

## Promotion of Sustainable Renovation in Europe

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# PROCEEDINGS OF ELCAS 2013

## 3<sup>RD</sup> INTERNATIONAL EXERGY, LIFE CYCLE ASSESSMENT & SUSTAINABILITY WORKSHOP & SYMPOSIUM



**ELCAS 3**  
**07- 09 JULY 2013**  
**NISYROS ISLAND, GREECE**

EUROPEAN COOPERATION IN SCIENCE AND TECHNOLOGY COST  
TU1104-SMART ENERGY REGIONS



**Edited by:**  
**Koroneos Christopher, Rovas Dimitrios & Dompros Aris**

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## PROMOTION OF SUSTAINABLE RENOVATION IN EUROPE

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### Abstract

It is well known that from the 160 million buildings in the EU the majority of them (estimated 85%) are thermally inefficient. Therefore, it is of serious matter that existing buildings become energy renovated. However, experiences gathered during the last decade showed that this process is not straightforward. This project will focus on early phases of a building project when the building owner still hasn't decided what to do and there is a possibility to influence the thoughts about renovation in order to plan for renovation measures that will make the building operate in a more sustainable way.

The main purpose of this study is to present the main aspects of initiatives in the field of energy upgrading of buildings in Europe today. Through a comprehensive literature review, light will be shed on issues related to both national policies and the main financial instruments that are currently pressing the energy renovation of buildings. Both the obstacles and the contribution of national regulations will be discussed, towards promotion of sustainable renovation in Europe today. This study is also expected to report on research initiatives currently being undertaken in Europe on the energy upgrade buildings, as well as on related research programs.

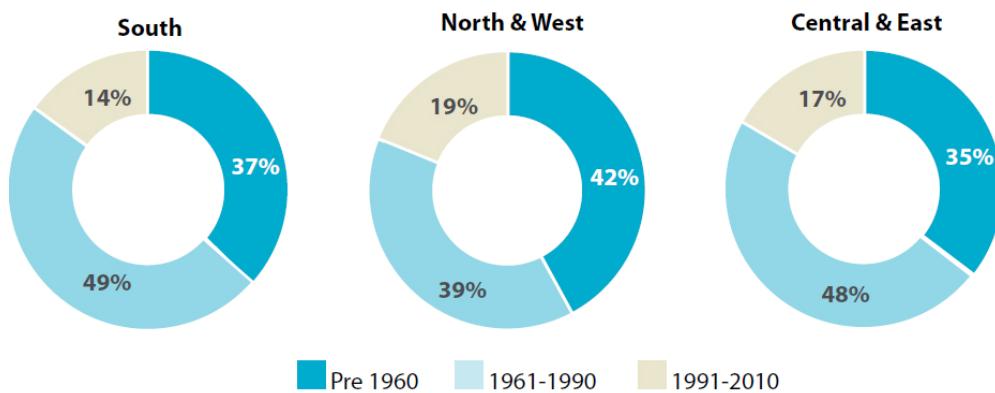
**Keywords:** Renovation, Europe, sustainable, buildings.

### 1. Introduction

The improvement of buildings' energy efficiency is currently one of the highest priorities of the energy policy of the European Union. The European directive 2002/91 and its recast set the necessary legal frame regarding the energy performance requirements of dwellings as well as non-residential buildings. As far as new buildings are concerned, the adoption of measures may easily be achieved by means of the legislative minimum energy requirements in building regulations. However the case of existing buildings is much more complex. Much of the existing building stock in Europe is due for renovation. Figure 1 shows the age categorization of building stock in southern, central and northern Europe. Member States must take measures to encourage existing buildings owners to renovate their properties by upgrading the buildings shell's thermal performance and to replace existing heating and cooling systems with high-efficiency appliances or renewable energy-based systems.

