

Improving energy efficiency in buildings

A policy brief from the Policy Learning Platform
on low-carbon economy

August 2017



**Interreg
Europe**



European Union | European Regional Development Fund



Introduction

Buildings of all types in Europe account for 40% of its energy consumption, 36% of its CO₂ emissions¹ and 55% of its electricity consumption². This means that savings of emissions and energy in buildings is vital to meeting the EU's climate and energy targets. Building renovation is another important way to tackle fuel poverty. To date, renovation rates remain low in the EU and renovating the existing building stock to make it more energy efficient remains a challenge. Even more so when considering the ambitious levels set by the Energy Performance of Buildings Directive which includes aims for nearly zero-energy buildings (nZEBs). Increasing the rate at which existing buildings are renovated to at least 2 to 3%, and certainly more for the public sector, per year until 2030 is a key objective of the EU's Resource Efficiency agenda. [The Energy Efficiency Directive](#) (EED) (2012/27/EU) identified the existing building stock as *“the single biggest potential sector for energy savings... crucial to achieving the Union objective of reducing greenhouse gas emissions by 80 to 95% by 2050 compared to 1990.”* These issues are picked up in several Interreg Europe projects, for example [BUILD2LC](#) and [REBUS](#) look at energy efficient refurbishment of buildings; [FINERPOL](#) investigates financial instruments for energy renovation and [Social Green](#) works with greening the social housing sector.

1. Renovation potential in the EU

Much of the European building stock is in need of renovation. More than 40% of it was built before 1960 and 90% before 1990³. Most of these buildings will still be standing in 2050⁴. Each year, new construction in Europe represents about 1% of building stock⁴. The total building stock is growing continuously, with the rate of newly constructed buildings exceeding the rate at which old buildings are demolished. Still, the demolition and construction rates are relatively low. For example, between 1980 and 2005 in eight EU countries the average annual demolition rate for residential buildings was about 0.1%, with the annual new construction rate between 1% and 1.5%⁵. By large, the remaining building stock consists of the older buildings, many of which are in need of renovations.

A precise estimation of renovation needs across Europe, however, is not that easy to obtain. There is a lack of consistent and accurate data. Official statistics agencies do not report on this, and the estimates come from a combination of housing condition surveys, construction

¹ <https://ec.europa.eu/energy/en/topics/energy-efficiency/buildings>.

² http://cordis.europa.eu/result/rcn/186598_en.html.

³ Itard, L., 2008. Building Renovation and Modernization in Europe: State of the Art Review.

⁴ The Economist, 2013. Investing in energy efficiency in Europe's buildings. A view from the construction and real estate sectors.

⁵ Itard, L. and Meijer, F., 2008. [Towards a sustainable Northern European housing stock: figures, facts and future](#).



market value surveys and one-off surveys. [A 2016 review](#) of the data estimates the annual ratio of renovation needs at 0,5 to 2,5% of Europe's building stock, with a typical figure being 1% or about 250 million m² per year.⁶

The definition of energy efficient renovation varies across EU legislation and in practice, with a variety of 'depths' of renovation defined and carried out. Less extensive renovation can be described as 'piecemeal' or 'single-measures' – e.g. just PV panels or double-glazing. This reduces energy consumption by less than 'deep' renovation.⁷ The Buildings Performance Institute Europe (BPIE) (2011)⁸ use the following definitions of renovation levels alongside an estimate of their market share, expressed as a percentage of all renovations:

- *Minor renovations – 85% of the market.* 1 or 2 measures (e.g. a new boiler) reducing energy consumption by up to 30%, costing on average 60 EUR/m².
- *Moderate renovations – 10% of the market.* 3 to 5 improvements, e.g. insulation of relevant parts of the dwelling plus a new boiler, reducing energy use by 30% to 60%, costing on average 140 EUR/m².
- *Extensive renovations – 5% of the market.* a package of measures working together leading to an energy reduction of 60% to 90%, with average costs of 330 EUR/m².
- *Almost Zero-Energy Building renovations - negligible:* replacement or upgrade of all energy using elements plus installation of renewable to reduce energy consumption close to zero, with average costs of 580 EUR/m². The [ZEROCO2](#) Interreg Europe project looks at near zero CO₂ emission buildings, and lists multiple good practice examples of how they can be achieved.

