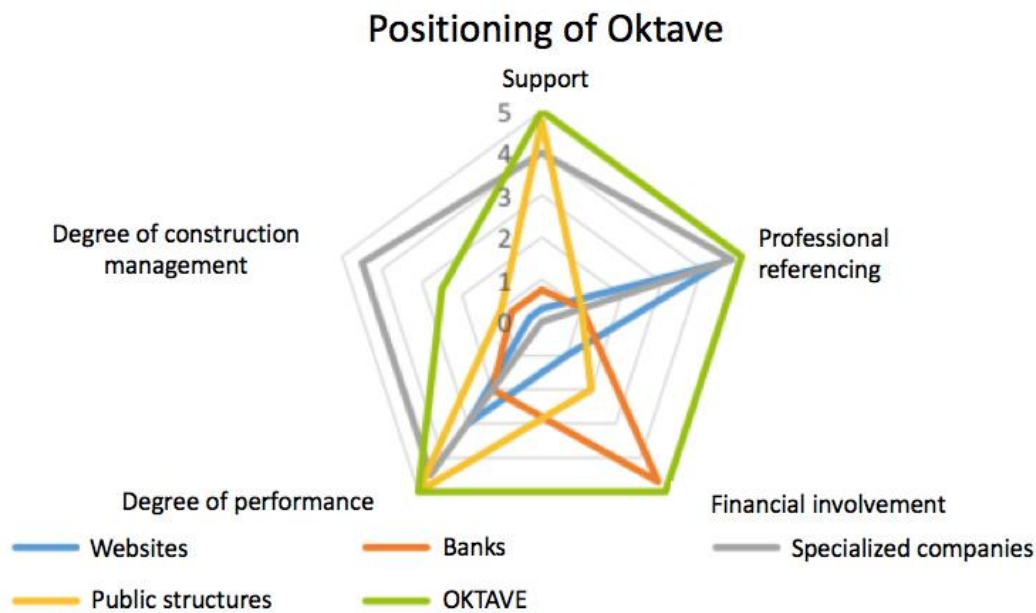
Oktave summarizes this multi-functionality, the links that Oktave creates between the different actors with a benchmark is presented below⁵⁵. Oktave strives to limit the cost of information for the consumer. Oktave is implemented in close co-operation with nine local refurbishment platforms set up by local authorities, which are the local one-stop service centers in relation with households.

53 <https://www.interregeurope.eu/policylearning/good-practices/item/379/psee-oktave/>

54 https://e3p.jrc.ec.europa.eu/sites/default/files/documents/publications/jrc113301_jrc113301_reportononestopsh op_2017_v12_pubsy_science_for_policy_.pdf

55 Rapport d'activité, Oktave, la rénovation à votre portée, 2014/2018 p22
https://www.oktave.fr/sites/oktave/files/actu/publishable_report_fr.pdf

Figure 8: Oktave's positioning



Renovations with Oktave support takes place in 8 steps:

- 1) Information gathering, first contact and welcome visit to Oktave.
- 2) Signing of the Oktave contract.
- 3) Mounting the renovation project with Oktave (choice of materials...)
- 4) Owner's decision.
- 5) Referral to nearby professionals, checking and comparing quotes, assistance in obtaining the assistance they can benefit from to propose a turnkey financing solution.
- 6) Financing agreement and signature of quotations with Oktave.
- 7) Carrying out the work and monitoring from A to Z.
- 8) Taking charge of the accommodation and follow-up by Oktave

For each renovation, Oktave proposes, in step 3, different renovation scenarios. Oktave's aim is to encourage individuals to opt for total renovations. Out of 180 experiments in 2018, 114 were partial renovations and 57 were total renovations.

8.1. Source of Finance for Lending

Oktave proposes to review the financial assistance to which the individual is entitled and to create the various files. This aid is equivalent to between 12 and 18% of the total amount of the work and comprises of local, regional, national and European aid.

The financial assistance Oktave uses most often⁵⁶ is:

- The Eco Zero Rate Loan (Eco PTZ) which can represent up to €30,000 of assistance for an energy renovation. The eco-PTZ is accessible to all owners and co-owners, occupants or lessors, who carry out energy renovation work. The dwelling must be at least 2 years old and declared as a principal residence. No means test is required, except your ability to repay the loan amount.
- The Energy Saving Certificate (CEE), which allows you to obtain up to €3,000 in assistance for the work undertaken.

⁵⁶ Oktave, Quelles aides financières pour ma rénovation énergétique

- The tax credit, about €5,000 for a couple with children and without credit.
- The zero-rate loan (PTZ), for first-time buyers, which is defined according to the location of the property, the price, and the family situation. One of the advantages of this system is the deferred payment.
- The specific aids of the ANAH according to income levels, degrees of renovation, etc.

Oktave also captures part of its income through the remuneration of its services and a 1% commission on loans. In 2014, it was expected that the packages (various prices described in section 4.b.) would yield €3,382,000 for 1000 renovations during the year.

In terms of legal structure, Oktave is a Société d'Economie Mixte (Semi Public Company, SPC) to attract funding from a wider group of investors (public authorities and private entities). This SPC is a third party financing company exercising an activity incorporating a technical facility (execution of works for reducing energy consumption) and a service including the total or partial financing of said works in exchange of regular and time-limited payment instalments.

Grand Est:

Grand Est is a region in France. Oktave can offer third party financing facility in partnership with the Grand Est SACICAP (socially beneficial cooperative companies for home ownership) and banks. A fund has also been set up to provide bridge funding for aid for home owners who cannot pay upfront the substantial costs of renovations

Procivis:

To shore up the service chain offered to customers, a trial third party financing phase was conducted with Procivis Alsace over two years (2015-2017). As part of this partnership between the Alsace Region and Procivis Alsace, the Region earmarked €500,000 to develop a third party financing activity: Procivis' role was to define the financing plans, advise on loan requests from individuals who had an agreed renovation project, and grant the loan (known as the 'Oktave' loan, zero interest during the trial phase)

Retail banks:

A call for expressions of interest was launched with retail banks to find a finance product for BBC energy renovation, attractive in terms of rates, upper limit and duration, on the banking market. Five retail banks signed up to the scheme (Caisse d'épargne d'Alsace, Crédit Mutuel, CICEst, Crédit Agricole, Banque Populaire).

From 2016 to 2018, the programme has successfully completed 180 projects, these include step by step renovations and whole-house renovations. The average cost of a single-family house reservation amounts to approximately €80,000. The number of supported renovation projects is projected to increase to 1,000 per year in 2021/2022.

No special partnership with banks but facilitates offers from banks and ESCOs. On average, 14% of the final renovation cost is covered by public subsidies and 63% by private loans. Total investments amount to €10.3m; share of private investments is 86% (23% personal contribution, 63% loans) and share of public grants is 14%.⁵⁷

8.2. Credit Underwriting Methodology

Oktave does not restrict the selection of homes that can benefit from its services, but it does require that a minimum energy performance is required after the work is completed.

⁵⁷ https://www.buildup.eu/sites/default/files/content/tr_d1.1_bpie_30_08_2019_fv.pdf

Although there are no selection criteria, Oktave has carried out a strategic segmentation. The SEM focuses on single-family houses and primarily targets the residential stock built before the first thermal regulation was introduced in 1975 and the most energy intensive (DPE E, F or G labels). That is 496,800 units in the Grand Est.