Energy savings through the renovation of the existing building stock is one of the most attractive and low cost options to reduce the emissions of CO<sub>2</sub> and potentially improve energy security by reducing imports of fossil fuels. Buildings' revitalisation strategies may have however much different impact depending on the climatic conditions of the

environment they are applied. High thermal mass buildings for instance which may be appropriate for the climates in central or northern Europe are not appropriate for the warm Mediterranean region, were light constructions are advised. Also the building conditioning conditions and the applied building services are much different in Europe, depending on whether the conditions of interest are winter or summer dominant. Studies carried out in the direction of defining the applicability of existing CEN standards for the calculation of buildings energy performance under summer dominant conditions, have shown that in terms of cooling loads a large gap between the calculated and the measured buildings energy performance. (Fokaides et al., 2011).



**Fig.1:** Age categorization of building stock in southern, central and northern Europe (Buildings Performance Institute Europe (BPIE), 2011)

By reducing energy consumption and focusing on indoor climate issues when renovating, co-benefits can be achieved such as reduced outlay on government subsidies, and improved health due to less air pollution and a better indoor climate, both of which also lead to fewer hospitalisations and improved worker productivity. (Fig. 2). In addition to the permanent benefits the energy renovations may bring, it is also expected that a much needed stimulus to the European economy at a time of economic underperformance, spare capacity and record low real interest rates in a number of countries will be produced. There are a range of co-benefits, which can also be harvested, in addition to the energy savings that renovation of the existing buildings stock will bring. Energy-related renovations could become a major source of revenue for Europe's construction sector. While most of the benefits from increased investments accrue to society as a whole, governments may also reap additional net revenue gains. A lower level of total energy consumption will reduce public spending on energy bills in e.g. public buildings and institutions, it will contain public spending through less hospitalization, it will imply a reduced need for subsidies to energy consumption, and facilitate the achievement of EU's 2020 renewable energy targets and reductions of greenhouse gases at a lower cost (Copenhagen Economics, 2012).

The promotion and expansion of sustainable renovation measures in Europe can only be achieved by opening up knowledge to communities and SME's in the construction sector. The implementation of state of the art techniques requires a strategy to enhance practical

application of renovation actions which can assure the mitigation of all negative impacts of non-sustainable urbanization.

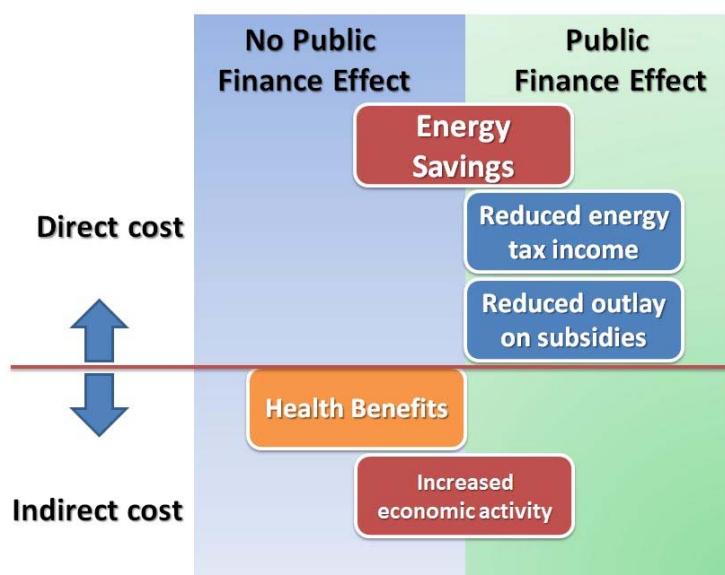
## 2. European policies towards promotion of buildings renovation

### 2.1 Europe's 2020 strategy

Europe 2020 is the EU's growth strategy for the coming decade. Concretely, the Union has set five ambitious objectives to be reached by 2020 in specific fields, energy being one of them. The 2020 energy strategy provides a solid and ambitious European framework for energy policy based around five pillars of action. These five priorities are

1. Achieving an energy-efficient Europe;
2. Building a truly pan-European integrated energy market;
3. Empowering consumers and achieving the highest level of safety and security;
4. Extending Europe's leadership in energy technology and innovation;
5. Strengthening the external dimension of the EU energy market.