The renovation potential of buildings in the EU is significant considering the age profile of buildings and the slow replacement rates. As stated earlier, more than 40% of EU's buildings were built before 1960. Based on the estimates that count 210 million buildings in the EU⁹, **up to 110 million buildings could be in need of renovation.** The study "Renovation tracks for Europe until 2050 – building renovation in Europe – what are the choices" concludes that by 2050¹⁰, 80% of the final energy use for heating can be saved by a deep renovation of the existing stock and by construction of new buildings that are nearly zero energy. The deep renovation of 3% of the building stock, or 25 billion m², would generate energy savings of approximately 100 TWh/y by 2020. If around 20% of the building stock was deeply renovated by 2030, it would save 750 TWh/y¹¹.

⁶ RESIDE project, 2015. Deliverable 1.1. A baseline scenario for energy efficiency renovations in Europe's residential buildings.

⁷ EP, 2016. [Implementation of the Energy Efficiency Directive \(2012/27/EU\): Energy Efficiency Obligation Schemes. European Implementation Assessment.](#)

⁸ Buildings Performance Institute Europe (BPIE), 2011. [Europe's Building under the Microscope: A Country-by-Country Review of the Energy Performance of Buildings](#)

⁹ Loebel, O., 2016. Opportunities and Challenges in Existing Buildings, the Renovate Europe Campaign, Advancements for Metal Buildings Congress, Ljubljana 22nd October 2016.

¹⁰ Ecofys, 2015. [The role of energy efficient buildings in the EU's future power system.](#)

¹¹ [http://www.europarl.europa.eu/RegData/etudes/STUD/2016/587326/IPOL_STU\(2016\)587326_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/STUD/2016/587326/IPOL_STU(2016)587326_EN.pdf)



The **investment required to renovate Europe's building stock** has been estimated to be around 1 trillion EUR.¹² Focusing less on energy efficiency and more on renewable energy supply, as an alternative to deep renovation, turns out to be roughly 3.5 % more expensive. Although costs of renovation differ per country, with labour costs likely to be a key factor in this variation.¹³ The Interreg Europe projects [FINERPOL](#) and [ZEROCO2](#) look at ways how financial instruments can be used to help pay for building renovation. In principle, all Interreg Europe projects that focus on energy in buildings look into financing mechanisms to some extent, for instance when identifying the good practices.

Building renovation also **generates employment**. A recent study¹⁴ estimated that in 2015 the **EU energy renovation market was worth approximately 109 billion EUR**, and supported 882,900 jobs.¹⁵ The French, German and Italian energy renovation markets account for almost half of the EU total. The German market is by far the largest, accounting for 22% of the EU total. Renovation accounts for 57% of the total construction market in Europe, with residential buildings accounting for 65% of the renovation market in 2015.¹⁶

Several Interreg Europe projects address energy efficient refurbishment of buildings. Below are two examples from [BUILD2LC](#) and [ZEROCO2](#) projects.



The [BUILD2LC](#) project aims to contribute to achieving the EU energy goals by improving the energy efficiency of public buildings when they are refurbished, with a view to reaching the ultimate goal of near zero energy buildings (nZEB). The project has been collating regional best practices under four headings: (1) new financial instruments; (2) professionalisation of the construction sector; (3) innovation; and (4) activation of demand and combating energy poverty. The report on these is now available on project's website¹⁷. Specific examples, selected from over 50 best practices, include:

- 100% online and simplified procedure for the request and justification of grants from the Incentives Programme for Sustainable Construction in Andalusia.

¹² IEA, 2014. [Special Report: World Energy Investment Outlook](#).

¹³ Ecofys, 2012. [Renovation tracks for Europe up to 2050](#).

¹⁴ Saheb, Y., 2016. [Energy Transition of the EU Building Stock. Unleashing the 4th Industrial Revolution in Europe](#).

¹⁵ The weighting coefficients used are 15% to assess the energy efficiency component of the renovation market is and 8.1 jobs per million invested, based on the US study by ACEEE, 2008. [The size of the US energy efficiency market: generating a more complete picture](#).

¹⁶ Saheb, Y., 2016. [Energy Transition of the EU Building Stock. Unleashing the 4th Industrial Revolution in Europe](#).

