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Topic 7

How to Refurbish All Buildings by 2050

Final Report
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Contents

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Executive Summary

In order to deliver the 2050 objectives of greenhouse gas reduction, significant changes are essential in the building sector. Our report describes the building refurbishment challenge, maps the policy options to tackle this challenge and gives recommendations to the EU on how to achieve it.

Chapter 1 sets the scene of the building refurbishment issue by introducing the problem faced by the decision maker, further elaborating the set of difficulties hampering renovation action and surveying the scale of the problem. The difficulties cover distorted energy prices, market and behavioral failures and other issues typical for the building sector. Having identified the problem on the level of the decision maker, the overall scale of the problem is assessed by characterizing the rate and deepness of the renovation activities needed to comply with the 2050 greenhouse gas reduction aims. We argue that both the rate of renovation and the overall deepness need to be increased to deliver around 90% greenhouse gas reduction in the building sector. In order to speed up to this level, the EU should facilitate the formulation of well-defined binding national targets, building refurbishment action plans and a dedicated technology roadmap.

Chapter 2 describes market facilitation as a solution for the problem. The energy services market for some buildings is still in its infancy (e.g. residential ones), therefore the collection, classification and analysis of information about the market is crucial to allow actors to make rational decisions. Furthermore, spreading of information by means of education and internet tools is a must to empower consumers make good decision. In case of underdeveloped markets, the exemplary actions of the public sector may give the required kick-start to the industry. Moreover, ESCOs are key intermediaries easing the transactions of players in the refurbishment market, providing refurbishment, financial and energy services as well. However, in order to ensure the development of the market, a clearly defined framework is needed. Member States should supply a level playing field for ESCOs by formulating rules of who to contract with, how to contract and what to contract. Besides, there is a role for the EU by providing accreditation, standardized templates of contracting, and measurement and verification protocols for savings.

Even if a well-functioning market is operating in all Member States, not all building owners will find it economical to renovate their properties. In **Chapter 3**, we elaborate how regulatory policy should influence the market prices of energy, the inputs, outputs and actors of renovation. The removal of distorted energy prices, provision of standards and the harmonization of energy performance certificates is found necessary, but not sufficient means of tackling the issue. To deliver the renovation targets, some actors need to be coerced to renovate by policy.

Chapter 4 explains how EU funds are currently used and points out the under-utilisation of the available budget. In the present state of constrained public resources, public funding should only be granted if funds are allocated in the framework of a national building refurbishment plan, if disincentives such as supported energy prices are not in place. Furthermore, the money should be allocated in a performance based manner, avoiding excessive subsidization and ensuring leverage of private funds.

Finally, our recommendations are synthetized at the end of our study. Three levels of solutions are identified: prerequisites, primary and secondary actions. The prerequisites are to provide correct economic signals by abolishing regulated end-user prices and internalizing the carbon price. Primary actions are to establish national building refurbishment plans and to create a working energy performance certification scheme. Finally, secondary actions include the facilitation of a building refurbishment market framework, strengthening of standards and labels, the development of a technology roadmap and making better use of EU funding.

Introduction

The built environment has a central role in our society. Buildings are not just the place where we live and work; the building sector is also an important sector in our economy. Yet, the energy performance of buildings is poor so that they are responsible for a large share of the overall energy consumption (40% within the EU) and they are also one of the most significant sources of greenhouse gas emissions (36% within the EU). Thus, buildings are also relevant for the achievement of the energy and climate objectives of the European Union (EU) for 2020 and 2050.

Considering that the average life span of a building is over 50 years and that a complete renewal of the existing building stock would take about 100 years, investing in building refurbishment is crucial to reduce energy consumption and greenhouse gas emissions in the EU. In this report, we take as given that in order to achieve the EU energy and climate objectives, it is necessary to refurbish all (or almost all)[1] buildings by 2050. So, the aim of this report is to give recommendations to the European Commission on how this could be accomplished at minimum cost; and hence, the title of the report: "***How to refurbish all buildings by 2050***".

Due to the relevance of the building sector in terms of capital investment and employment, refurbishing all buildings can have significant macroeconomic effects. Indeed, depending on the study, it is estimated a total investment need of 600-1800 billion in the building sector until 2050.[2] Moreover, the investment in building refurbishment may also bring additional co-benefits (including health and social effects).[3] Even if the analysis of these effects is not within the scope of this report, we consider that benefits resulting from the investment in building refurbishment may be larger than the costs, which is implicit in the ambitious targets defined at the EU level for the building sector.

In order to provide recommendations on how to refurbish all buildings by 2050, the report is structured as follows: we start by describing the building refurbishment problem (Chapter 1), and continue with an assessment of the different policy options, distinguishing between market facilitation (Chapter 2), regulatory instruments (Chapter 3), and public support (Chapter 4). In each chapter, we discuss how the EU institutions could be involved, and the report concludes with recommendations on how that could be achieved.

First, the description of the **problem**. Building refurbishments are the result of complex decision processes, involving many actors.[4] The realization of the investment depends on their individual decisions, which do not always lead to refurbishments,

1 Following the definition of the Energy Performance of Buildings Directive (EPBD), certain buildings are exempted from the regulation of renovation: first, officially protected historical buildings or buildings of architectural merit; second, places of religious activity and worship; third, industrial buildings used for less than two years; fourth, buildings used in less than four months of the year or consuming 25% of the energy they would need for whole-year operation; fifth, stand-alone buildings having a floor area less than 50 m^2 (EU, 2010a).

2 The estimation of investment needs for the building sector up to 2050 are quite different depending on the study, which can also be explained by the different characteristics of the models used. In IEA (2010a), it is estimated a total investment need of €1750 billion up to 2050 for the building sector (model includes all building end-uses), while BPIE (2011) reports a total investment of €600-900 billion for the same period (model includes only heating and cooling energy uses).

3 Studies typically quote labour market effects because refurbishing buildings is labour intensive and typically done domestically. For more details see, e.g.: Ürge-Vorsatz (2012a); Levine et al. (2007); Ürge-Vorsatz (2010 and 2012b).

4 The present level of energy use in buildings is the result of decisions made by hundreds of millions of actors, including the building owners, renters, developers, energy suppliers, financial service providers, equipment producers, and intermediaries (i.e. the so-called Energy Service Companies).

even when they are economical. Indeed, this is partly caused by the energy prices that are currently distorted, the lack of skills of the different actors, and also market failures. The report discusses these difficulties hampering building refurbishment, and also looks at the scale of the problem, showing that there is the need to not only speed-up (i.e. increase the current rate of refurbishment) but also increase the energy and greenhouse gas emission savings achieved when refurbishing a building (i.e. increase the current deepness of refurbishment).

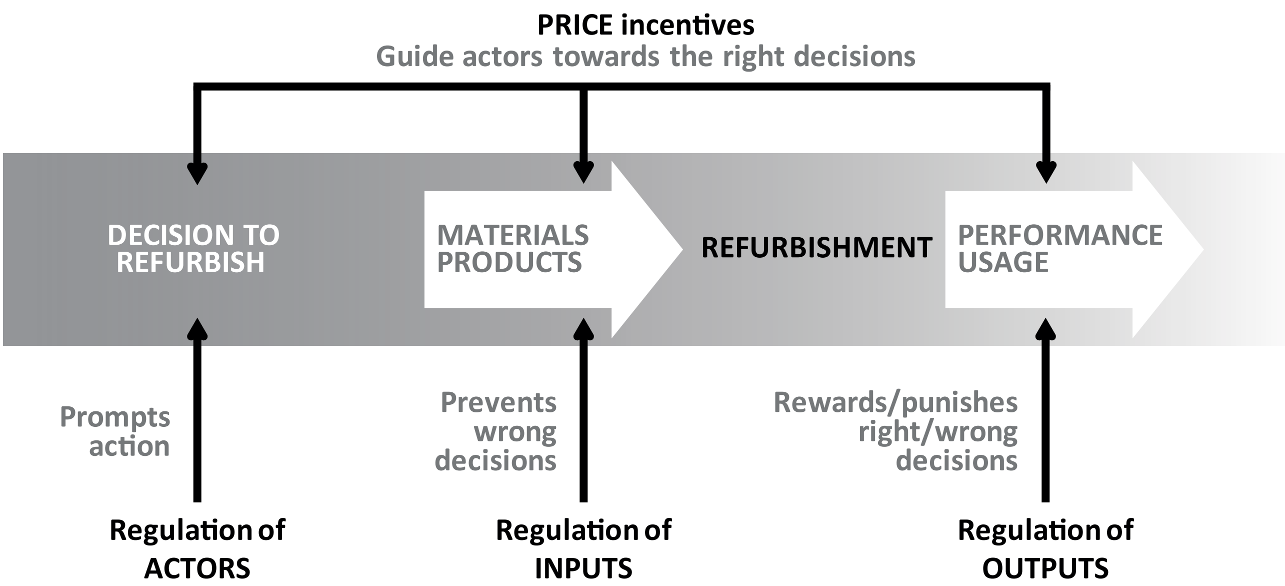
Second, the analytical approach used to assess the different **policy options**. Even if the difficulties could be partly remedied with market facilitation, regulatory instruments and/or public support will also be needed, for instance, because building refurbishment investments need to go beyond what is economical at today's prices. Hence, there is the need to look at these three policy options, and we also need to understand what could be the role of the EU within each of them. We grouped the regulatory instruments into four categories to facilitate their assessment (Figure 1).

We consider that all these categories are complementary and the reasons are the following:

- Price incentives are needed to give building actors correct economic signals to refurbish, but also to guide them towards the right choices when refurbishing, and to provide them with incentives for an efficient use of energy in buildings. Today, these signals are often distorted: for instance, the EU-ETS does not cover buildings, only the electricity used in buildings; carbon taxation is limited so that the carbon price has not yet been internalized in the building refurbishment decisions.

- However, price incentives do not suffice to reach the target. Indeed, sometimes the economic case for refurbishment is uncertain at today's prices. Plus, even when refurbishing would already be clearly economical, there are many other issues, such as unqualified decision makers and market failures that may still prevent actors from undertaking refurbishment. This can then justify the

Figure 1: Analytical framework for regulatory instruments



Source: own depiction

use of additional regulatory instruments, such as regulation of actors (which can oblige them to act), regulation of inputs (which can avoid that actors can take the inappropriate decisions when acting), and regulation of outputs (which can regulate performance and incentivize actors to use energy in a manner that is efficient and compatible with the greenhouse gas emission reduction targets).