Energy efficiency is one of the central objectives for 2020 as well as a key factor in achieving the long-term energy and climate goals. Europe is blessed with a vast amount of potential when it comes to saving energy. Estimates show that average energy savings for a household could amount to €1 000 per year. Ambitious objectives can be set and innovative solutions for immediate and long-term action should be developed, if more energy will be saved (COM (2010) 639).



**Figure 2: Effects of energy efficient renovation of buildings (Copenhagen Economics, 2012)**

The energy challenge is one of the greatest tests faced by Europe today. Rising energy prices and increasing dependence on energy imports jeopardise our security and our competitiveness. Key decisions have to be taken to reduce drastically emissions and fight climate change. Energy conservation is largely dominated by existing buildings. In most industrialized countries new buildings will only contribute 10% - 20 % additional energy consumption by 2050 whereas more than 80% will be influenced by the existing building stock. If building renovation continues at the current rate and with the present common policy, between one to over four centuries will be necessary to improve the building stock to the energy level of current new construction. Reuse of the existing housing stock in European countries is increasingly becoming a primary concern of European housing policy and practice because the annual production of new dwellings amounts to only about 1% of the housing stock (Thomsen and der Flier, 2002). However, changes in the social environment are changing the objectives of housing renovation policies in the era of sustainability. Though the intrinsic objective of improving housing quality remains the same, the political objective of renovation is changing little by little. For instance, in the past, when deterioration of housing quality became a social problem, improving the physical performance of housing by upgrading structural performance and maintenance was the main objective of renovation. However, since the 1980s when national welfare emerged as significant issue, improving housing for the elderly and the disabled became the main objectives of renovation policy in some countries. (Baek and Park, 2012)

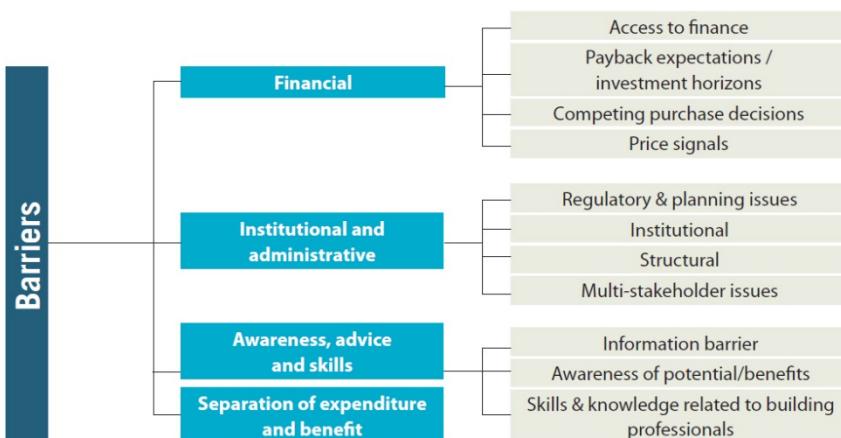
## **2.2 Financial instruments towards an energy efficient building stock**

Any strategy to tackle the challenge in the buildings sector will require a significant amount of financial investment and therefore long-term political commitment. Currently, all 27 Member States have on-going programmes to support the energy performance of existing buildings, either in form of conventional or innovative financing or through the help of external funding. Some Member States have a large range of financial support options, reflecting the needs of their wide range of building types. However, the level of ambition of financial programmes should be increased in order to create more impact and to unlock further private investments in deeper renovation. Very few programmes have set ex-ante goals and objectives, and few have an evaluation of their effectiveness. Few programmes have a constant monitoring process throughout their implementation. There is a need for greater use of common key performance indicators to make comparisons easier. The commonly used indicators for evaluation are: annual energy savings (TWh, GWh or toe); heating energy demand (kWh/m<sup>2</sup>a); CO<sub>2</sub> emission reduction (tonnes CO<sub>2</sub>/year); total number of applications or project rehabilitations; number of new jobs created (Maio et al, 2012).