Oktave is open to tenants and non-occupier owners, but interacts mainly with owner-occupiers, who represent 59% of the main residences (2,358,000 units) but also with co-owners. Oktave's segments its priority target populations into home owners with fully or nearly fully-paid mortgages, high income households, and first time buyers.⁵⁸ To target the first-time buyer, Oktave has also entered into partnerships with real estate agencies that offer a renovation package included in the sale price of the house.

8.3. Interactions with local policy

Oktave is a service initially public and initiated by the Grand Est Region and the ADEME, which assists owners of individual houses in their complete renovation project. Oktave was launched to support the Regional Energy Transition Law for Green Growth. This law sets a national target of 500,000 major home renovations per year from 2017 and states that the entire building stock must achieve BBC energy performance by 2050. The Grand Est region has the ambition to renovate 1500 individual houses per year.

8.4. Mechanisms for customer to repay debt

Customer repayment here refers to the relationship between the resident and on-lending bank. In order to benefit from Oktave's services, the individual must pay a service fee. This fixed price is paid in 3 stages: first instalment at the signing of the Oktave contract, second instalment at the signing of the specifications for the start of the works and balance at the end of the works. There are three tariffs for this package: €3000, €4000 or €6000 depending on the project management as well as Oktave's involvement in the creation of the financing applications. Taking into account the effects of financial optimization, a study by Negawatt⁵⁹ in June 2018 found that support costs between €2000 and €3000 per support. This cost represents a maximum extension of 2 years of the monthly loan payments, which allows the household to finance the project support. The financial offer shall include at least the determination of the plan for financing the works, the identification of eligible aid and the assessment of the amount remaining to be paid by the contracting authority.

Oktave also offers an original service by putting customers in touch with partner banking institutions in order to facilitate the financing of all or part of the work. The loan offer will consist of short-term bullet loans to pre-finance the aid and long-term loans.

8.5. Benefits and risks to the parties

Benefits for households

Oktave supports its client in the construction of a financing plan. The idea is to limit the financial effort by compensating the cost of renovation by reducing the energy bill. The average energy bill in the Grand Est is €1750 per dwelling per year. Out of 118 experiments, the average price of partial energy renovation works is €50,000 for a 40% reduction in kWh usage while a complete renovation is €80,000 for an average gain of 61% in kWh.

Oktave's limitation compared to other platforms supporting energy renovation is that Oktave does not offer direct third-party financing. Indeed, Oktave only carries out indirect third-party financing since it is its partner, registered in the capital of Oktave, PROCIVIS Alsace, which pre-finances the financial aid to which households have access.

58 Rapport d'activité, Oktave, la rénovation à votre portée, 2014/2018 p22
https://www.oktave.fr/sites/oktave/files/actu/publishable_report_fr.pdf

59 <https://www.actu-environnement.com/media/pdf/news-31523-etude-negawatt-renovations-completes-BBC-p-recarite.pdf>

The fund therefore offers an advance in the form of a loan with zero interest rate. This advance makes it possible, in particular, to strengthen the household's file for the loan from its bank when it is subdivided into a work loan.

The financing of the construction work is the responsibility of the individual, although they do receive financial assistance at different levels: local, regional, national and European. Oktave contributes to the support of the financing application with the banks.

Benefits for on-lending institutions

Although Oktave does not directly finance the loan, the organisation is responsible for both mobilising the most favourable bank offers and supporting its customers in the repayment construction. Oktave having previously analysed and optimised the financial effort (burden of the loan offset by the reduction of the energy bill) that the individual will have to bear, the bank is more confident in the client's ability to repay. In addition, the advance of financial assistance is recorded as a contribution to the loan file.

Risks to the Parties

Since Oktave is only a platform that brings together households, organisations offering financial assistance, construction industries and financing offers, Oktave does not bear any risk. Credit risks are borne by entirely by lending banks.

8.6. Suitability of design features for EuroPACE

Conditions for Successful Implementation

Oktave's main aim is to improve the flow of information between the different partners. In order for successful implementation, there needs to be sufficient collection of technical and financial information needed for the scoping of the overall renovation project. The system must be interoperable with other information systems.

The partners who will share, update and use information include⁶⁰:

- The regional operator
- The project funders (retail banks, ANAH, CAF, pension funds, local authorities, etc.)
- Building professionals
- Local energy platforms and EIE advisers
- Home-owners looking to renovate their individual home

Secondly, annual energy cost is one of the most important factors in the homeowners' decision to implement energy efficiency measures. Hence, comprehensive evaluation of energy savings and a potential guarantee on energy savings may encourage energy efficient renovation of houses. At present it is less likely that a guarantee will be given due to uncertainties regarding energy savings potential and also in the context of varying household energy behaviour. However, such concepts exist for industrial and public buildings (the ESCO concept) and may emerge for residential buildings. It is possible that service providers may consider offering a guarantee on energy savings based on theoretical calculations. Also, it should be emphasised that the energy efficiency improvements bring along other benefits like improved thermal comfort or indoor air quality.

60 https://www.oktave.fr/sites/oktave/files/publishable_report_en.pdf

9. KfW

KfW's "Energy-efficient Construction and Refurbishment" programmes, coupled with the KfW Efficiency House Standard have become a household name in Germany. The Programme was established in 2006 to upgrade the building stock in East Germany. It has demonstrated that loan programmes can improve living conditions while generating business opportunities and employment in the buildings sector.

Since its establishment, KfW has helped over 5.2 million households make energy-efficient new-builds or refurbishments. It has issued close to €100bn in loans or grants to builders and renovators as part of its "Energy-efficient Construction and Refurbishment" programmes. By June 2019, KfW's promotional funding had triggered investments of over €340bn in building measures.⁶¹

Improving the country's building standard has contributed significantly to Germany's CO₂ mitigation targets. Since 2006, the emissions savings associated with these investments have accumulated to over 9 million tons annually.

KfW's programmes have also generated return flows to the Government from the construction and retrofit activities. The Value Added Tax (VAT), based on the present rate of 19 percent, exceeds the budget contribution to the KfW programmes. Including indirect taxes and effects on the public budgets by social contributions and reduced costs for unemployment, an external evaluation estimated that the Government is receiving around €4 for every euro it spent from the budget for the "Energy Efficient Construction and Retrofit" Programme.⁶²

9.1. Source of Finance for Lending

KfW's concessional lending is not direct and invokes an on-lending principle. Intermediary financial institutions (mostly commercial or public banks) on-lend KfW funds to their final customers. These on-lending financial institutions meet KfW criteria established in consultation with the respective federal ministries.

As an apex institution KfW is only refinancing loans issued by local retail banks. It does not compete with retail banks and KfW does not issue loans directly to final customers making the energy efficiency retrofits. The on-lending banks assess the creditworthiness of the customer and the viability of the investment. The credit risk remains with the on-lending bank.