In general, we consider that the success of different building refurbishment policies might be quite context specific, and so it is not possible to provide a list with market facilitation, regulation and public support options that would be appropriate to all EU Member States. Flexibility should be left to Member States to tailor building refurbishment policies to their own context.

Still, the role of the EU institutions could be about: (1) assuring that there is commitment to address the problem at national level (Chapter 1); (2) contributing to the development of the building refurbishment market (Chapter 2); (3) facilitating the implementation of regulatory instruments to steer the refurbishment of buildings (Chapter 3); and (4) making best use of existing EU funding for building refurbishment (Chapter 4).

1. Building refurbishment problem

In this chapter, we introduce the building refurbishment problem. The chapter is structured in three sections: section 1.1 illustrates the difficulties hampering building refurbishment; section 1.2 analyzes the scale of the problem; and section 1.3 discusses how the EU institutions could help assuring a commitment to address the problem at national level.

1.1 Difficulties hampering building refurbishment

The purpose of this section is to identify the main difficulties hampering the refurbishment of buildings, and to then illustrate that the degree in which difficulties apply to a certain investment can depend on the type of building and the type of refurbishment concerned.

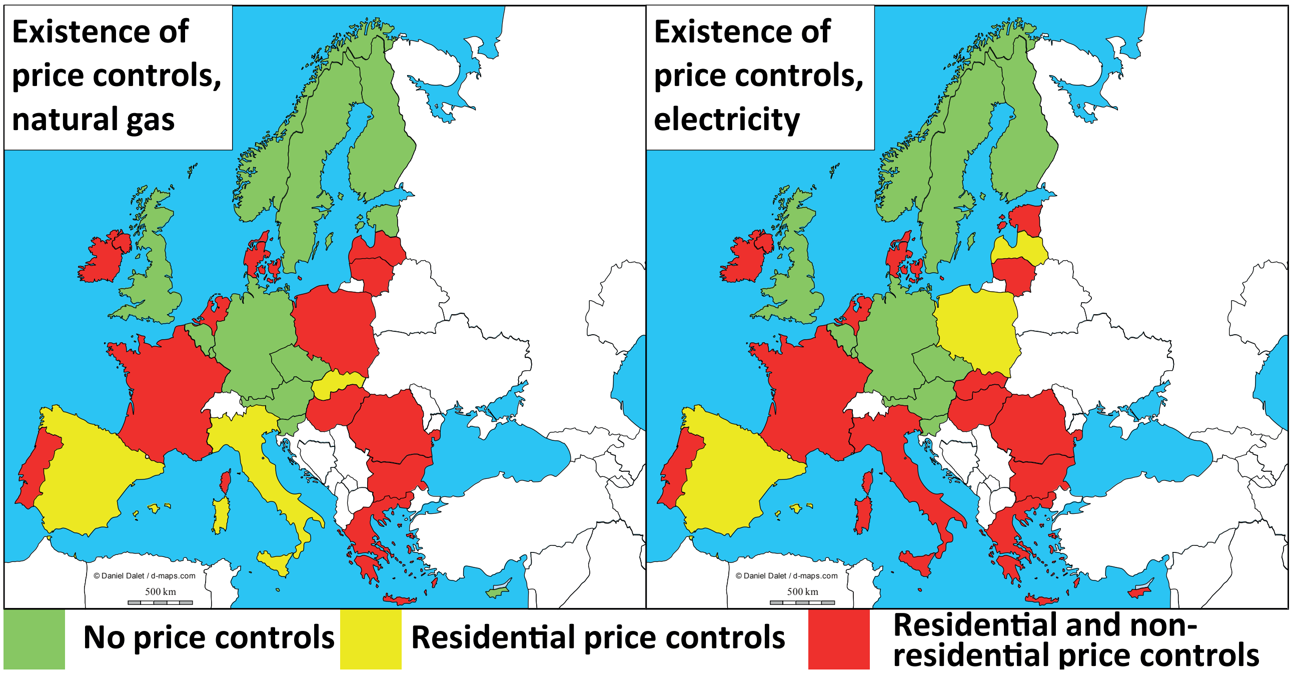
1.1.1 Main difficulties

In what concerns building refurbishment investments, the main difficulties are the following: (1) distorted energy prices; (2) unqualified decision makers; and (3) simple market failures.

The first issue is related with the existing **distortions in energy prices**. Energy prices are currently not fully aligned with the energy and greenhouse gas emissions saving objectives for the building sector, distorting the costs and benefits of refurbishment investments. For instance, despite the ongoing energy market integration in Europe, regulated end-user energy prices still exist in 19 countries for residential users and 16 countries for non-residential consumers (EC 2011a, see Figure 2). Moreover, there are also some EU Member States that subsidize energy consumption by setting lower VAT rates for energy products, making energy efficiency investments less cost-effective and, consequently, less attractive.[5] Furthermore, besides the fact that prices are kept artificially low for political reasons, the externalities of greenhouse gas emissions have also not yet been fully internalized into the energy prices. The EU-ETS indeed does not cover

5 France, Greece, Ireland, Italy, Luxemburg and the UK apply VAT rates below the standard VAT rate for natural gas and electricity. VAT for natural gas is lower than the standard rate in Malta (DG Tax, 2012a).

Figure 2: Mapping of current regulations of end-user prices in Europe



Source: EC 2011a; map outlines by Dalet (2007-2012)

buildings, only the electricity used in buildings; and carbon taxation is limited.

Secondly, there is an issue regarding **unqualified decision makers.** The building refurbishment decision process involves many small actors that often do not have the appropriate skills and/or information to take these decisions rationally. This implies that their decisions are biased by their own perception of risk, which is not always linked to the economic risk of the investment. For instance, customers tend to perceive the upfront cost and the discount rate higher than they would do in case of other investments. Indeed, actors typically prefer to save money upfront rather than to save on future energy bills; and, when investing for future savings, they typically only invest if the payback period is short.

Thirdly, investors are typically confronted with several **market failures** (Box 1) when investing in building refurbishment, including: information problems, high transaction costs and externalities. Furthermore, the asymmetry of information regarding the quality of materials and building renovation carried out may lead to the adverse selection of contractors, creating a low-performing refurbishment market. Classical principal-agent problems also inhibit the refurbishment investment in the renting market. Additionally, there are usually strong externalities that need to be taken into account while refurbishing, since there are not only interactions between different systems and components in a building, but also within different dwellings or buildings.

Nowadays, buildings are renovated every 30 to 40 years on average (DG Energy, 2012), but energy or greenhouse gas emission savings are rarely the main driver. Drivers typically include: the end of the lifetime of the building, its components and/or systems; the improvement of the living quality and comfort of the building; and improvement of the appearance and economic value of the building.[6] Indeed, a building is mainly a place to work and/or live and its energy use and greenhouse gas emissions are a consequence of building qualities, such as proper lighting, indoor air quality, and comfort.

There are comprehensive building labeling schemes that evaluate the quality of a building, i.e. including the provision of health and well-being, the accessibility conditions, and energy performance. For instance, in the well-known BREEAM scheme, only 26.5% of the quality evaluation is energy related.

Box 1: Literature review on market failures affecting building refurbishment

Market failures related to building refurbishment may be classified into four main categories: externalities, information issues, transaction costs and financial market failures. Externalities cover mainly three issues: the negative environmental externality of energy consumption, the positive externality of technology adoption and the positive externality of innovation (Jaffe and Stavins, 1994; Jaffe et al., 2005; Golove and Eto 1996). First, the environmental externalities are not included in the energy price (Gillingham et al., 2009). Second, since owners do not know the effect of refurbishment on their energy consumption and energy bill before the investment is taken, first adopters of a technology or even first clients of a certain contractor create positive informational externalities. Third, the positive externalities of R&D activities are also present (Newell et al., 1999; Olmos et al., 2011b; see Box 3 for further details).

Imperfect information deals with two types of failures, asymmetric information and lack of information. Asymmetric information on one hand leads to adverse selection of contractors and/or building materials: measuring energy performance of the renovation is costly and difficult. Therefore the installers may provide lower quality services (Holt et al., 1995). On the other hand, asymmetric information gives rise to the split incentives issue as well, inhibiting refurbishment action (OECD/IEA, 2007). Lack of information about the options to renovate, potential savings, etc. prevents the innovation itself (Howarth et al., 2000).

Transaction costs or hidden costs of renovation refer to the non-monetized search cost of the renovation activities and contractors, alternative cost incurred by monitoring of the installer, asset specificity of the investment and disruption cost in the use of the building caused by the renovation action. Ecofys reported hidden costs as high as the cost of implementation for some measures (Ecofys, 2009). Caird et al. (2008) found that over half of loft insulations surveyed were cancelled due to the disruption of the renovation and the hassle of cleaning the attic.

Financial market failures signify the problem of investors attempting to raise funds for energy efficiency investments. Financial institutions are less experienced regarding building renovation market than the traditional financial markets. Therefore, they may be less inclined to provide attractive funding for such investments. Moreover, savings are uncertain and difficult to measure and so banks are cautious to conclude contracts based on the payback by savings. The scarcity of financing options for energy efficiency was noted as a substantial barrier (UNEP, 2009; OECD/IEA, 2007; EuroACE, 2010; Estache and Kaufman, 2011).

6 See the surveys presented in Jakob (2007), Caird et al. (2008), Jensen and Gram-Hanssen, (2008), Summerfield et al. (2009), Tuominen et al. (2012).

1.1.2 Degree in which the main difficulties apply to different investments

The building sector is diverse, and the degree in which the main difficulties apply to a certain investment can depend on: (1) building ownership; (2) building usage; (3) housing arrangements; (4) type of refurbishment; and (5) timing of refurbishment.[7]

First, the **building ownership.** A building can be publicly or privately owned. When a building is owned by a public entity, the investors might be confronted with additional institutional failures, such as "not in my term" and "not my business" type of issues.[8] Moreover, when the owner is not the user, he usually does not have any incentives in paying for refurbishment, since he is not the one benefitting from the decrease in the energy bill; and the user not being the owner also lacks the incentives to invest, since he often has no guarantee that he will stay long enough to capture the benefits.