## **2.3 Barriers hindering renovation uptake**

Experience over several decades has identified numerous barriers that hinder the uptake of renovation measures. In simple economic terms, the fact that there is a large untapped cost-effective potential for improving the energy performance of buildings is evidence that

consumers and investors, as well as society in general, are not keen on investing in energy saving. The fact that there is a large untapped cost-effective potential for improving the energy performance of buildings is evidence that consumers and investors, as well as society in general, are not keen on investing in energy efficiency. This human dimension combined with a variety of other factors need to be understood and addressed if an ambitious retrofit strategy is to be successful. It is a complex set of issues that impact all actors in the buildings chain. (Buildings Performance Institute Europe (BPIE), 2011). Renovation barriers can be classified according to the Fig. 3. While four of the classification categories specifically pertain to financial barriers, many of the other categories such as institutional, information separation of expenditure and benefit barriers also have a direct relationship with the need for financial instruments.



**Figure 3: Classification of barriers towards renovation (Buildings Performance Institute Europe (BPIE), 2011)**

## 2.4 The contribution of the national energy building codes

A key driver for implementing energy efficiency measures are the building energy codes, through which energy-related requirements are incorporated during the design or retrofit phase of a building. While several Member States had some form of minimum requirements for thermal performance of building envelopes in the 1970s, the Energy Performance of Buildings Directive (EPBD) was the first major attempt requiring all Member States to introduce a general framework for setting building energy code requirements based on a “whole building” approach. Examining the requirements set by each Member State, it is clear that large variations exist in terms of the approach each country has taken in applying building energy codes. In some countries two approaches exist in parallel, one based on the whole building approach and the other one on the performance of single elements. In others, the single element requirements act as supplementary demands to the whole building approach. In some cases the requirements for renovating buildings can be as ambitious as the new build requirements. Major changes are expected through the application of the cost-optimality concept in energy performance requirements as introduced by the recast EPBD (European Union, Directive 2010/31/EU) which should also gradually converge to nearly zero energy standards, a requirement for new buildings from 2020 onwards. An appropriate level of enforcement

compliance with building energy codes should also be of concern and a point of attention for policy makers as it is necessary to ensure that enough rigour and attention to detail are undertaken when applying energy efficiency measures.

## **2.5 National initiatives in the field of buildings renovation**

In the following section some representative cases of national initiatives towards promoting sustainable buildings' renovation in Europe are presented. In UK the Green Deal programme was recently launched by the British Department of Energy and Climatic Change (DECC) on October 2012 to permit loans for energy saving measures for UK properties. The energy savings should be larger than the loan repayments for the Green Deal loan to be made under the "Golden Rule". The registers of Green Deal Installers, Green Deal Advisors and Green Deal Providers became active at the launch. Property Assessments can now be undertaken by Green Deal Advisory Services and Installations under the Energy Company Obligation can now take place. Following this, the first Green Deal Plans has been available since 28 January 2013. DECC proposes tying low interest loans of estimated 7%, issued by Green Deal Providers for energy efficiency improvements to the energy bills of the properties the upgrades are performed on. These debts would then be passed onto new occupiers when they take over the payment of the bills.

In Spain, the Government has announced in March 2011 20 energy saving measures, some of them related to the building sector. Concretely these measures include

- granting credit to Energy Service Companies (ESCos). The initial financing budget here will be 600 million €.
- promotion of the use of biomass for heating in buildings
- the rationalisation of energy consumption by public administrations.
- extension of credits for the renewal of high performance heating energy systems
- obligatory energy certification for non residential buildings with more than 400 kW heating installed.