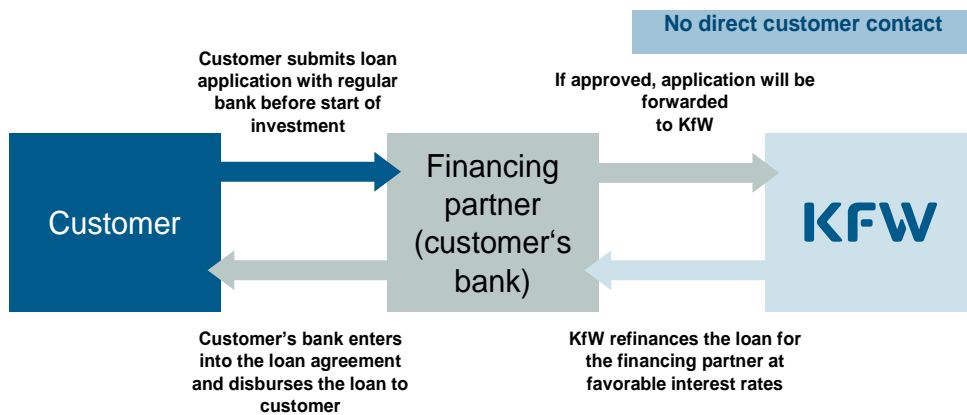
The model below depicts the two key relationships:

- 1) KfW's interactions with the financing partner (the customer's bank).
- 2) The financing partner (the customer's bank) and the customer investing in the retrofit.

61 https://ec.europa.eu/energy/sites/ener/files/documents/08_housing_bettina_dorendorf_kfw.pdf

62 https://wec-policies.enerdata.net/Documents/cases-studies/DE_Financing_energy_efficiency_buildings.pdf

Figure 9: KfW's on-lending principle



KfW is the source of financing for the local bank

Since 1948 KfW has been committed to improving economic, social and ecological living conditions all around the world on behalf of the Federal Republic of Germany and the federal states.⁶³ To do this, it supplied funds totalling €75.5bn in 2018 alone; of this total, 40% was spent on measures aimed at protecting the climate and the environment. KfW has no retail branches and does not hold any customer deposits. In 2018 a total of 144 bonds in 14 currencies with a total volume of €76.1bn were sold to institutional investors around the world.

Globally, KfW is one of the most active, non-governmental issuers in international capital markets with an annual issuance volume of around €60-80bn. Supported by the top credit standing of KfW Bankengruppe and the additional security provided by the direct guarantee of the Federal Republic of Germany all three financial rating agencies - Moody's, Scope Ratings and Standard&Poor's - have assigned KfW with a triple-A rating.

In 2018 KfW also continued its "green" capital markets strategy and successfully issued "Green Bonds – Made by KfW" in euros and Swedish krona. With an outstanding volume of €14.5bn by the end of 2018, KfW is the second largest green bond issuer among the promotional banks worldwide and the biggest issuer in Germany.

How does KfW finance the local bank?

The decision whether a loan application meets the promotional criteria rests with KfW. Generally, KfW requests the application to be fielded before starting the measures. KfW requests evidence that the envisaged measures correspond with the promotional criteria both at the time of application as well as after completion. The respective documents have to be issued by eligible energy auditors and they have to comply with KfW's quality criteria.

The customer has to meet the promotional conditions, or if in the course of checking the compliance with the promotional condition, it turns out that the investment does not meet the promotional condition, the loan is withdrawn, if it is already been paid out, the customer must redeem it immediately.

Under the law governing KfW [10], the German Government can mandate KfW to provide concessional loans at better terms than capital market refinancing. Funds from the federal budget are used to subsidise interest rates, as partial debt relief or provided as grants under conditions agreed upon with the Federal Government.

63 https://www.kfw-entwicklungsbank.de/PDF/Download-Center/Materialien/2018_Nr.6_Lessons-Learnt-from-Germany-and-Emerging-Economies.pdf

The promotional conditions (interest rates, scope of partial debt relief) are adjusted from time to time depending on a variety of factors (general interest rate development, availability of funds from the federal budget, market demand for promotional products).

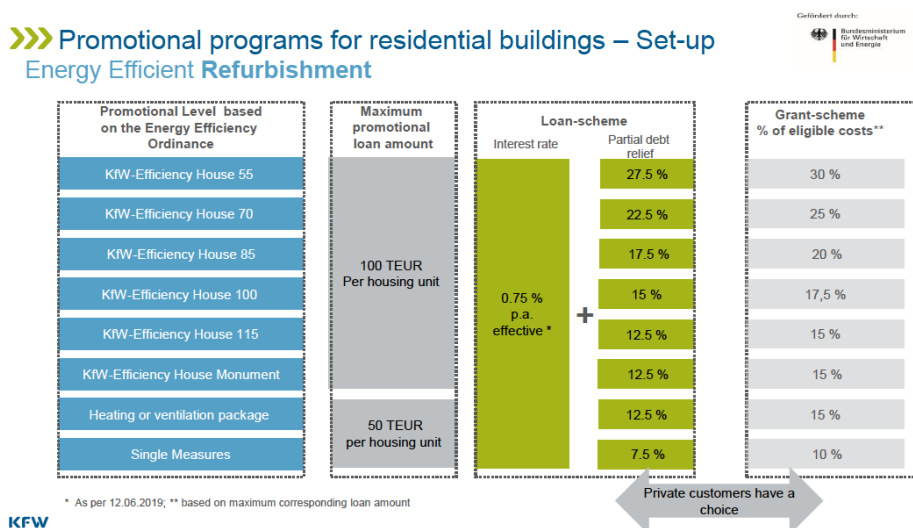
9.2. Credit Underwriting Methodology

- 1) The owner gets information about Energy efficiency refurbishment scheme from www.energiesparen.kfw.de
- 2) The owner engages an Energy Consultant who develops the concept/plan for refurbishment activities and uses an online tool to check if the project is suitable for promotion.
- 3) The owner submits the full online application process to the owner's bank, who then assess the creditworthiness of the owner and files the application for promotional loan.
- 4) KfW receives the documentation from the owner's bank, if approved, the loan is committed and disbursed. The owner has entered into an agreement with the owner's bank. KfW will provide the refinancing for this loan to the owner's bank,
- 5) The owner then carries out the refurbishment project and the Energy Consultant remains engaged on an ongoing consultancy or supervision basis to confirm the energy efficiency level reached.
- 6) The owner's bank then confirms that the promotional loan has been used in compliance with the promotional loan's conditions.
- 7) KfW books partial debt relief according to the energy efficiency level reached.

On request of the applicant and after approval of the on-lending bank, KfW will grant a loan up to a certain amount per dwelling. The interest rate for all levels of energy-efficiency improvements is identical; however, the programme rewards the achievement of the higher levels of energy efficiency improvements partial debt reliefs of the loan amount once the building has been completed and once it has been certified that it is complying with the criteria for the respective level. Considering the low interest rates of the German housing finance market that have been prevailing for quite some time, the partial debt relief is the main promotional incentive. It is staggered according to the achieved promotional level (see Fig. 8 below).