Second, the **building usage.** There are residential and commercial buildings. The energy use of commercial buildings is often better monitored than in residential buildings and so, it is easier for energy experts to choose the most adequate measures. Moreover, since commercial dwellings are usually larger than residential ones, the transaction costs of refurbishing represent a smaller share of the overall cost, compared to residential renovations. Owners of a commercial building are also expected to act more rationally in economic terms, and so may also pay more attention to their energy bills in the case these represent a sufficiently high part of their expenses. Moreover, the technical solutions for services buildings might be relatively more standardized (e.g. according to the type of services provided) while for households it has to be studied case by case. The lack of information might be higher for households and so also the issue of unqualified decision makers.

Third, the **housing arrangement**. There are numerous possibilities, not only in terms of users but also in terms of owners. Indeed, there are some buildings with a single-owner and user (a detached house), others with a single owner and multiple users (e.g. social housing,) and multiple owners and users (as high apartment blocks). The externalities present in a refurbishment strongly depend on the housing arrangements. For instance, when refurbishing, the owner of an apartment has to consider the characteristics and conditions of the other apartments within the building, and his technical options might be also constrained by the decisions of other owners.[9] Moreover, even when there is only one user and owner of the building, he might share certain energy infrastructures, such as a district heating network.

Fourth, the **type of refurbishment.** There are several options to reduce the greenhouse gas emissions of the existing building stock (Annex 1), which can be very different in terms of capital cost, payback time and technical complexity. For instance, when refurbishing a building, it might be technically easier to install renewable energy technologies to create a so-called

7 This section is partly based on OECD/IEA (2007)

8 "Not in my term" refers to the constraints to local governments actions due to the limited resources available; and "not my business" refers to the constraints caused by the lack of expertise or competences from local governments (See Meeus et al., 2011a for more details).

9 Indeed, within an apartment block, to improve the thermal insulation of the roof, or to install additional exterior insulation, it is necessary in most countries to have the agreement of the owners of all the apartments. In some countries, such as Austria, Denmark, France, Hungary, Italy and Portugal, the decisions may be taken by a majority of the owners, even if a minority does not agree with the renovation works. It is noteworthy that this may facilitate the renovation of buildings, but may also raise other freedom issues, namely the coercion of minority owners by the majority to incur costs of renovation.

net zero energy building, than to invest in insulation of the envelope and to replace heating and cooling systems in order to get closer to (or even reach) a passive house standard. The costs and benefits of the different options are also context specific and depend on the building characteristics. Indeed, the use of solar thermal technologies might have a payback period of less than 5 years in the south of Europe, while the period may be much longer in other parts of Europe.[10]

Fifth, the **timing of refurbishment**. The difficulties can be quite different, depending on whether the refurbishment investment is coupled with other periodical maintenance works or is done independently, at a different time. For instance, according to Ecofys (2005a, 2005b), the improvement of wall insulation, when included in the framework of general renovation measures in the façade, can reduce its amortization time to less than half. Also, if the replacement of components for more efficient ones is done when they reach the end of their lifetime, the costs will certainly be lower than if they are substituted before.

1.2 Scale of the problem

In this section, we illustrate the scale of the problem by looking at the EU policy objectives for the building sector, and what they imply in terms of building refurbishment investments in comparison with current investments.

1.2.1 EU objectives for the building sector and for building refurbishment

Currently, several initiatives at the EU level already focus on the building sector and, in particular, on building refurbishment; and the European Commission recently released a consultation paper that summarizes Community level involvement (DG Energy, 2012). It refers to the relevance of the building sector in the overall energy consumption and greenhouse gas emissions, as well as to the large untapped potential for cost-effective savings in buildings.[11] The paper also mentions the need to refurbish the existing stock because most of the existing buildings will still be around in 2050.[12] Finally, the fact that buildings are not frequently refurbished is worsened by the limited consideration for energy and greenhouse gas emission savings when a building is undergoing refurbishment.[13]

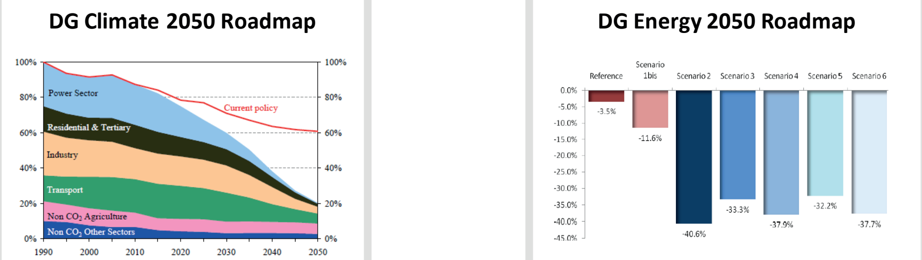
10 One way to compare the cost of the options is to utilize the marginal abatement cost curves (MACCs), popularized by McKinsey. MACCs offer a quick comparison of technology costs and show the potential of policy options. The shortcomings of such method are to disregard the synergic nature of renovation actions and the inability to include whole building approach, inability to address market barriers, and the failure to capture the behavior of actors due to the oversimplified technical approach (Kesicki and Strachan, 2011; Stoft, 1995). Although some variations by countries occur, the cheapest option ensuring small savings considered by MACCs is usually the change of lighting to CFL or LED, followed by the retrofitting of HVAC systems, with a bigger potential reduction. Building envelope renovations offer the most savings, but are usually among the highest cost options (McKinsey, 2007, 2008a, 2008b, 2009a, 2009b, 2012).

11 *"Buildings must be central to the EU's energy efficiency policy, as nearly 40% of final energy consumption (and 36% of greenhouse gas emissions) is in houses, offices, shops and other buildings. Moreover, buildings provide the second largest untapped cost effective potential for energy savings after the energy sector."* (DG Energy, 2012)

12 *"In this context, it is important to stress that buildings constructed today will be there for the next 50 to 100 years. For example, 92% of the building stock from 2005 will still be there in 2020 and 75% in 2050. This is due to the very low demolition rates (about 0.5% per year) and new built construction rates (about 1.0% per year)."* (DG Energy, 2012)

13 *"Moreover, the current general refurbishment cycles are between 30-40 years but those which lead to energy efficiency improvements are at longer intervals (60-80 years). With approximately 3% of the building stock being renovated per year, this signifies that in only half of the cases energy efficiency improvements are included (i.e. 1.5% energy-related renovation rate per year)."(DG Energy, 2012)*

Figure 3: Building sector in the 2011 roadmaps by the European Commission



Targets for CO_2 **emissions**' reduction compared to 1990

80% within all sectors

88 to **91%** within the **building sector**

Targets for **energy consumption** reduction compared to 2005

32 to **40%** among all sectors (p.e.)

39 to **48%** within the **building sector** (f.e.)

Source:: EC, 2011b, 2011c, 2011d

The European Council has recently also asked for an elaboration of a low carbon 2050 strategy[14] to the European Commission who responded shortly after with two roadmaps. Both have implications for the building sector (Figure 3), identifying building refurbishment as a great opportunity but also as an important challenge.

First, the **DG Climate roadmap.** Concluding its investigation of cost-effective pathways to reduce greenhouse gas emissions by 80% by 2050 relative to 1990 levels, this roadmap indicates specific targets for the different sectors (EC, 2011b).[15] In the building sector (referred to as the residential & tertiary sector), the ambition is to reduce greenhouse gas emissions by 88-91%. The main challenge is to finance the necessary investments, and the refurbishment of the existing stock is said to be a greater challenge than the construction of new and net-zero energy buildings.[16]

Second, the **DG Energy roadmap.**[17] This roadmap projects primary energy savings between 32 to 40% by 2050 compared to 2005 (EC, 2011d), after developing several scenarios that start from the greenhouse

14 *"The European Council looked forward to the elaboration of a low carbon 2050 strategy providing the framework for the longer term action in the energy and other related sectors. Reaching the EU objective, in the context of necessary reductions according to the IPCC by developed countries as a group, of reducing greenhouse gas emissions by 80-95% by 2050 compared to 1990 as agreed in October 2009 will require a revolution in energy systems, which must start now. Due consideration should be given to fixing intermediary stages towards reaching the 2050 objective. The European Council will keep developments under review on a regular basis."* (EUCO, 2011)

15 The DG Climate Roadmap presents the following sector-specific GHG emissions reduction targets: 93-99% in the power sector; 54-67% in the transport sector; 88-91% in the residential & tertiary sector; 83-87% in the industry sector; 42-49% in agriculture; and 70-78% in other sectors. (EC, 2011b)

16 *"Some Member States are already pro-actively using structural funds. The analysis projects that over the next decade investments in energy-saving building components and equipment will need to be increased by up to €200 billion. Several Member States have already implemented smart financing schemes, such as preferential interest rates for leveraging private sector investments in the most efficient building solutions. Other private financing models must be explored."* (EC, 2011b)

17 See also Jones and Glachant (2010), Meeus et al. (2011b) and Meeus (2012).

gas emission reduction target for the energy sector in the DG Climate roadmap. Its impact assessment also indicates that achieving these savings would imply a reduction of 39-48% in final energy consumption for the building sector (referred as residential & tertiary sector). Again, buildings are identified as crucial to achieve the objectives, referring to their potential to produce more electricity than the energy they use.

To sum up, the EU 2050 objective for the building sector, as presented by these two roadmaps, corresponds to a reduction of GHG emissions by 88 to 91%, compared to the 1990 levels (hereafter, the "2050 building sector target") implying a reduction of final energy consumption by 39 to 48%, compared to 2005 levels.

1.2.2 Long-term visions on building refurbishment

The path towards this 2050 building sector target includes several important trade-offs. Not only are there different types of refurbishment investments that can be undertaken, there is also the possibility to avoid refurbishments by accelerating the renewal of buildings. Furthermore, investing more in building refurbishment can be to refurbish them more often or to be more ambitious when refurbishing them; and we can follow a linear path, or we can do more efforts at a later stage when technology will be more developed.