¹⁷ https://www.interregeurope.eu/fileadmin/user_upload/tx_tevprojects/library/BUILD2LC_Guide_Good%20Practices_2semester.pdf



- Standardisation and simplification in modernisation of multi-apartment buildings and public buildings in Lithuania.
- Actions in low income households to improve energy efficiency through visits and energy diagnosis in the UK.
- Rehabilitation of buildings and removal of asbestos in Poland.
- The Zagee project in Croatia, involving the reconstruction of public buildings in Zagreb via a Project Development Assistance instrument (PDA).
- Smart procurement in Sweden.
- Complete renovation of apartment buildings - System Dominum – in Slovenia.



The Promotion of near zero CO₂ emission buildings due to energy use ([ZEROCO2](#)) project focuses on the energy performance of buildings. It intends to design state-of-the-art policies at the local, regional and national level promoting near zero emission

buildings, present various financial tools in order to promote these types of buildings, and work on combinations of different technologies and energy efficiency sources, which could help achieve the EU's 2020 energy efficiency targets.

The project has recently completed a report¹⁸, which summarises the energy policies and best practices the project partners have identified. With regard to the energy efficient refurbishment of buildings, the report states that 70% of the buildings under the management of the ZEROCO2 partners were built during the 1980s. The partners recognise the challenge to adapt these buildings to achieve energy standards expected of new buildings. Only targeted national and regional policies and appropriate financial tools can reduce the gap between what can be easily achieved and what is required to achieve the energy efficiency levels that are necessary to reach the EU targets. The report features 15 good practice profiles, with eight of these focussing on the energy efficient refurbishment of buildings such as schools and apartments.

2. Overview of current policies to boost building renovation

The Energy Performance of Buildings Directive (EPBD)¹⁹, together with the Energy Efficiency Directive (EED)²⁰, the Renewable Energy Directive (RED)²¹, the Ecodesign Directive²² and Energy Labelling are the **key EU legislation** setting framework for long-term improvements in the energy performance of Europe's building stock.

The table below provides an overview of these policies and the **barriers that they address** related to the energy efficient refurbishment of buildings in the EU:

¹⁸ See the 'Common Report' at <https://www.interregeurope.eu/zeroco2/library/>

¹⁹ Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings.

²⁰ Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency.

²¹ Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources.

²² Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products.



EU building renovation policies classification according to the barriers addressed					
Policies	Financial barriers	Technical barriers	Processes barriers	Regulatory barriers	Awareness barriers
Energy Performance of Buildings Directive (EPBD)	√√	√√	√	√ Detailed building regulations delegated, but this sets limits, which should help consistency	√ Exemplary public sector + Building stock observatory
Energy Efficiency Directive (EED)	√	√	×	√ Some MSs have adjusted regulations as a result	√ Exemplary public sector
Renewable Energy Directive (RED)	√ (indirectly, as MSs have RES support tariffs to help meet the targets)	×	×	×	√ Exemplary public sector
Ecodesign & Energy Labelling Directive	×	√ Ecodesign	×	×	√√ Energy labelling
EU funds	√√ ERDF, Cohesion Fund, H2020, IEE, etc. providing grants and/or FIs	√ Build up skills (was part of IEE, now H2020)	×	×	×
Roadmap for the Energy Union	√√ Smart Financing for Smart Buildings	×	×	×	×

Source: Trinomics

- √ - Addresses the barrier to a certain extent.
- √√ - Addresses the barrier to a great extent.
- ×



Each member state has its own regulations regarding buildings and renovation, in line with the EPBD and EED. Analysis of the **member state policies** indicates that 43% are *financial and fiscal measures*, of which 90% are grants; 25% of the policies are *regulatory measures* - mostly directed at the implementation of the EPBD provisions regarding new buildings, and not renovations; and 13% of the policies are measures addressing issues such as *training and capacity building*.²³ The Interreg Europe projects [LOCARBO](#) and [Social Green](#) are exchanging successful policy measures aimed at increasing of energy efficiency in buildings.



The overall objective of [LOCARBO](#) is to improve policy instruments targeting demand-driven initiatives to increase energy efficiency related to the built environment. This is to be achieved by finding innovative ways for regional and local authorities to support behaviour change among energy

consumers. Good practices identified to date include:

- the Big Switch Off in the UK: a staff awareness campaign that aims to reduce building electricity consumption by encouraging behavioural change in building users;
- the implementation of the Energy Services Company (ESCO) model in Lithuania, including the main activities and new financial opportunities for the modernisation of industrial companies and public lighting provided by municipalities.