Figure 10: Promotional incentive scheme

Promotional programs for residential buildings – Set-up Energy Efficient Refurbishment



The eligibility for financing is based on objective and transparent promotional criteria. The criteria must be precise to avoid the misuse of funds. At the same time, they have to be concise and comprehensible, so that the final customer understands what documents must be provided. As some criteria are technical, based on regulatory

requirements or corresponding DIN standards, it is challenging to define the obligations in a practical way. KfW solved the issue by defining levels for building standards, described by the “Effizienzhaus” label.⁶⁴

Whether or not a building is fulfilling the promotional criteria is checked by an energy calculation using an asset rating. This is in line with the modalities of the calculation for the building permit. However, the requirements of the KfW programme are stricter regarding primary energy consumption and heat losses through the building envelop (peripheral surface) of the building. For the asset rating calculation several commercial software tools are available, covering the requirements both for the building code and the promotional programmes. Involving a qualified energy auditor during the design and application process is mandatory. The auditor has to certify that the calculation is correct and in line with the building design. Once the works have been completed, the auditor also certifies that it has been done in a way that the promotional level is reached.

A similar approach is in place for the comprehensive retrofit of buildings. It also focusses on an entire building but here single measures are being supported as well – like the insulation of walls, efficient windows or ventilation systems with heat recovery. This allows retrofitting a building step by step, as the economic effects of energy saving measures are higher if the works can be combined with due maintenance works.

For retrofit of buildings, the interest rate of the concessional loans and the step-up bonus are even more attractive than for new buildings. This reflects the fact that the specific costs of retrofit activities are higher than the incremental costs in new constructions. The maximum step-up bonus for retrofit to the highest energy efficiency category (“KfW-55”) currently amounts to 27.5% of the loan amount.⁶⁵

To meet the particular demand of certain groups of customers (owner of family homes, homeowner associations) pure grants can also be issued for retrofit as an alternative to concessional loans. Additionally, grants are available for the cost of advisory services by energy auditors when preparing and implementing a refurbishment project. These funds are also available to pay for the costs associated with the mandatory involvement of an energy expert during the process of application for a promotional loan or grant.

9.3. Interactions with local policy

KfW’s promotional programmes work alongside Germany’s policy mix for promoting energy efficiency. Indeed, KfW is mandated by the German government to implement promotional programmes which generally receive financial support from the federal budget. The KfW Programme Germany’s energy efficiency strategy and transpose the European Energy Efficiency Directive into its National Energy Efficiency Action Plan (NAPE), putting ‘Efficiency First’ as a guiding principle. The policy aims to reduce primary energy consumption by 20% by 2020, compared to 2008, and halve it by 2050.

The NAPE sets out the Energy Efficiency Strategy of the Federal Government by defining cross-sectoral measures for the benefit of stakeholders in both the residential and non-residential building sectors. The NAPE also aims to establish and scale energy efficiency as investable and scalable business models, with an underlying objective of improving energy efficiency in production processes.

The KfW programmes have created a ready supply of approximately 14,000 experienced and quality contractors (as of 2019). These contractors must be listed in a targeted register, which was developed in 2012 to support the

64 https://ec.europa.eu/energy/sites/ener/files/documents/08_housing_bettina_dorendorf_kfw.pdf

65 https://www.kfw-entwicklungsbank.de/PDF/Download-Center/Materialien/2018_Nr.6_Lessons-Learnt-from-Germany-and-Emerging-Economies.pdf

promotional programs. Listing on the register requires: proof of professional experience, re-listing every 3 years, ongoing training, and a AAA-list reputation among energy efficiency experts.

Creation of this fluid energy efficiency financing-ecosystem also increases the individual responsibility and accessibility of such investments for homeowners.

KfW's promotional system and the mandatory requirements of the Energy Saving Ordinance (EnEV) have aligned to use the same performance standards and technical requirements. For example, KfW's 'Effizienzhaus55' label translates the Energy Saving Ordinance (EnEV) requirement that the legally permissible primary energy demand of a building compliant with the Energy Saving Ordinance, is undercut by at least 20 percent.

This cohesion has enabled the Effizienzhaus label to be recognised as a performance standard, it is now utilised for investments that do not, themselves, utilize the programme.

9.4. Mechanism for Customer to repay debt

Customer repayment here refers to the relationship between the resident and on-lending bank.

There are different promotional levels offered by energy construction/ refurbishment, if it turns out that the customer does not meet the promotional level immediately targeted by the lower one, partly redemption of the grant has to be conducted. Or the customer benefits only from a lower degree of promotion.

The element of promotion offers a very low interest rate which applies to all promotional levels. But the most important promotional element is the partial debt relief which can be as high as 27.5% reduction in the loan. If it turns out that the level attained after the project is completed is lower than the one being targeted, then the customer would only be entitled to receive a loan relief at the lower applicable rate. The percentage always being in line with the promotional condition.

9.5. Benefits and risk allocations to the parties

For promotional customers:

- Attractive promotional conditions (flexibility – choice between loans and grants. financially attractive conditions: very low interest rate; partial debt relief;)
- Easy access to promotional product spectrum (web-based; customer bank)
- Professional client support through mandatory involvement of an energy expert
- Fast online approval process for promotional loan and grant products

For on-lending institutions (commercial banks/savings banks and insurance companies):

- Enhanced product spectrum for their clients, improvement of cross-selling potential
- Access to liquidity without capital market refinancing costs
- Attractive handling fee to compensate for on-lending activities
- Free of charge ongoing training and information for bank employees

For the public budget

- Additional income from VAT and social security contributions

Risk allocation to the parties

For the large-scale promotional products KfW work through financing partners, KfW does not take the end customer credit risk, this is borne by the financial partner, these are mostly corporate/financial institutions, but also insurance companies. End customer enters into a loan agreement with the credit institution and the customer comes to your office and asks for loan to refurbish the property. What you want, make sure is that the loan can

be redeemed by asking not only for proof of regular income, but also an assignment or a mortgage to act as collateral for the loan. Normal procedure. KfW provides the refinancing for this particular loan to the financing partner, the partner benefits from the fact that they do not have to refinance loan

Figure 11: Loan conditions

Energy Efficient Refurbishment – Loans Conditions

Loan amount:	<ul style="list-style-type: none"> › 50.000 EUR per housing unit for single measures › 100.000 EUR per housing unit for an Efficiency House
tenor:	› Up to 30 years
Fixed interest rate:	› First 10 years
Interest-free years:	› 1 to max. 5 years
Collateral:	› backed by normal banking security
Commitment fee:	› 12 months free, thereafter 0.15 % per month
Early repayment:	› Possible; full loan amount, early repayment fee
Combination:	› Possible with other promotional programmes

0.75 % eff. *

* Status: 12.06.2019

9.6. Suitability of design features for EuroPACE

KfW is supported by a government mandate. The long-term availability of public funds to support promotional programmes creates the basis for the development of promotional products. This budget is carefully managed to support the promotional products in accordance with market conditions and product strategy.

KfW offers a competitive capital market refinancing condition to on-lending banks, which dramatically lowers the cost of refinancing their loan books. The on-lending model creates a broad network of on-lending banks who conduct ongoing training and provide information on product development for financial institutions.

This network is complemented by an enabling environment of other stakeholders who also undergo ongoing training and share best practice to improve the market for energy efficiency, these include: owner associations, housing associations, all kinds of representatives of the building sector, representatives of the energy-efficiency industry, chambers of architects & engineers, chambers of commerce, chambers of craft, energy efficiency experts and actors across the political spectrum (ministries, members of parliament, political parties).

These stakeholders become familiar with KfW-Effizienzhaus, which becomes an established brand, that is used consistently as the basis for customer investment planning. This encourages further standardisation uptake of the KfW-Effizienzhaus standard, in turn, marketing of energy efficient houses becomes easier than standard homes.