There are several studies that present visions on the future energy system including the building sector (Annex 2), but only two consider the above mentioned trade-offs for Europe up to 2050, i.e. a study from the Center for Climate Change and Sustainable Energy Policy (3CSEP) called "Best Practice Policies for Low Carbon & Energy Buildings" (Ürge-Vorsatz et al., 2012), and a study from the Building Performance Institute Europe (BPIE)[18] called "Europe's Buildings under the Microscope" (BPIE, 2011).

Both studies focused on the trade-off between (1) the speed at which buildings are refurbished (the refurbishment rate); and (2) the level of energy or greenhouse gas emission savings that are achieved when refurbishing a building (refurbishment deepness). The 3CSEP study also considers the trade-off between renewal and refurbishment of buildings, warning that a too high refurbishment rate can be counterproductive as new buildings tend to be more efficient than refurbished buildings. In what follows, we however focus on the BPIE scenarios because, contrarily to the 3CSEP scenarios, they have been designed to reach the 2050 building sector target.

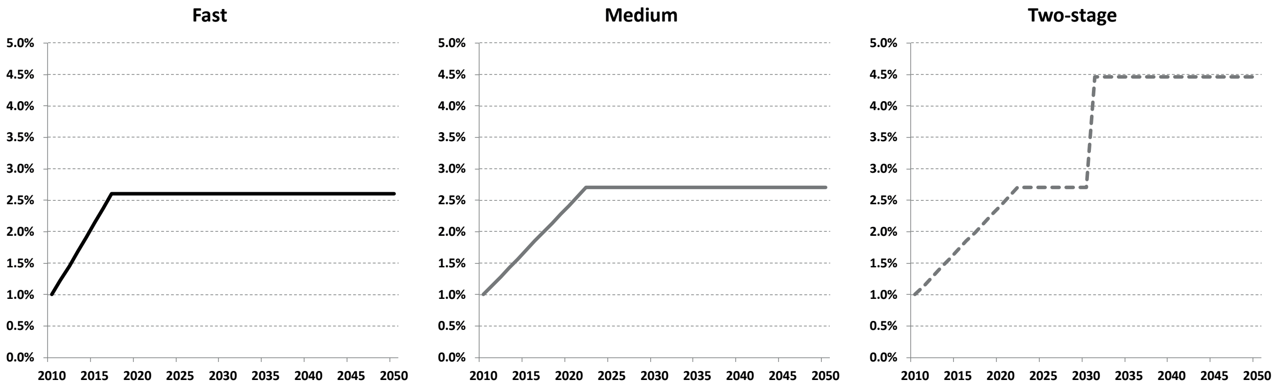
First, the **refurbishment rate.** In every scenario of the BPIE study, all existing buildings are refurbished at least once by 2050, which implies an average annual refurbishment rate of 2.5% between 2010 and 2050.[19] Since they consider that the current rate of refurbishment is around 1%, the rate would need to more than double.

Figure 4 illustrates three of the scenarios considered by the BPIE study, in terms of the evolution of the refurbishment rate over time. Within the *fast scenario*, the rate of refurbishment rapidly increases in the beginning, reaching a 2.6% rate by 2017; then this rate is maintained between 2017 and 2050. In the *medium scenario*, there is a slower increase of the refurbish-

18 The institute was founded in 2010, by the ClimateWorks, the European Climate Foundation and the European Council for an Energy Efficient Economy (eceee), providing analyses targeted at the Energy Performance of Buildings Directive (EPBD).

19 Indeed, 2.5% of existing stock X 40 years = 100% of existing stock.

Figure 4: Alternative acceleration paths for the building refurbishment rate



Source: BPIE (2011) and own calculation, illustration own depiction

ment rate in the first years, but the acceleration period only stops by 2023, when a 2.7% rate is reached. There is also a *two-stage scenario* similar to the *medium scenario* up to 2030; and then, between 2030 and 2050, it accelerates further in order to refurbish the whole building stock between 2030 and 2050, including the buildings already refurbished in the previous period. In this case, there are buildings that are refurbished twice: within the first period only minor refurbishments are done; after certain technology has had more time to develop, deeper refurbishments are performed in all buildings.

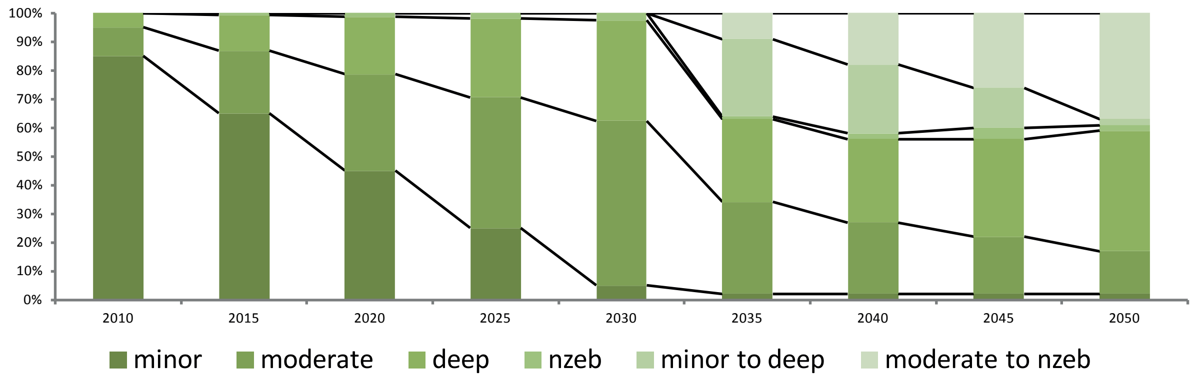
Second, the **refurbishment deepness.** Each scenario in the BPIE study has an underlying "deepness mix", i.e. the share of buildings that achieve different levels of savings over time.[20] For this purpose, four levels of deepness of refurbishment were defined, according to the final reduction on energy use achieved in the refurbishment: (1) minor, achieving 0 to 30% reduction; (2) moderate, achieving 30 to 60% reduction; (3) deep, achieving 60 to 90% reduction; and (4) nearly-zero energy (nZEB), when reaching more than 90% reduction. According to the study, building refurbishments currently delivers 9% of final energy savings for the total building stock on average, considering that most of the refurbishments achieve minor savings.

Figure 5 illustrates the evolution of the deepness mix over time in one of the scenarios considered by the BPIE study, i.e. the *two-stage scenario* presented before. In this case, until 2030, the share of *moderate* and *deep* refurbishments increases at the expense of *minor* refurbishments; then, between 2030 and 2050, the share of *deep* refurbishments further increases at the expense of *moderate* refurbishments. From 2030 onwards, we see new refurbishment categories appearing, which correspond to the buildings refurbished a second time (either going from moderately refurbished to nearly-zero energy buildings, or from minor refurbished buildings to deeply refurbished buildings).

By combining different refurbishment rate pathways with different refurbishment deepness pathways,

20 Due to the different characteristics of the existing building stock, it is clear that the costs of improving energy performance will be also very diverse. Thus, not all the buildings are expected to reach very high levels of energy performance; instead a "deepness mix" is expected, so that some buildings will only be subjected to minor refurbishments while others may reach passive house level (and others may be even exempted for historical and cultural reasons).

Figure 5: Example of a path towards deeper refurbishments



Source: BPIE (2011)

the study developed 5 scenarios that may or may not achieve the 2050 target for the building sector. Among these five scenarios, only two meet the target: Deep Scenario and Two-Stage Scenario. When comparing both scenarios with the current situation (Table 1), there are two observations noteworthy:

- First key observation is that, in order to meet the target, both rate and deepness of refurbishment will have to at least double or triple, compared to the current situation.

- Second key observation is that, if deepness is not immediately increased in order to wait for technology to develop, there will be a need for a two-stage refurbishment process. In this case, there would be also a higher share of nearly zero energy buildings by 2050.

Nonetheless, it is important to keep in mind that this study only considers the energy demand for heating and cooling, it does not consider that buildings could simply also be renewed quicker than they are today, nor did it consider the integration of renewable energy technologies in existing buildings as an alternative to reducing their energy use.

1.2.3 National strategies on building refurbishment

Within the EU, there are already some Member States that have ambitious strategies for building refurbishment, including: Austria, Denmark, France, Germany, and the UK (Table 2). Even if these strategies do not always specify the concrete objectives for building refurbishment in terms of rate and deepness, they already show that national governments are aware of the need to speed up building refurbishment and to increase the savings when refurbishing.

In **Austria** (BMLFUW, 2007; BMWFJ, 2010; WWFWWF and Ecofys, 2011), there are two relevant strategies: the 2007 Climate Strategy, developed by the Federal Ministry of Economy, Family and Youth; and the 2010 Energy Strategy, developed by Federal Ministry of Economy, Family and Youth in collaboration with the Federal Ministry for Environment, that partly revises the first. Within the initial strategy, the intent to increase the current rate of refurbishment (estimated to be below 1%) is clearly stated. The strategy includes a two steps approach, i.e. to refurbish 3% of the existing building stock per year between 2008 and 2012, and onwards increase the rate of refurbish-

Table 1: Comparison of the current situation with two scenarios of the BPIE report

	Current	Deep Scenario	Two-Stage Scenario
Building sector GHG emissions reduction by 2050 (compared to 2010 level)*	72%	90%	91%
Rate of refurbishment (average value)	1%	2.5%	3.3%
Deepness of refurbishment (average value)	9%	68%	71%

*Note that the GHG target in the roadmap is compared to 1990 levels, but 2010 emissions are already lower, so reducing 90% compared to 2010 is even overachieving the target.

Source: BPIE (2011)

ment to 5% until 2020. Later, this strategy was revised and a stable rate of 3% per year was established as the target for building refurbishment. Regarding the deepness of refurbishment, the strategic documents do not specify the intended targets; instead, they only refer that low energy house standards need to be targeted for the refurbishment of existing buildings. In 2010, the strategy has been legally implemented by the Council of Ministers.

In **Denmark** (The Danish Government, 2009), the government worked out a strategy for building refurbishment in April 2009, which provides a more detailed view of the objectives for the building sector based on the more general strategies. However, within this strategy they do not specify a target for building refurbishment, neither in terms of rate nor of deepness.