The objective of the [Social Green](#) project is to improve regional policy instruments linking the social housing sector and fuel poverty with green building interventions related to the policy, institutional, financial and technical levels. The project has produced a conceptual report, which concludes: “Europe has been facing a decline in its social housing stock since the 1990s, most dramatically in Central and East European countries. At the same time, fuel poverty, housing shortages, rising home prices, and aging social dwellings are growing problems in many major cities. Greening social housing – by improving insulation, energy use, and the domestic environment – can cut carbon emissions while improving quality of life for low-income groups. However, current practices and certification schemes lack harmonisation, and regulatory differences between countries can make the greening process slow and costly. There are additional social risks of greening social housing, as renovations can increase rental costs for tenants and contribute to gentrification.” Despite significant challenges, Social Green has developed a framework of good practices and tools that can provide inspiration to planners and policymakers wanting to engage with green social housing development.

²³ Saheb, Y., 2016. [Energy Transition of the EU Building Stock. Unleashing the 4th Industrial Revolution in Europe](#).



3. Examples of policies to boost building renovation

There are a wide range of voluntary and mandatory policy initiatives or schemes that are designed to stimulate the energy efficient renovation of buildings in the EU. The table below categorises some of the key policies. For some of these measures good practices of Interreg Europe projects have been added.

Categorisation of policy measures to boost building renovation	
Type	Examples of policy options
Regulatory	<ul style="list-style-type: none"> Mandatory building codes, set by each MS, in line with the Energy Performance of Buildings Directive (EPBD) requirements Minimum Energy Performance Standards (MEPS), e.g. UK's policy to require landlords to renovate their properties to a minimum energy standard before they can be rented out or when the tenant changes Refurbishment obligations, e.g. EED requirement for Member States to renovate 3% per year of the total floor area of buildings owned and occupied by the central government Energy Efficiency Obligation Schemes (EEOS), e.g. Danish EEOS, which has operated since the 1990s and has overachieved its annual energy saving target in every year except one. The Spanish approach where an EEOS equivalent is combined with Structural Funds to finance domestic energy efficiency investments
Financial and fiscal	<ul style="list-style-type: none"> Subsidies and financial instruments, e.g. the French Habiter Mieux programme and the German Reconstruction Credit Institute's (KfW) programmes, Slovakian Municipal Sustainable Energy Financing Facility (MunSEFF) facility financed by the European Bank for Reconstruction and Development (EBRD) and the EC. The Interreg Europe ZEROCO2 and BUILD2LC projects work with financial instruments. Grants for research, development and innovation (RDI) programmes, e.g. for nZEBs & smart meter roll-out, Horizon 2020. The Interreg Europe CLEAN project focusses on technologies and open innovation for low carbon Tax incentives (e.g. income tax incentives based on the renovation investment as a whole. In this case a maximum renovation expenditure allowance (in EUR per building) can be set against earnings to reduce the taxable amount and reduce the tax bill of the household or building owner. Examples of these measures can be found in Italy, France and Belgium Energy Service Company (ESCO). The Interreg Europe FINERPOL project features example of ESCO.
Information campaigns & Labelling	<ul style="list-style-type: none"> Awareness raising and information campaigns. The Interreg Europe LOCARBO project has identified several good practices on this. EU Energy Performance Certification (EPCs) (Voluntary) energy labelling schemes, e.g. BREEAM, LEED, HQE and Passive house institute EU ecodesign and energy labelling
Others	<ul style="list-style-type: none"> Voluntary and negotiated agreements. Example of a voluntary agreement would be a covenant where a housing association agrees to renovate their properties to reach a specific energy performance, e.g. energy label B, within a specific timeframe. This example requires a structured and regulated rental market. The Interreg Europe REBUS project works with this issue. Energy audits. The Interreg Europe EMPOWER and LOCARBO projects focus on monitoring energy use. Skills development and capacity building programmes, e.g. BUILD UP skills programme

Source: Adapted from Castellazzi L., Zangheri P., Paci D., 2016. [Synthesis Report on the assessment of Member States' building renovation strategies](#)

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Policy brief: low-carbon economy

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August 2017



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