Customer acquisition and retention continues to strengthen through ongoing improvements to product access. KfW has also created a digital application process to make it more customer-friendly. The "Bankdurchleitung Online 2.0 (BDO)" platform provides customers with direct confirmation regarding the eligibility of their application from their financing partners almost immediately. Owners of single- and double-occupancy homes

have been able to apply for all promotional grants online within a few moments using KfW's grant portal since November 2016.

The success of the KfW programmes has revealed valuable lessons on design features of relevance to the EuroPACE project. In particular, the KfW programmes:

- 1) **Integrate energy efficiency provisions into a clear framework for regulation, information and support for renewables.** This has created a strong, enforceable legal standard to underpin change and generate clear, consistent messages about the direction and radical nature of change required.
- 2) **Provide repayable loans on favourable terms, or performance-linked investment subsidies,** rather than unconditional subsidies or tax concessions, as a more reliable and sustainable funding mechanism.
- 3) **Provide qualified expert advice and installation so that appropriate work is carried out to a high standard.** As a result, the promised energy gains and a positive customer experience have been achieved, and over time the German construction industry has acquired great expertise in this area.
- 4) **Require investments in energy efficiency are made before subsidies for renewable energy are paid.** This increases the proportionate contribution renewable energy can make to meeting overall demand, saves money, makes a bigger contribution to the wider goal of climate protection, and provides a more coherent overall message to the public about the need to reduce CO₂ emissions.
- 5) **Adopt a 'whole house approach' to energy saving,** even if measures are adopted piecemeal, and high energy efficiency measures only implemented bit by bit as people work on different parts of their houses. This enables the overall ambition for energy efficiency improvement to become clear for energy suppliers and builders, while giving some assurance to government that the required emission reductions will be achieved.
- 6) **Support experimentation and innovation,** to build awareness and familiarity for new approaches to energy efficiency, and to identify successful approaches that can be taken to scale.

10. Summary of Programmes and Readiness

10.1. Country programmes

Belgium

Energy efficiency financing programmes in Belgium are available across the Flanders, Walloon and Brussels-Capital regions. Low income tenants in Brussels may apply for the green loan scheme, which is offered at 0% and supported by guarantee funds. Similarly, in Flanders, the Fund for the Reduction of the Global Cost of Energy (FRGE) aims to help the most vulnerable persons obtain assistance through a local subsidiary when selecting appropriate measures, executing the instalments and making payments. In practice these tenants are long-term tenants and the landlords can accept an engagement of co-financing or lower the loan or guarantee a minimum duration of rental contract. The tenant stays responsible for repayments of the loans.⁶⁶

In the Walloon Region, the Financial Incentives for Energy Savings Investments in Buildings (HOU-BEL30)⁶⁷ measure, comprised of both subsidies and loans, supports projects in terms of RUE associated with buildings (excluding public sector buildings). 33 grants have been designed to promote investments in energy savings including (heating systems, domestic hot water, envelopes, ventilation and heat recovery and electrical/lighting consumption). The system was replaced in 2015 and is now only available to low-to-medium income households below €93,000 net revenue in dwellings that are at least 20 years old. The grant increases for lower income and is multiplied by 1.5 for household incomes below €41,100, and by 3 for household incomes below €21,900. The overall budget of these grants has reduced from €65m to €40m, they have also reduced in scope to only cover energy audits, roof insulation, wall insulation, floor insulation and heating systems (gas condensing boilers, heat pumps, biomass boilers and solar water heaters). Besides the subsidies, 0% interest rate 'Ecopack' loans are also granted, for investments in roof, wall and floor insulation, which are awarded through either the FWL (Fonds wallon du Logement) or the SWCS (Société wallonne du Crédit social).

Portugal

Portugal has implemented several energy efficiency lending programmes for which homeowners can apply through private sector banks. These ensure that EU funding sources to supplement capital are sourced from the private sector or the Portuguese government. These include: Casa Eficiente 2020, IFRRU 2020 and Linha BPI. The financing conditions for the home owner are agreed case-by-case by the lending bank.

The Efficient Home 2020 programme is managed by the Portuguese Confederation of Construction and Real State and co-financed by the EIB and private Portuguese banks (CGD, Millenium BCP and Novo Banco). IFRRU 2020 is another programme that is approved by the Regional Operational Programs (POR), the Mainland and the Autonomous Regions and the thematic program Operational Sustainability and Resource Efficiency (PO SEUR). On average, loans can have terms of up to 20 years and meet a maximum of 75% of the overall project costs. So far, exact impacts are not certain however the BPI programme does set clear criteria expected energy savings aiming for CO₂ savings of at least 13 tCO₂eq/year and energy savings of 50,000 kWh/year.

Spain

Spain has three main energy efficiency lending schemes: PEREER, Cetelim Spain and ICO line. Managed by IDAE, PAREER programs are mainly focused in deep renovations in any type of buildings to improve EE of building façades or their heating, cooling and lighting installations as well as the replacement of conventional power. The beneficiaries are owners of all types of residential and other tertiary uses buildings. Retrofits can range from

⁶⁶<https://publications.jrc.ec.europa.eu/repository/bitstream/JRC89892/final%20report%20on%20financing%20ee%20in%20buildings.pdf>

⁶⁷ http://www.measures-odyssee-mure.eu/public/mure_pdf/household/BEL30.PDF

€30,000 to €4m. Cetelem services are user-friendly and works online. In particular, they provide an online calculator to get an estimate of loan conditions. Moreover, there's no need to change bank to apply to this loan. It's aimed to finance either residential homes and/or buildings that are seeking to improve energy consumption and install energy renewable measures. This financial product also serves communities that are willing to improve common spaces thus improving quality of life. ICO has more than 20 agreements with financial institutions. Loans can get up to €12.5m and the term of repayment can vary from 1 year to 20 years.

Of the three, PAREER by IDAE has showed remarkable results by renovating 42,491 dwellings to date. The multiplier effect of investments is €304m. In terms of savings, the project avoided 105,985 tCO₂/year and created 5,480 jobs.

Whether or not such energy efficiency financing projects will be viable in the long term depends, on the provision of financial resources at a low-cost and long-term. There are various key factors that influence the financial matrix and that have a strong impact upon the amount and forms of state participation within the renovation sector:

5. *Cost of Finance for Long-term Energy Savings:* The character of the renovation sector is determined by whether consumers can fund deep renovations over the long-term at low cost (5% for 20 years) as opposed to only having access to short-term finance at unsecured lending rates (9% for 5 years);
6. *Energy Prices:* The future evolution of Spanish energy prices, especially those (like gas) which have the most significant impact on the cost of home heating, is a critical determinant of the returns for deep renovation measures;
7. *CO₂ Value:* The ability for the household (or funder) to financially perceive the value of the CO₂ emissions savings commensurate with deep renovation actions can materially impact renovation rates, especially as prices rise over the 2020-2050 horizon;
8. *Technology Curve for Renovation:* It is likely that as sector momentum builds, firms that are serving this new market will find economies of scale, process efficiencies and labour savings as they renovate hundreds of thousands of Spanish homes per year as opposed to a few buildings.