In **France** (Grenelle, 2010a), there is an ambitious policy on building refurbishment, established by the Grenelle de l'Environment roundtable talks and implemented by the Grenelle 2 law. Within their strategy, the intention of refurbishing 400 thousand buildings per year is presented, what would mean to almost double their current rate (in 2010, 250 thousand buildings have been refurbished). Moreover, the targets in terms of deepness are presented in the strategic documents as the will to reduce primary energy consumption of buildings by 38%, up to 2020.

In **Germany** (BMWI, BMU, 2010), the government has developed its low carbon energy policy, i.e. "Energiekonzept", and the corresponding law has been approved in 2011. Within the building sector, an increase of the annual refurbishment rate to 2% is targeted, i.e. they intend to more than double the current rate (below 1%). In what concerns the deepness of refurbishment, average energy savings per refurbishment are not specified; instead they present the intent to reduce primary energy consumption by the building sector by 80% up to 2050 (compared to 2005 level).

In the **UK** (DECC, 2012; HMG, 2011), the building sector has deserved special attention for more than a decade. The strategic documents developed by the Committee on Climate Change state that the priority regarding energy savings in the UK should be to improve energy efficiency in homes, businesses and public buildings, but, specific targets in terms of rate and deepness of refurbishment are not specified in any of the strategic documents.

Note that the UK expresses its strategic objectives for buildings in greenhouse gas reductions, while in France, Germany, and Austria the above discussed strategic objectives are expressed in (primary) energy savings. The latter seem to exclude one of the technical options, which is about integrating renewable electricity generation into buildings (i.e. net zero energy buildings, see Annex 1).

To sum up, to meet the 2050 building sector target, most, if not all buildings will need to be refurbished. Then, this would imply that all the difficulties mentioned in section 1.1 need to be overcome, even in the specific cases where they can be stronger or more prominent. Indeed, it is not enough to only invest in the buildings where difficulties are weaker or easier to overcome. Furthermore, the above analysis of the problem also indicates that it is not sufficient to speed-up building refurbishment; we also need to increase the savings achieved when refurbishing a building. This implies that doing more of the same is not enough; there is also the need to deploy refurbishment technologies and measures which are yet not widely used.

1.3 How EU institutions could assure that there is commitment to address the problem at national level

Considering the scale of the problem, and the many difficulties that will need to be overcome, it will be very important to ensure that there is commitment to address the problem at national level. In what follows, we discuss how EU institutions could play a role.

1.3.1 Binding national refurbishment targets

Setting binding national targets is a typical way for EU institutions to help assuring that there is a commitment to address a problem at national level. In the context of the 2020 energy strategy, targets have been set to reduce greenhouse gas emissions, and to increase renewable energy, i.e. the climate and energy package (EU, 2009a), and both are expected to be met.

Table 2: Summarizing table for EU Member State building refurbishment strategies ("NS": Not Specified in the referenced strategic documentation)

EU Member State Examples	Rate		Deepness	
	Current	Targeted	Current	Targeted
Austria	Below 1%	reach 3% to 2020	NS	Use of low energy house standard
Denmark	NS	NS	NS	NS
Germany	Below 1%	2% of the stock/year	NS	Reduce primary energy in buildings by 80% of 2008 to 2050
France	250,000 buildings/ year (2010)	400,000 buildings/ year	NS	Reduce primary energy in buildings by 38% to 2020
UK	NS	NS	NS	NS

Binding national targets for building refurbishment would need to be expressed in greenhouse gas emissions, and there is already a target for greenhouse gas emissions in non-EU-ETS sectors, which includes the building sector, but it is currently up to Member States to decide what they do in the sectors not covered by the EU-ETS.

1.3.2 National building refurbishment action plans

Mandating the development of national action plans and monitoring their implementation is also a way in which the EU institutions may nurture commitment to address the problem at national level. In the context of the 2020 energy strategy, there are for instance National Energy Efficiency Action Plans (EC, 2009) and National Renewable Energy Action Plans (EU, 2009a). The firsts are used to track progress towards the currently non-binding energy saving target, and will be used to evaluate in 2013-2014 whether it is necessary to make these targets binding; while the seconds are used to monitor progress towards the already binding renewable energy target. In this particular case, the EU could mandate to Member States the development of National Building Refurbishment Action Plans. The EU already took a first step in this direction, since the Energy Performance of Buildings Directive requires Member States to submit a plan on how to overcome the difference between the current energy performance and the minimum requirements established by the directive (EU, 2010a).

In order to develop a National Building Refurbishment Action Plan, Member States would need to perform a survey of the energy performance of the current building stock, as well as an inventory of the energy and greenhouse gas savings potential. Such plan should also include the setting of intermediate targets and the definition of milestones along the way, in order to increase the credibility of such goals and consequently prompt investment. Moreover, the survey of the existing building stock would allow Member States to identify the biggest potentials for energy and greenhouse gas emissions savings, and thus allow them to establish priorities and to design a coherent strategy at national level. So, besides assuring commitment, these plans can also contribute to improve policy making at the national level, as information on the existing stock is currently often lacking.

It would also be opportune to have a harmonized methodology for data collection, standardization and classification, and cost-benefit methodologies to develop such a plan. In what concerns data collection, the energy performance certificates (Box 4) implemented in all Member States could in principle be used, but the information included in the certificates differs significantly between countries, and a central register of certificates is often missing. Moreover, the Regulation accompanying the Energy Performance of Buildings Directive establishes a comparative methodology framework to be used by Member States for calculating cost-optimal levels of refurbishment for existing buildings and building elements, being already a first step to the development of a harmonized cost-benefit methodology (EC, 2012).

The development of the national action plans should be also coordinated with lower level planning to take into account local opportunities (Meeus et al., 2011a, Vandevyvere, 2011). In most European cities, the buildings that compose a neighborhood are indeed often from the same period and with similar typologies. So, technical solutions used to refurbish one of the buildings can often be easily adapted to most buildings in the same neighborhood, reducing the costs for information regarding the different technical options.

1.3.3 Building refurbishment technology roadmap

Technology roadmaps are instruments that have been used in the context of the Strategic Energy Technology Plan of the European Commission. The roadmaps list the research, development, and demonstration activities needed to achieve the EU energy and climate objectives, and will also be used in the future to track progress in technology development with so-called Key Performance Indicators.

A building refurbishment technology roadmap does not yet exist, but it could help assuring that there is commitment to support the development of the technologies needed for deep refurbishments. The development of such roadmap should be strongly linked to the National Refurbishment Actions Plans, to take into account the priority needs as well as the different milestones from now up to 2050 concerning technology development.

2. Market facilitation for building refurbishment

In this chapter, we discuss how the building refurbishment market could be facilitated. The chapter is structured in three sections: section 2.1 talks about improving the awareness of the market players, section 2.2 focuses on how the market can be organized, and section 2.3 considers how the EU institutions could contribute to the development of a building refurbishment market.

2.1 Improving the awareness of the market players

The purpose of this section is to illustrate different tools to increase awareness of different market players, distinguishing between: information tools, education and public authorities that lead by example.

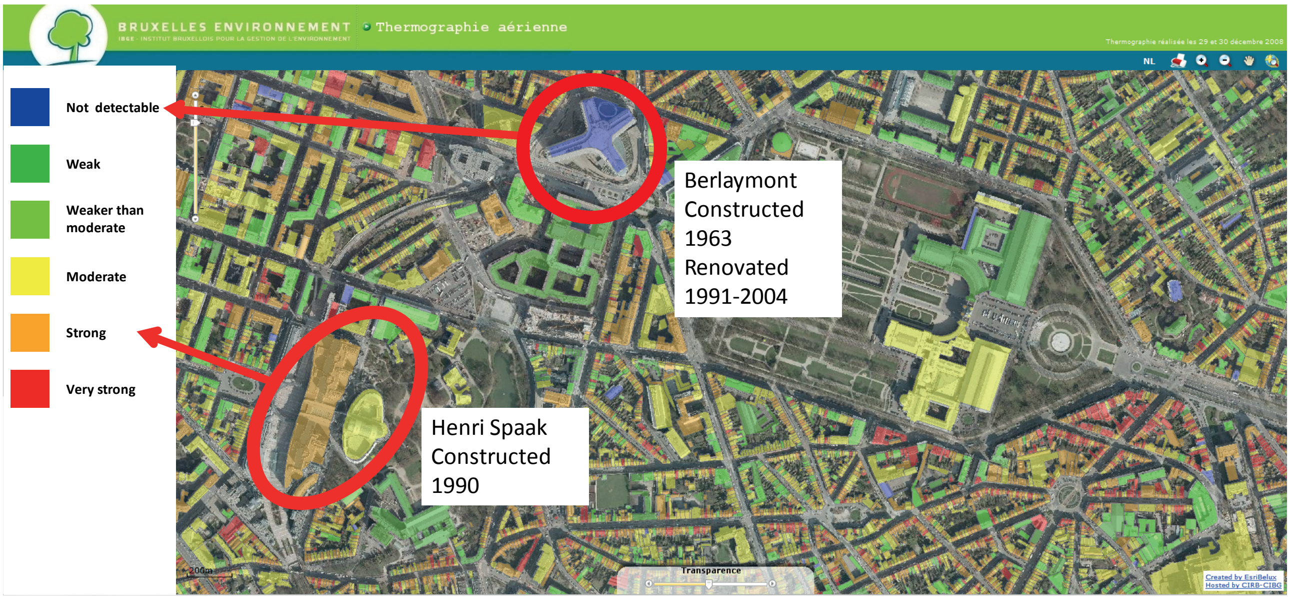
2.1.1 Information tools

To improve the awareness of the market players, we need several tools: (1) to collect, standardize and classify information; and (2) to spread information on the energy performance of buildings, and on how to improve this performance.