Many of these measures, such as for example the ESCos granting or the obligatory energy certification of existing buildings is expected to boost up renovation projects in the country.

France provides tax credits for energy restoration works. The eligible works includes most types of home energy conservation, provided the installation meets agreed performance standards. The tax credit is only available for the costs of the materials. All types of residential property are eligible for the tax credit, given that the property is at least two years old. There are maximum limits on the level of the tax credit that can be granted, although these are quite generous.

In Sweden the building code applies for renovation of existing buildings with consideration to the extent of the renovation and the possibilities of the building. Several regulations on sustainability aspects also apply for renovation of existing buildings, but only for renovation of the main structure or building services. For existing building only regulations

exist on energy performance-thermal insulation and on water conservation-efficiency techniques. In case of energy performance-thermal insulation a lower level applies in comparison with new buildings.

In Austria, the government of Lower Austria is currently offering very generous grants to those who buy and renovate residential and other properties. With prior approval, up to 50% of the cost is covered for installing insulation - including thermally efficient replacement windows - and also for the cost of installing energy saving central heating such as "pellet" ovens which are fuelled from renewable energy sources. Very low interest subsidised loans through a local bank are also offered, with banks favourably considering mortgages with lower deposits.

### **3. European research and other initiatives in the field of buildings renovation**

#### **3.1. The Renovate Europe Campaign**

The Renovate Europe is a major EU-Campaign, currently on-going, initiated by EuroACE (The European Alliance of Companies for Energy Efficiency in Buildings). Renovate Europe currently organizes events throughout Europe and publishes reports on boosting renovation measures in Europe. Renovate Europe has set the following targets for the upcoming years:

- Raise the yearly renovation rate for existing buildings to 3% by 2020
- Improve energy performance of existing buildings by 80% over existing performance levels
- Recommend effective solutions to key barriers – such as finance, training, etc.
- EU requirement for 3% deep renovation yearly rate of public sector buildings
- Complete the deep renovation of the entire EU building stock by 2050
- Define ambitious intermediate objectives for 2020 and 2040
- Develop a roadmap to achieve these objectives according to local, regional and national needs

#### **3.2. IEA research initiatives in the field of building renovation**

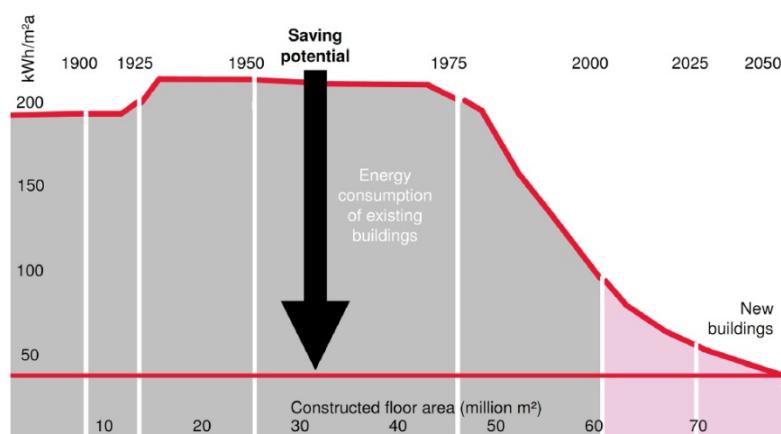
The field of buildings energy renovation is one of the most interesting research areas in the field of buildings energy efficiency. Currently several research projects are being carried out in this field. IEA Annex 50, entitled „Prefabricated Systems for Low Energy Renovation of Residential Buildings” (completed in 2011), focused on the development and demonstration of an innovative whole building renovation concept for typical apartment buildings. These solutions were mainly based on prototype, prefabricated roof systems with integrated HVAC, hot water and solar systems, as well as highly insulated envelopes with integrated new distribution systems for heating, cooling and ventilation. This research project has chosen an entirely new approach, based on the provision of a new building envelope that was easy to mount from the exterior and allowed a lot of

flexibility to improve the architecture. Interior work was reduced to a minimum. The project has focused on apartment buildings with a general need for renovation that should not only become energy efficient, but also require improvements to the architecture and living comfort.