The impact of low-cost, long-term financing for energy savings is fundamental and easy to illustrate: a deep renovation of an average Spanish home (E6 Mix for 81m² living space) saves 83% of the energy demand, or about €684 annually on the domestic energy bill. Financing gained at 9% for 5 years allows a capital available from future energy savings, for up-front investment of only €2,660. The same energy saving, with 20 years financing and an interest rate of 5%, would suppose an initial investment capacity of approximately €8,530. In a world where the cost of deep renovation for the average Spanish home is estimated at over €14,000, there will clearly be very little deep renovation if consumer finance is only offered at 9% for 5 years.

Table 4: Cost of finance

Country	Cost of interest	Subsidy *	Set by **	Underwriting***
Belgium	Differs depending on the region and borrower profile.	0% loan available	Grant size determined by household income	
Netherlands	Differs depending on the local policies to support	Local authority blends different tenors of debt to	Loan terms are set by the private	Scheme level borrowing by social housing provider

	them and unit cost of gas/electricity	maintain a fixed and low medium-term interest rate	banks providing them	and judged on their credit worthiness
Spain	Euribor+0.0%	Resources managed by the IDAE originate from the National energy Efficiency Fund, General State Budgets and IDAE's own financing.	Public agencies	Individual property level
Portugal	Schemes off a 0.25% discount	No subsidy	Commercial banks	Commercial banks, credit line for half loan from EIB

* Subsidy relative to the national rate

**Who sets it, private bank or public agency?

***Is the underwriting being done at scheme or individual property level?

10.2. Overview of the programmes

Energiesprong: The Energiesprong model aims to deliver standardised net-zero retrofits to multiple social housing units. By working with housing associations instead of individual homeowners, the scheme manages to achieve increased energy efficiency and exploit efficiencies of scale. An “Energiesprong” retrofit is provided for and financed by the housing association by combining future savings on energy cost from tenants, repairs and maintenance. The objective is that tenants have the same monthly expenses after the treatment as the savings in fuel cost finance the debt service. Tenants pay the housing association an “energy plan”, with an allowance for energy usage to achieve a guaranteed indoor temperature, hot water and electricity. The housing association uses revenue from the energy-plan to pay for the retrofit debt costs and electricity used for the heat pumps. In the Netherlands, the project has contracted 30,000 houses in the period of 2016-17, creating a working budget of €1.5m. Project performance differs per country and primary energy savings are 131 GWh/year, 97.5 GWh/year and 198 GWh/year for France, UK and the Netherlands respectively.⁶⁸

Oktave: Oktave is a one-stop-shop for different services connecting energy renovations contractors, building professionals and financing organisations. It provides support and clarity to individuals on energy renovation, project definition and financing. The programme has assisted 488 households, 160 step by step renovations, 56 whole-house renovations and 60 renovations in portfolio. So far, it has avoided 351tCO₂ and 1826 MWh in energy savings.⁶⁹ Current shareholders are; regional council, PROCIVIS and the national bank with an equity of €3m.

KfW: KfW, the German state-owned development bank, has long supported energy efficiency investments in residential buildings through the “Energy-efficient Construction and Refurbishment” programme (the KfW

68 https://energiesprong.org/wp-content/uploads/2017/04/EnergieSprong_UK-Transition_Zero_document.pdf

69 https://ec.europa.eu/info/sites/info/files/4.1_oktave_gaspard.pdf

programme) and Efficiency House standard. The KfW programme has been supporting energy saving in residential buildings since 2006, with over 5 million housing units, approximately 40% of which were newbuilds. The bank has issued close to €100bn in loans or grants to builders and renovators as the KfW programme, and by June 2019, KfW’s promotional funding had triggered investments of over €340bn in building measures, reducing CO₂ emissions by approximately 9 million tonnes per year.

Overall Assessment of the three programmes

Table 1 provides a clear overview of the basic features and functions of each project in order to draw links and comparative analyses across projects in different regions.

The **finance source** refers to the main sources of capital provided to maintain these programs or initiatives. Source type will differ depending on the service the programme offers. For example, KfW (indirectly) provides for loans and is therefore the main financial source. On the other hand, Oktave is an online platform serving as the “middle-man” and does not have loans sitting on their balance sheet and link capital providers and various funds to potential customers seeking loans.

Next, **credit underwriting** examines how lenders assess the creditworthiness of borrowers. These programmes offer due diligence and credit check services to lending institutions to minimise information asymmetry between parties.

Thirdly, the **risk allocation** differs between initiatives. In some cases the homeowners are entirely responsible for conducting renovations and loan repayments once they have been verified and approved by a certified energy expert (KfW), while Oktave and Energiesprong ensure homeowners have access to appropriate builders and contractors to execute refurbishments.

Lastly, there are **overlapping benefits** that stem from each programme. From a macroeconomic standpoint, all programs create jobs in the building industry. Furthermore, homeowners and housing associations gain access to more favourable loan terms for renovation purposes. Post-renovation, building values can increase by up to 25 percent.⁷⁰

Table 5: Comparison of schemes

	Energiesprong	KfW	Oktave
Finance Source	<ul style="list-style-type: none"> - Grants: EU’s ERDF and National Governments - Loans: NEF (Rabobank, ASN bank, CEB) 	<ul style="list-style-type: none"> - KfW on-lends to local banks 	<ul style="list-style-type: none"> - Mix of local, national and European aid - Energy Savings Certificate: provides up to €3000 - Tax credit: up-to €5000 for couples with children
Credit Underwriting	<ul style="list-style-type: none"> - Based on housing associations, not individual tenants. - Associations must consist of >10 individual units. 	<ul style="list-style-type: none"> - Local bank assesses creditworthiness of applicants and ensures that use of promotional loans complies with KfW’s conditions 	<ul style="list-style-type: none"> - No restriction on eligibility - Follows an SEM focusing on single-family houses and targets residential blocks

⁷⁰ <https://www.cibsejournal.com/case-studies/a-forward-leap-how-dutch-housing-process-energiesprong-guarantees-performance/>

<p>Risk Allocation</p>	<ul style="list-style-type: none"> - Social housing provider: responsible for debt repayment - Solution provider: costs of finance associated with cost/time overruns, technology failures 	<ul style="list-style-type: none"> - Homeowner: responsible for carrying out refurbishment project and debt repayment 	<ul style="list-style-type: none"> - Oktave is a connecting platform offering financial assistance and therefore does not bear any risk. - Credit risks are borne by banks as usual loans
<p>Overlapping Benefits</p>	<ul style="list-style-type: none"> - Once debt is repaid, tenants' disposable income increases by €2,200 - Job creation for the next decade - Increase in property value 	<ul style="list-style-type: none"> - Homeowner: generous loan conditions, efficient approval process - Commercial banks: enhanced product spectrum, increased liquidity - Public: additional income tax and social security contributions - KfW: no branch network necessary, diversification of risks 	<ul style="list-style-type: none"> - Households: full support during construction and financial planning phase - Commercial bank: relieved from due diligence work and offered the most favourable offers that ensures repayment

10.3. Market potential by technology/solution

The potential for each market (Belgium, Spain, Portugal and the Netherlands) was assessed considering current annual renovation rate, housing stock and average renovation budget from the previous chapter. Each market's potential are fundamental inputs to assess EuroPACE's lending potential as we will discuss later on. Such market potential was established as a range between the current trends and a 5% yearly growth.