First, **collecting, standardizing and classifying information** (CA-EPBD, 2011; BPIE, 2011). The energy performance certificates (Box 4), made mandatory by the Building Energy Performance Directive for some buildings (EU, 2010a), can be used to collect information and built up a central register. Certificates were collected in 18 Member States in a centralized manner. However, only 11 Member States were able to utilize the collected data so far and compile a centralized register. Certification is not widespread yet: except for the UK and the Netherlands, merely 10% of the dwellings owned an energy performance certificate in the Member States. Another example of collecting information is thermal imaging. Figure 6 shows a snapshot of such an image for Brussels, measuring the energy losses of roofs in the city, highlighting the energy performance of two buildings that host the European Parliament (*Henri Spaak*) and the European Commission (*Berlaymont*), respectively.

Second, **spreading information** (Novikova et al., 2011; Logica, 2007; ERGEG, 2010). Spreading infor-

Figure 6: Snapshot of the thermo-graphic map of Brussels



Source: BIM (2008)

mation can be done via the internet or other media, energy bills, smart meters with display functionalities, and energy performance certificates:

- **Internet tools** - Typical examples are energy saving calculators,[21] or databases listing certified companies who may give expert advice on renovation.[22] But, online sources are regarded unreliable by some actors, so they cannot serve as the only way of spreading information. Furthermore, internet penetration is still insufficient to reach the majority of people targeted in a significant part of the EU population.[23]

- **Energy billing** - Billing information of past consumption is a signal which is highly effective at reaching consumers. Nevertheless, such a signal may only work properly if billing is frequent and displays actual consumption. In 2010, only 9 EU Member States[24] used monthly billing in electricity and only 8 in natural gas.[25] Moreover, historic consumption patterns are only reported in 12 EU Member States for electricity, and in 8 for natural gas. Note that only in 5 EU Member States, energy bills provide information to consumers on how they can save energy. Moreover, it is crucial that the information is provided in an understandable way so that consumers comprehend and are able to use this information to improve their consumption.

21 In Austria, energy regulator E-Control provided an online tool which gives a rough estimation of the energy performance of the building and offers refurbishment options to be considered by consumers. Similar tools are available in the UK (Energy Savings Trust), Germany and the Netherlands.

22 For example, the energy agency in Germany provides a list of certified energy efficiency experts. In Hungary, the Chamber of Architects certifies and provides the list of engineers.

23 In 2010, daily regular internet usage was below EU average of 65% in 14 Member States (Bulgaria, Greece, Italy, Romania, Czech Republic, Ireland, Spain, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Portugal) (Seybert & Lööf, 2010)

24 Estonia, Latvia, Slovakia, Spain, Sweden. Monthly billing is used in Finland, UK, Hungary and Poland to an unknown extent. ERGEG received answers from 23 Member States, Bulgaria, Cyprus, Malta and Slovenia failed to answer the questionnaire (ERGEG, 2010).

25 Estonia, Romania, Slovakia, Sweden. Monthly billing for natural gas is used in UK, Hungary, Italy, and Poland to an unknown extent (ERGEG, 2010).

- **Smart meters with display functionalities** - The planned rollout of smart meters and the possibility of providing the consumer with information about their own real-time consumption will significantly improve their awareness of energy costs. Meters may include historical (compared to past consumption) or social (compared to the consumption of neighbors) feedback. They can also include functionalities of control and automation via other platforms, such as smart phones or web-based interfaces (Vasconcelos, 2008; Olmos et al., 2011a).

- **Energy performance certificates** (Box 4) - These certificates can be used to collect and spread information. Indeed, these certificates typically contain recommended measures: in 14 EU Member States, it is based on a standardized list of technologies, in others on experts' recommendations. Furthermore, display of energy certificates in well-performing public buildings resulted in continuous enhancement of energy efficiency (Bryan et al., 2011, Godoy-Shimizu et al., 2011).

2.1.2 Education

Education to improve the awareness of the market players can be either general, or targeted at professionals.

First, **general education**. Member States can consider introducing sustainable use of energy to their curriculum. In the 2050 timeframe, the curricula for young pupils could include awareness of sustainable and responsible energy use in buildings, just as civics education. A substantial amount of materials is already available in all official languages of Europe for such a course in the Intelligent Energy project Managenergy.

Second, **professional education**. Education of contractors is crucial because building owners trust the advice of these experts. The contractors must realize the importance of energy efficiency aspects and should be able to provide up-to-date information. Note also that the demand for professional education is expected to increase because of increased employment due to increased investments in building refurbishment (Ürge-Vorsatz, 2010, 2012b). Moreover, education of the policy makers and regulators at local, national and EU level may help alleviate the institutional failures and result in better regulation and market conditions.

2.1.3 Public authorities that lead by example

For many years the opportunity of using public procurement has been largely ignored in innovation policy, while empirical evidence is increasingly indicating that it can be a more efficient instrument than the most frequently used R&D subsidies to stimulate innovation (Edler and Georghiou, 2007). The refurbishment of public buildings can indeed improve the awareness of market players by functioning as demonstration projects, which will be especially important for new technologies or new types of contracts, like energy performance contracts (Section 2.2).

For instance, the Spanish Government opened a call for tenders to implement energy services in over 300 public buildings in order to reduce the energy consumption of buildings owned by the national government by 20% (Marino et al., 2010). In France, the Government should start the renovation of all public buildings by 2012, thus creating substantial demand for refurbishment (Grenelle, 2010b).

2.2 Market organization

The purpose of this section is to discuss the importance of Energy Services Companies (ESCOs) as intermediaries in the building refurbishment market, and how an organized market can contribute to enabling their business models.

2.2.1 ESCOs as important intermediaries

Building refurbishment is a complex decision process. Indeed, there is the need to understand and identify the existing refurbishment opportunities, which techniques and technologies to use, and how to implement them. Transacting with (1) building refurbishment providers, (2) financial service providers and (3) energy suppliers is a significant burden and risk for building owners and users. ESCOs can therefore be important intermediaries (Table 3).

First, ESCOs can facilitate transactions with **building refurbishment providers**. By outsourcing the implementation of a project to an ESCO, clients can reduce their searching and information costs. These costs also include the costs related to contracting, i.e. conceiving the terms, conditions, and guarantees of the contract (see next section). An ESCO typically also provides some form of performance guarantee for the services provided, allowing technical risks to be transferred away from the customer, referred to as energy performance contracting. As illustrated in Figure 7, the concept is that the reduction in energy costs is enough to pay for the project and to the customer benefit from savings.

Second, ESCOs can facilitate transactions with **financial service providers**. By outsourcing the financing of the project to an ESCO, clients can further reduce their searching and information costs. In this case, the ESCO also takes over the credit risk. Note also that there are three basic ESCO business models (Annex 3), and in two of them, the ESCO typically (partly or fully) provides financing of the project (i.e. the so-called "shared savings", or "supply contracting" ESCO business models). This is mostly the case for projects with strong performance guarantees. When savings are only guaranteed in terms of energy, instead of in monetary terms (i.e. the so-called "guaranteed savings" ESCO business model), financing is typically done by the client, but having such a performance guarantee can anyway indirectly facilitate access to financial services.

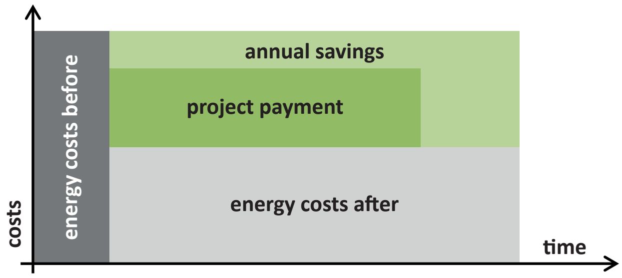
Third, ESCOs can facilitate transactions with **energy suppliers.**[26] By outsourcing the energy management of a building to an ESCO, clients can reduce their operational and maintenance costs and risks. The ESCO then also fully takes over the savings risk. Note that this is what is done in the supply contracting ESCO business model. The customer is then guaranteed a reduction of his current energy bill throughout the contracting period. This is an attractive proposition, but it can only work for clients that can express in a contract what they need in terms of energy services, and whose building operation and maintenance can be taken over by an ESCO. This type of contracting is therefore typically used for commercial rather than residential buildings.

Note finally that ESCOs focus mostly on energy savings, which can conflict with other building qualities, such as proper lighting, indoor air quality, and com-

26 It is noteworthy that energy suppliers themselves could in principle provide energy services similarly to an ESCO. Indeed, energy suppliers already have a contractual arrangement with the consumer and privileged access to information on consumption patterns. Moreover, this would be especially opportune when energy efficiency obligations are put on energy suppliers.

fort. For instance, users of a newly automated heating, ventilation and air-conditioning system found the inability of adjusting temperature too intrusive, resulting in the installation of additional electric heaters and on the long run removal of the automation (Crosbie and Baker, 2009).

Figure 7: Energy performance contracting[27]



Source: own depiction

2.2.2 Enabling the ESCO business models

Despite the clear advantages that ESCO business models can bring as intermediaries in building refurbishment investments, this concept is still not well developed in Europe. There seems to be consensus that a coherent framework for the ESCO market is lacking (Bertoldi et al., 2006; Marino et al., 2010 and 2011; Szomolanyiova and Sochor, 2011; Vine, 2005).

Thus, in this section, we analyze how such framework could help to enable the use of ESCO business models. We refer to one of the EU Member States that started experimenting with an organized market for building refurbishment (Box 2); and we also illustrate how this organized market enables the ESCO business model with clear rules for: (1) who to contract, (2) how to contract, and (3) what to contract.

First is **who to contract.** The UK Green Deal includes an accreditation scheme designed for auditors giving advice, as well as for building refurbishment installers, and service providers, including ESCOs. This type of accreditation schemes is crucial to establish and maintain confidence in the building refurbishment market; this is a kind of quality label that allows investors to trust who they are contracting. However, it is important to ensure that such accreditation scheme should not hamper the new-entries in the market and thus prevent competition.

Second is **how to contract**. The UK Green Deal also includes standardized contracting. This is about reducing transaction costs, especially important for smaller clients. Note that the UK Green Deal follows a business model where the ESCO takes over the technical, credit, and saving risks. In the UK, energy suppliers are now even obliged to provide the necessary billing services to ESCOs, and the energy supply contract stays within the building, even if the owner or user of the building would change.