IEA Annex 56 entitled „Cost-effective energy and carbon emission optimization in building renovation“ (currently on going), aims at developing a new methodology for cost effective renovation of existing buildings, using the right balance between the energy conservation and efficiency measures for one side and the measures and technologies that promote the use of renewable energy on the other. This methodology is to be used by interested private entities, helping them in their renovation decisions, as well as by governmental agencies that can use it for the definition of regulations and their implementation. The methodology allows:

- establishing cost optimized targets for energy consumption and carbon emissions in building renovation,
- clarifying the relationship between the emission and the energy targets and their eventual hierarchy and
- determining cost effective combinations of energy efficiency measures and measures that promote the use energy from renewable sources.

A renovation guide book based on cost effective solutions and on an optimal value concept, supported by exemplary case studies and by flexible tools, will be produced within the development of the methodology.



**Figure 4:** Constructed floor area and specific energy consumption of existing buildings and target value for sustainable renovation. (IEA, Annex 50)

### 3.3. IEE programmes in the field of building renovation

Several initiatives have also been taken under the Intelligent Energy Europe programme. The „Energy intelligent Education for retrofitting of social houses“ (EI-Education) project targeted on social housing companies, municipalities and other housing stock owners by an education programme with the aim of helping them carry out energy-intelligent retrofitting. The programme used mixed learning techniques adapted to the varying circumstances in participant countries. EI-Education inspired social housing companies to

practise energy intelligent retrofitting, resulting to a relevant guidebook, based upon 62 best practice examples from 11 countries, showing increases in energy efficiency of at least 30%. Education programmes for social housing companies were also developed in six participating countries. National training courses were organised for over 150 representatives from about 90 social housing companies. As a result of EI-Education, a project of energy intelligent retrofitting of 250 row houses has already started in Denmark.

Another IEE project, entitled „New Integrated Renovation Strategy to improve Energy Performance of Social housing project” (NIRSEPES), set itself the goal of increasing thermal efficiency by at least 30% by developing an integrated strategy for energy renovation in social housing across the EU. It analysed existing typical buildings in Spain, Greece and Germany, with a view to comparing technological solutions for retrofitting and its cost-effectiveness. Local forums, tailor-made financing schemes, awareness-raising campaigns, education, training, and retrofitting plans were all part of this integrated approach. The main output of this project was a tool for calculating capital value and annuity of invest in energy-efficient retrofitting in social housing. Existing financial incentives were further developed with a view to promoting best energetic renovation for all types of housing. Recommendations also resulted for successful energy retrofitting from technical, social and economic points of view, targeting both policymakers and individuals.

REQUEST, a collaborative IEE project across 11 EU Member States, aimed to increase the uptake of low carbon renovation measures in residential properties, throughout Europe. The central objectives of REQUEST were the development of tools and practices to increase the uptake of Energy Performance Certificates (EPC) recommendations and the provision of a quality standard for low carbon renovation. Pilot projects in partner countries tested and measured the impact of the new tools to further refine their development. The outcomes of REQUEST led to increased quantity and quality of renovation projects and to enhanced uptake of and cooperation between existing initiatives.

#### 4. Conclusions

In this study, important aspects of the field of energy upgrading of buildings in Europe were discussed. Both initiatives at national policies and actions taken at the research level towards the sustainable upgrade of the European building stock were presented. This work has highlighted the importance of energy upgrading of buildings in Europe today, and the fact that this can be a vehicle for growth and job creation, at a time of economic recession.

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