Considering the current figures on market stock and renovation rates we find that the yearly renovation works are around 122,000 in these markets together. Applying the average budget for each market we find that the spending in renovation works are approximately €2.3bn per year. If we apply a 5% annual growth rate in the renovation rate, we could reach a market spending potential of more than €12bn in the next 5 years and almost €30bn in the next 10 years.

Current Market Indicators for Belgium, Spain, Portugal and the Netherlands:

Based on the data depicted in previous sections of the document, the table below summarizes the existing housing stock, renovation rate for each market and estimated average budget:

Current Market Indicators	Belgium	Spain	Portugal	Netherlands
Housing stock	4.911.973	18.535.900	5.900.000	7.800.000
Renovation rate	0,33%	0,08%	0,08%	1,10%
Average budget	20.000 €	12.000 €	12.000 €	20.000 €

Source: Zebra2020

(*) no data available for renovation rate in Portugal – considered the same as Spain for projections

Projected market spending for renovation works applying no growth on renovation rate and other factors.

Based on the current market indicators (see previous table), the table below shows a 10-year projection of the estimated market spending in home renovations. As a conservative assumption, no growth is applied. An estimated annual spending of approximately €2.3bn per year in these 4 markets together.

Market Spending (000 €)	1	2	3	4	5	6	7	8	9	10	Total (10y)
Belgium	324.190	324.190	324.190	324.190	324.190	324.190	324.190	324.190	324.190	324.190	3.241.902
Spain	177.945	177.945	177.945	177.945	177.945	177.945	177.945	177.945	177.945	177.945	1.779.446
Portugal	56.640	56.640	56.640	56.640	56.640	56.640	56.640	56.640	56.640	56.640	566.400
Netherlands	1.716.000	1.716.000	1.716.000	1.716.000	1.716.000	1.716.000	1.716.000	1.716.000	1.716.000	1.716.000	17.160.000
Total (/year)	2.274.775	2.274.775	2.274.775	2.274.775	2.274.775	2.274.775	2.274.775	2.274.775	2.274.775	2.274.775	22.747.749

Projected market spending for renovation works applying 5% annual growth on renovation rate.

The following table shows housing renovation market spending applying a 5% annual growth on the renovation rate. The accumulated total is an estimated spending on housing renovations of almost €30bn on 10 years.

Market Spending (000 €)	1	2	3	4	5	6	7	8	9	10	Total (10y)
Belgium	324.190	340.400	357.420	375.291	394.055	413.758	434.446	456.168	478.977	502.925	4.077.630
Spain	177.945	186.842	196.184	205.993	216.293	227.107	238.463	250.386	262.905	276.051	2.238.169
Portugal	56.640	59.472	62.446	65.568	68.846	72.289	75.903	79.698	83.683	87.867	712.412
Netherlands	1.716.000	1.801.800	1.891.890	1.986.485	2.085.809	2.190.099	2.299.604	2.414.584	2.535.314	2.662.079	21.583.664
Total (/year)	2.274.775	2.388.514	2.507.939	2.633.336	2.765.003	2.903.253	3.048.416	3.200.837	3.360.878	3.528.922	28.611.874

10.4. Lending potential and initial pipeline

EuroPACE's lending potential is based on four main drivers: housing stock, renovation rate, penetration rate and average budget for renovation. Projections start with the current renovation rate applied to the housing stock and estimated average budget per renovation. The result is the estimated housing renovation market (in euros). The starting point for EuroPACE's projections takes into account that it is an innovative financial instrument and the go-to-market strategy developed in Olot. Therefore, it is expected a low demand from homeowners at the beginning that increases as marketing strategies are implemented and trust in the program grows. Then, in the following years, a conservative growth rate is applied improving not only EuroPACE's penetration rate in the housing renovation market but in the market's renovation rate as well. One of the assumptions is that the market will be positively affected by EuroPACE and the average renovation rate will increase as homeowners' awareness increase as well. It is estimated that the renovation rate in Belgium and Spain improves by 5 basis points (bp) every year, and 2 bp for the Netherlands. As there is no data available for Portugal, it is estimated the same renovation rates as Spain. Nevertheless, other new or on-going local initiatives and schemes will benefit from the improvement of renovation rates in those markets, so it is considered a maximum penetration rate for EuroPACE's financial instrument in each market. It is projected that EuroPACE will have a faster grow in its penetration rate in Spain than in Belgium or the Netherlands, however it stabilizes after 7 years. Different implementation dates are projected for each country in order to reflect the complexity of setting up operations.

Projected dwellings' renovation rate during next 10 years.

Renovation rate in the first year are current rates in these countries. It is estimated that the renovation rate in Belgium and Spain improves by 5bp every year, and 2bp for the Netherlands.

Renovation rate	1	2	3	4	5	6	7	8	9	10
Belgium	0,33%	0,38%	0,43%	0,48%	0,53%	0,58%	0,63%	0,68%	0,73%	0,78%
Spain	0,08%	0,10%	0,15%	0,20%	0,25%	0,30%	0,35%	0,40%	0,45%	0,50%
Portugal	0,08%	0,10%	0,15%	0,20%	0,25%	0,30%	0,35%	0,40%	0,45%	0,50%
Netherlands	1,10%	1,12%	1,14%	1,16%	1,18%	1,20%	1,22%	1,24%	1,26%	1,28%

(*) no data available for renovation rate in Portugal – rates for Portugal are estimated the same as Spain

Projected EuroPACE's penetration rate.

The penetration of EuroPACE in the renovation market it is estimated below. The Spanish market projects a faster grow than the others, reflecting the complexity of setting up operations in different countries.

Penetration rate	1	2	3	4	5	6	7	8	9	10
Belgium				1%	3%	5%	7%	10%	14%	18%
Spain	1%	5%	8%	12%	17%	22%	24%	26%	27%	28%
Portugal			1%	3%	5%	7%	10%	14%	18%	22%
Netherlands					1%	3%	5%	7%	10%	14%

Projected EuroPACE's lending potential.

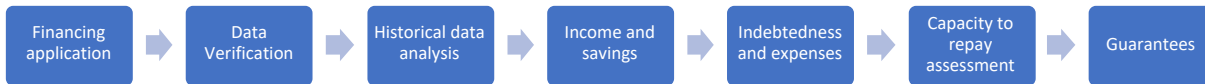
Applying projected renovation rate, the average budget per renovation and penetration rate to the housing stock, it is estimated that EuroPACE's lending potential is almost €4bn in the next 10 years.

Europace's Lending Potential (000 €)	1	2	3	4	5	6	7	8	9	10	Total (10y)
Belgium	0	0	0	4.715	15.620	28.489	43.324	66.803	100.401	137.928	397.280
Spain	2.966	18.536	44.486	88.972	157.555	244.674	311.403	385.547	450.422	519.005	2.223.567
Portugal	0	0	1.328	5.310	11.063	18.585	30.975	49.560	71.685	97.350	285.855
Netherlands	0	0	0	0	18.408	56.160	95.160	135.408	196.560	279.552	781.248
Total (/year)	2.966	18.536	45.814	98.998	202.646	347.908	480.862	637.318	819.068	1.033.835	3.687.950

10.5. Affordability tests for households

The affordability of the loans requested by homeowners (HO) is tested through a credit analysis process that evaluates many aspects related to their capacity to repay the loan. The analysis process is explained below.