Third is **what to contract**. The UK Green Deal also includes standard measurement and verification procedures to measure savings. This is extremely important as it is the basis on which ESCOs provide performance guarantees in their energy performance contracts with building users or owners. Therefore, standardized protocols are needed to reduce the mistrust of clients and financers with ESCO business models. Note also that there is a European Association of ESCOs that started promoting an International Performance and Measurement & Verification Protocol (IPMVP) (eu.bac and eu.esco, 2011). This protocol defines different options (adapted to different applications) and describes how savings should

27 Note that the Internalization of carbon price into the energy price is important to make sure that the building refurbishment market, and this type of energy performance contracting, is aligned with the objectives of reducing greenhouse gas emissions in buildings, see also section 3.1.

Table 3: Summary of the main added value of the different energy performance contracting business models (see Annex 3)

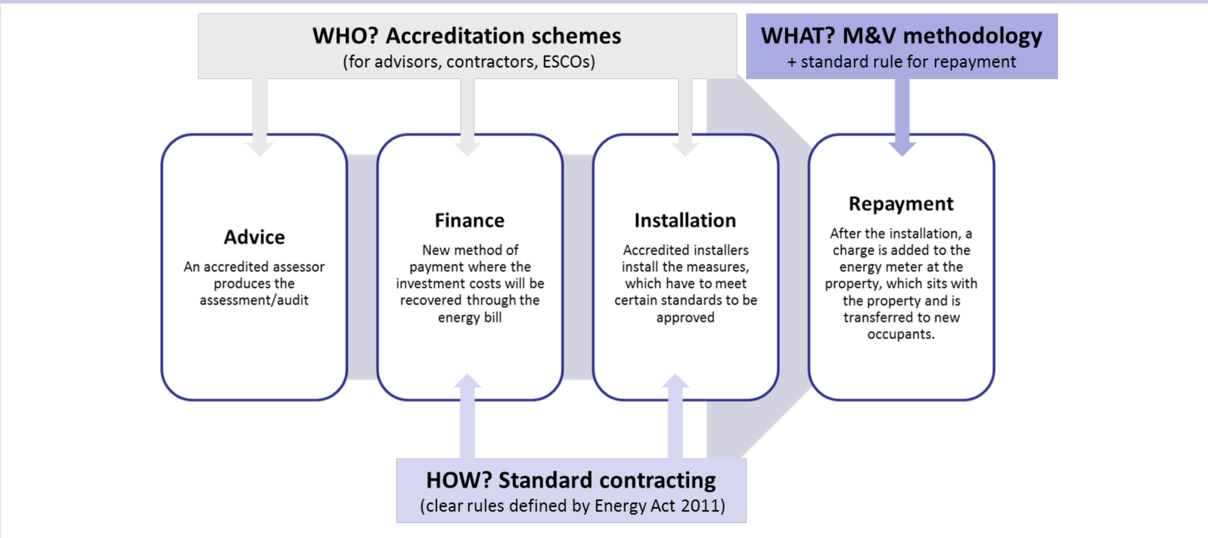
ESCO role as intermediaries that facilitate the transactions with	Guaranteed savings	Shared Savings	Supply contracting
Refurbishment providers	YES	YES	YES
Financial service providers	NO/YES	YES	YES
Energy suppliers	NO	NO	YES

Source: own depiction

be measured in each option.

Finally, it is important to remember that ESCOs, even if important to prompt building refurbishment, are not the only intermediaries that can push refurbishment. Indeed, we should also keep in mind the possible role of building refurbishment providers and financial institutions in enabling the development of the building refurbishment market. Indeed, market facilitation can also be about enabling financial service providers to provide capital to building refurbishment. In the case of the UK Green Deal, the perceived risk of the financial institution has for instance been reduced because the repayment of the loan is connected to the energy bill, which are more likely to be paid than separate loans. In the case of Germany, public support has been used to allow financial institutions to provide low cost capital to refurbish buildings, see Chapter 4.

Box 2: UK Green Deal, a framework to enable the development of ESCOs market (DECC, 2012; HMG, 2011)



Green Deal was established by the national government in the UK to enable large-scale energy efficiency improvements in British households. It consists on a framework that provides support to building owners/users throughout the whole process (as shown on the scheme above). The Energy Act 2011 includes provisions for the Green Deal, including: the establishment of an accreditation scheme for all energy services providers; and the establishment of clear rules for the contracting procedures, defining standard contracting and billing.

2.3 How the EU institutions could contribute to the development of the building refurbishment market

There are many initiatives to improve the awareness of market players, such as BUILD-UP that provides an EU platform to collect and exchange experiences (BUILD UP, 2009), and the promotion of smart metering.[28]

At this stage where Member States only just started to experiment with organized markets for building refurbishment, like the UK Green Deal, it will be difficult to agree on an EU design. Still, it is important that Member States have a market framework for building refurbishment, which should include: (1) accreditation (who to contract), (2) standardized contracting (how to contract) and (3) measurement and verification protocols (what to contract). As we discuss in what follows, the EU institutions are already involved in these three issues, and more could be done.

- First, **accreditation.** The Energy Services Directive (EU, 2006b) already took a step in this direction, as it requires Member States to ensure the availability of appropriate qualification, accreditation and/or certification schemes for providers of energy services. The EU institutions could be further involved by introducing an EU quality label for ESCOs that Member States could voluntarily subscribe to, or by at least providing guidelines for national accreditation of ESCOs.

- Second, **standardized contracting**. The Energy Services Directive (EU, 2006b) also took a step in this direction because it includes an obligation to make model contracts for the financial instruments available to existing and potential purchasers of energy efficiency, including energy performance contracting. The EU institutions could be further involved by supporting the design of contract templates.

- Third, **measurement and verification protocols**. The Energy Service Directive (EU, 2006b) defines a methodology for measurement and verification of energy savings, which is the methodology to be used for the National Energy Efficiency Action Plan (NEEAP) that Member States are required to submit (EC, 2009). In other words, this methodology has not been designed to be used for energy performance contracting for the refurbishment of buildings. There is also a study that started collecting and comparing the current energy performance contracting practices in Europe, i.e. the European Energy Service Initiative (EESI) supported by the Intelligent Energy Europe (EESI, 2009). The EU institutions could be further involved by supporting the development of an EU standard protocol.

28 Communication from the Commission. Smart Grids: from innovation to deployment. COM(2011) 202 final. Available at: http://ec.europa.eu/energy/gas_electricity/smartgrids/doc/20110412_act_en.pdf.

3. Regulatory instruments for building refurbishments

In this chapter, we discuss how regulatory instruments could be used to steer the refurbishment of buildings. The chapter is structured in five sections: section 3.1 looks at how we can modify the price incentives decision makers are facing; and, from section 3.2 to section 3.4, we discuss the regulation of actors, inputs, and outputs, respectively; in section 3.5 we consider how the EU institutions could facilitate the implementation of regulatory instruments.

3.1 Price incentives

Providing price incentives refers to interventions that affect directly the relative prices relevant for refurbishment decisions. This includes the prices of energy sources, services, and building components and systems. The instruments are therefore the following: energy and greenhouse gas emission taxes, removal of fossil fuel subsidies, tax advantages for equipment with favorable energy efficiency or renewable energy utilization properties, support or special tariffs to promote the use of renewable energy sources in buildings. In what follows, we discuss the rationale of this category of regulatory instruments and its limitations.

First, the **rationale**. Price incentives are needed to give building actors correct economic signals to refurbish, but also to guide them towards the right choices when refurbishing, and to provide them with incentives for an efficient energy use in buildings. As already discussed in Chapter 1, we need more carbon price regulation to internalize the reduction of greenhouse gas emissions into the building refurbishment decisions, while there should be less end-user regulated prices for electricity and gas since these interventions are distorting the building refurbishment decisions.

Second, the **limitations**. The main advantage of the price incentives is that it is market compatible and technology neutral, but it will not suffice to reach the 2050 building sector target. In some cases the economic case for refurbishment is uncertain at today's prices. Where refurbishing would already be clearly economical, there are other issues, such as the unqualified decision makers and market failures that may still prevent actors from undertaking refurbishment. This can then justify the use of additional regulatory instruments (Figure 1), such as regulation of actors (which can oblige them to act), regulation of inputs (which can avoid that actors can take the inappropriate decisions when acting), and regulation of outputs (which can regulate performance and incentivize actors to use energy in a manner that is efficient and compatible with the greenhouse gas emission reduction targets). The Member states we surveyed indeed use a combination of price incentives with other regulatory instruments (Annex 4).

3.2 Regulation of actors

Regulation of actors refers to refurbishment obligations imposed on the various actors, which can be the building owners or users, distribution grid operators, energy suppliers and/or even public entities. In what follows, we discuss the rationale of this category of regulatory instruments and its limitations.

First, the **rationale**. It can be necessary to oblige actors to act because the expected investments are not always economical from the point of view of the individual decision maker. There are many different practices that implement such an obligation and the experience is that it is difficult to generalize what works best, as this can be quite context specific. Obligations however tend to be put on third parties since obligations for building owners or users are more difficult to administer and enforce, while there are exceptions. With the exception of the UK, the saving obligations have been expressed in energy rather than greenhouse gas emissions, which would be more aligned with the 2050 building sector target (Box 3).

Second, the **limitations**. The limitations are also actor specific. Energy suppliers and distribution grid operators, for instance, have privileged information to identify promising investments, and they already have a contractual relation with building owners and users, but their core business is to deliver energy so it is against their interests to save energy. Nevertheless, even if the split incentives affect both distribution grid operators and suppliers, in the case of distribution (since it is a regulated business) the disincentives can be at least partly corrected through changes in the way these grid companies are regulated.[29] Alternatively, the obligations can be put directly on building owners and users, but this then requires individual building inspections to monitor compliance. Note that such inspections already exist for the healthiness of buildings (e.g. in Sweden to check for moist), and their safety (e.g. Demark), but not yet for their energy performance.

3.3 Regulation of inputs

For the regulation of inputs we can distinguish between: technology standards (i.e. minimum energy performance requirements) and labeling (i.e. providing energy performance information) for building products and materials. In what follows, we discuss the rationale of this category of regulatory instruments and its limitations.

First, the **rationale**. Because of the actors' lack of skills and market failures, it can be necessary to avoid (with standards) or reduce (with labeling) the risk that actors make inappropriate decisions in selecting material and products when refurbishing.