Affordability test process



Homeowners start the process requesting financing for the OSS and receiving a list of documents to be analysed during the process. Having received the documents from the client, GNE Finance will verify if the HO has any overdue payment of bills, taxes and other loans. This verification is done through a national database that gathers information about bad payers shared by financial institutions, utilities and other providers. Its reports provide detailed information on the personal credit and payment history of individuals, indicating how they have honoured financial obligations (such as mortgage related payments, etc.). Additionally, GNE will analyse income, savings generated by the retrofit, indebtedness and employment status to assess HO's capacity to repay the loan. Considering the property as a guarantee of last resource, GNE Finance lean on a property value database to assess the value of the property and make the necessary adjustments on the loan amount, interest rate and term. By the end of the credit analysis, GNE Finance can either approve the loan request or deny it.

11. Recommendations for the EuroPACE programme

Financing a successful energy efficiency retrofit programme that reach a high proportion of older homes and including enough measures to make a dramatic reduction in energy needs is a huge challenge. This combination of depth and scale is something that has proved elusive to energy efficiency programmes run by member states (often with EU funding).

The first thing to note is that the success of an energy efficiency programme, depends to a large extent on the national context. Different countries vary in:

- their governments' readiness to provide subsidies to reduce the payback period of the loan programmes;
- the conditions of the housing stock and the extent to which building standards have already exploited the low hanging fruit; and
- national climatic conditions which effect the size of the energy bill and hence the realisable saving in energy costs from a deep retrofit programme.

This means that the EuroPACE proposition needs to be adjusted for the local circumstances. In particular it should take advantage of local subsidy programmes and provide information and assistance to homeowners to apply. Where funds for subsidy are limited there might be a limited window of time before the funds are exhausted. Therefore, the programme should target clusters of homes which are intrinsically harder to treat with poorly insulated envelopes where the improvement in the energy efficiency will deliver the greatest benefits.

A second point to note is that homeowners will often alternate sources of finance to fund their energy-efficiency retrofit. In particular home-owners mortgage providers might be able to increase the size of the existing mortgage to finance the added costs of the energy efficiency retrofit. The Energy Efficient Mortgages Initiative (EeMAP) is a noteworthy initiative being piloted by many banks in the EU which is seeking to create standards and data protocols for energy efficient mortgages. However, the cost of increasing an existing mortgage can also be substantial and be more costly than an additional loan.

Furthermore, there is ample evidence from decades of energy efficiency programmes that simply providing finance, even at a discounted rate of interest, is not enough to motivate the scale and depth of energy efficiency retrofits needed to achieve the EU carbon saving goals.

To reach these goals the programme design and marketing must be carefully considered. A loan-based energy efficiency programme, such as EuroPACE, is both a business proposition and a transformational delivery programme. It therefore has to navigate green finance and behavioural science. To be successful business proposition, the usual criteria used to evaluate business decisions have to be applied: relative costs of measures and savings in energy bills, size of market, physical appeal of the measures, convenience of the process and risk to the different parties.

The different parties in this business transaction different priorities:

- *Tenants*: retrofits should be carried out quickly and without hassle, at no net additional cost to tenants, they should deliver comfort and be visually appealing. Resident buy-in can be increased if tenants can preview how retrofit will look like through simulation, and if other people they trust recommend it.
- *Owner*: the capital outlays are as low as possible, the debt service costs can be reliably recouped from the tenant, hassle of organising and financing are minimised, little effort needed to ensure maintenance of measures and the risk of poor installation or equipment failure is borne by the installer.
- *Lender*: high volume of loans, high value of loans, lending is secured on an asset which can be easily liquidated if the loan defaults, or some other reliable form of guarantee is supplied. The lender is not exposed to risks that they are not responsible for managing, or which they have not been priced.

- *Contractor*: new and continuous market. Technology is reliable and can be installed and maintained with minimal extra training.

In terms of the market failures identified in section 3.2 the case studies reviewed provide a number of learnings to the EuroPACE project.

Lowering cost of finance: A number of the schemes reviewed have achieved reductions in the interest charged relative to the market rate. For instance, a 0% of interest is charged in Belgium and Oktave (Eco Zero Rate Loan - Eco PTZ). These piggy-back on existing loan programmes provided by the national or regional governments. The main innovation offered by Oktave is simplifying the task of finding existing government subsidies the participating homeowner is entitled to. The scheme needs to also minimise the administration cost of the loan borne by the owner. Oktave for instance limits this to 1% of the money borrowed.

Shortening payback periods of measures: a number of the schemes offer grants to defray part of the capital costs of the interventions improving the payback of the investment. The best example of this, KfW increases the level of the grant according to the level of energy efficiency attained by the retrofit both improving the payback period and encouraging the building owner to be more ambitious. The Energiesprong seeks to reduce the capital cost of the measures by exploiting economies of scale, treating many homes at a time and fabricating the measures to be installed off-site. The most effective way of reducing the payback period to provide energy efficiency grants or feed-in tariffs is determined by the government and is outside the control of the EuroPACE programme. But perhaps regions or cities that are able to offer KfW style incentives should be targeted. Oktave targets home constructed before 1975 when France introduced thermal building regulatory standards thus targeting the least energy efficient homes.

Piece-meal implementation: KfW have adopted a unique approach where deep retrofits trigger higher percentage rates of subsidy. Energiesprong has gone further in the sense that the programme requires treated home to be net-zero obliging all social housing providers (the group targeted by the programme) wishing to participate to adopt a highly ambitious cluster of measures.

Knowledge gap: the case studies show a number of different approaches to bridging the knowledge gap and helping homeowners select the best treatments for them. The lowest-cost option is to develop a web-based energy-use calculator in which the consumer enters information about their home and the calculator proposes and ranks measures. Such an approach is used by the Portuguese examples. However, take-up is low suggesting they are ineffective at driving up demand. Oktave's one-stop shop, and the KfW schemes go a step further and put the consumer in touch with qualified and certified contractors. Oktave provides access to an independent advisor that assists the consumer through the process of selecting and managing the contractors.

Fragmented market: The only program reviewed here that sought to aggregate consumers within a locality was Energiesprong which seeks social housing providers with large numbers of housing units. EuroPACE should try to identify partner towns with similar homes in geographical proximity to increase potential savings per unit.

Split-incentives: most of the programmes implicitly target owner-occupiers. The only exception is the Energiesprong which targets social housing providers that are interested in the environmental and fuel-poverty benefits of the deep retrofits.

Risk mitigation:

Risks borne by consumers: Energiesprong took the most ambitious approach to managing risks of equipment failure / non-performance by insisting that manufacturers provide long term warranties or insurance policies to ensure performance. The homeowner was also guaranteed a specified level of improvement in energy efficiency backed up with sophisticated monitoring of energy use and temperatures.



Developing, piloting and standardising on-tax financing for residential energy efficiency retrofits in European cities and regions

Credit risk: In the examples surveyed banks and other mortgage providers used their usual underwriting criteria to set the interest rate based on borrowers' credit risk. The Portuguese Linha BPI/BEI Eficiência Energética receives a portfolio level guarantee from EIB to protect the lender against credit risk. This might have a minor positive impact on the interest rate offered. The approach of protecting lenders against credit risk is through providing a lien against the mortgage used by PACE in the USA has never been attempted in Europe.