Second, the **limitations**. Energy performance is not only about choosing the right products and materials when refurbishing, it is also determined by the installation and the behavior of building users and owners after the installation. Moreover, the performance of certain building systems and components depends on the whole building and its interactions with other systems and components. For instance, the installation of a very efficient boiler will not guarantee a high performance level of the building as a whole, since the latter might have insufficient insulation.

3.4 Regulation of outputs

For the regulation of outputs we can distinguish between: performance regulation, which imposes energy performance requirements (such as the establishment of minimum energy performance level for refurbished buildings); and usage regulation, which imposes minimum requirements on how energy is used, including behavioral constraints (such as the establishment of minimum and maximum indoor air temperatures).[30] In what follows, we discuss the rationale of this category of regulatory instruments and its limitations.

First, the **rationale**. To address the lack of skills of the actors and market failures, it can be necessary to regulate not only the energy performance of buildings, their systems and components, but also to incentivize

29 For instance, the volumetric billing could be removed, decoupling revenues from consumption. Some federal states have already introduced decoupling and lost revenue adjustment mechanisms, which recompense the net revenue losses of utilities who engage in renovation activity. Another solution would be the establishment of a network reference model, which provides benchmark revenue and investment cost estimates, allowing for decoupling revenues from usage. These measures do not provide an incentive for carrying out renovation activity, but remove a significant barrier of the distribution companies (MIT, 2011).

30 Currently, performance regulation already exists in the building codes of 14 Member States for renovation (PRC, 2011). Moreover, there are also some examples of local governments that established buildings codes with stricter performance requirements than the ones defined at the national level (Meeus et al., 2011a).

Box 3: Energy or greenhouse gas emission saving obligation schemes

The main experiences with energy or greenhouse gas emission saving obligation schemes are from UK, Italy, France, Denmark and the region of Flanders (in Belgium). Currently there are also some schemes emerging in Poland and Ireland.

They differ in terms of eligible sectors, obliged parties, option to trade, nature of the saving target, measurement and verification methodology, cost recovery and sanctions. They have in common that their achieved savings have been mainly in the building sector.

The table below presents some of the major design choices of these 5 schemes.Because of considerable differences in the measurement and verification methodologies, the relative performance of these schemes cannot be compared. The benefits have been reported to be larger than expected, but issues have been raised regarding the transparency of the evaluation used in different Member States with concerns of double counting.

In conclusion, there is not a "one size fits all" for saving obligation schemes, the design has been typically adapted to the national context, priorities and decisions concerning energy and greenhouse gas emission savings (Bertoldi, 2012; Cowart, 2012; Pavan, 2012).

	UK	Italy	France	Denmark	Flanders (BE)
Obliged parties	Electricity and gas suppliers	Electricity and gas suppliers	All energy suppliers	Electricity, gas and heat distributors	Electricity distributors
Eligible customers	Residential	All	All except EU-ETS sector	All except transport	Buildings
Nature of saving target	CO_2 lifetime savings	Cumulative primary energy savings	Lifetime final energy savings	Annual final energy savings	Annual primary energy savings
M&V approach	Deemed savings	Deemed savings	Deemed savings	Specific engineering calculations	NA
Accreditation of savings	Ex-ante	Ex-ante (majority)	Ex-ante	Ex-ante (adjusted)	Ex-ante
Trading option	Trading among suppliers	Spot market OCT (dominant)	OCT	No trading	No trading

Note: This box has been mostly based in the material presented in the "Energy Efficiency and the Internal Market Workshop", held by the Florence School of Regulation in collaboration with the CEER, on 30th March 2012.

actors to use energy in a manner that is efficient and compatible with the greenhouse gas emission reduction targets. Indeed, output regulation can reward good and/or punish inappropriate decisions.

Second, the **limitations**. The main limitations of output regulations are related to their administration and enforcement. For instance, energy performance regulations rely on energy performance certificates. The Energy Performance of Buildings Directive (EU, 2010a) already made such a scheme mandatory in each EU Member State, but it does not yet apply to all buildings, and there are concerns about the implementation of this scheme in some Member States

(Box 4). To enforce compliance with requirements such as the minimum and maximum indoor air temperatures for residential buildings is even more challenging.

3.5 How the EU institutions can facilitate the implementation of regulatory instruments to steer the refurbishment of buildings

The purpose of this section is to discuss how the EU institutions can facilitate the implementation of regulatory instrument to steer the refurbishment of buildings, starting from their current involvement (Table 4).

3.5.1 Price incentives

In what follows, we discuss the EU involvement in: (1) end-user regulated prices for electricity and natural gas; (2) energy taxation; (3) carbon pricing.

First, **end-user regulated prices** for electricity and natural gas. Infringement procedures against these practices not in line with the EU liberalization legislation are already on-going, but additional action could be envisaged in order to speed-up their abolishment. For instance, the EU could help avoiding paradoxes such as providing subsidies for energy savings investments to Member States that are keeping energy prices artificially low.

Second, **energy taxation**. Minimum energy excise duties have already been introduced in nearly all Member States (except for Cyprus, Slovakia and the UK), but energy taxes still represent only 2-3% of the electricity and natural gas bills in Europe (Eurostat, 2011a; DG Tax, 2012b). Moreover, some Member States subsidize energy consumption by setting lower VAT rates for energy products which can heavily distort the costs and benefits of building refurbishment.[31] The EU could therefore advocate the strengthening of the minimum rates of taxation for the different energy carriers set by the Directive 2003/96/EC (EU, 2003).

Third, **carbon pricing**. The EU-ETS currently does not apply to buildings, and so it could be extended to the building sector or, alternatively, carbon taxation could be implemented to internalize the greenhouse gas emission reductions into building refurbishment decisions.

3.5.2 Regulation of Actors

In what follows, we discuss the EU involvement in: (1) obligations for building owners; (2) obligations for energy suppliers.

First, obligations for **owners of buildings**. The Energy Performance in Buildings Directive (EU, 2010a), obliges building owners who intend to sell or rent, to have an energy performance certificate but they are not obliged to perform any energy efficiency improvements. Moreover, the buildings that undergo a major renovation have to comply with the regulations that apply to new buildings. Note also that the proposed Energy Efficiency Directive (EU, 2011a) includes a specific obligation to refurbish annually 3% of the floor area in public buildings from 2014.[32]

31 France, Greece, Ireland, Italy, Luxemburg and the UK apply VAT rates below the standard VAT rate for natural gas and electricity. VAT for gas is lower than the standard rate in Malta. (DG Tax, 2012a).

32 For a detailed discussion of the proposed Energy Efficiency Directive, see Fouquet and Nysten, (2012).

Second, obligations for **energy suppliers.** The proposed Energy Efficiency Directive (EU, 2011a) includes an obligation for energy retail suppliers to achieve annual savings of 1.5% of the respective energy sales.

Note that there is a rationale for implementing saving obligations, but it is not clear on which actor this obligation should be put, and what works best can be context specific. Therefore, it could be better to leave that choice of actor up to Member States.

3.5.3 Regulation of Inputs

In what follows, we discuss the EU involvement in: (1) labeling; and (2) technology standards.

First is **labeling**. The EU is already involved in setting minimum requirements for national labeling schemes; and for office equipment and appliances the EU joined the Energy Star program in 2006 (EU, 2006a). The Energy Star program in Europe is a voluntary participation regime for office equipment manufacturers, delivering a market pull for producers to create products which outperform the minimum requirements. From 2008

Box 4: Energy performance certificates

What is it?

According to the EPBD recast (EU, 2010a), all Member States shall establish a system of certification of the energy performance of buildings, helping to achieve more harmonized evaluation and communication of the energy performance of the existing building stock. Indeed, energy performance certificates are considered important tools to raise awareness of energy consumption and also address some of the market failures that lead to sub-optimal energy efficiency improvements in buildings (IEA, 2010b).

The certificate shall include the energy performance of a building and reference values (such as minimum energy performance requirements) so that owners or tenants of the building can compare and assess its energy performance. Recommendations for cost-optimal or cost-effective improvement of the performance must also be included, with an estimate for the range of payback periods or cost-benefits over the measures' economic lifecycle as well as an indication on where the owners or tenants of the buildings can receive more detailed information. Additional information, such as annual energy consumption, share of energy from RES and existing financial incentives, may also be included in the energy performance certificates. The validity of a certificate can be up to ten years.

What is the scope?

The issue of an energy performance certificate is mandatory for: (1) buildings or building units which are constructed, sold or rented out to a new tenant; and (2) buildings where a total useful floor area over 500 m2 is occupied by a public authority and frequently visited by the public. On 9 July 2015, this threshold shall be lowered to 250 m2. (EU, 2010a) In the case of (2), the certificates also have to be displayed in a visible part of the building.

Implementation at the national level

Currently, all Member States have already implemented a certification system for the energy performance of buildings, but five of them (Greece, Hungary, Romania, Spain and the Brussels Region of Belgium) still have not implemented it for all types of buildings required by the legislation (BPIE, 2011).

Even if there are some contents which have to be included in all the certificates, the certificates issued by different Member States are very different among them (Thomsen and Wittchen, 2010). There are significant differences not only in terms of appearance and labeling scales, but also in terms of the methodology behind the values presented (in the way energy performance rating is obtained, the recommendations are formulated, etc.).

Moreover, these different methodologies do not always provide robust and credible results. Also, the physical unit used to identify energy performance differs a lot among Member States: while in some is the actual energy consumption, in others it is a relative value, compared to a reference case. Regarding the additional data, CO2 emissions is the one that is most frequently included, even if not all Member States.

Examples of labels: Italy (left), Denmark (center), Sweden (right)

Source: CA-EPBD, 2011

on, EU institutions and Member State governmental authorities are required to purchase office equipment which meet or exceed the criteria set by the Energy Star framework (EC, 2008). The Labeling Directive of 1992 (92/75/EC) was replaced in 2011 by the Directive 2010/30/EU, setting new classification and requiring energy performance labels for household air conditioners, white goods, televisions and light bulbs. Both Energy Star and energy labels display performance related to energy use, not greenhouse gas emissions.

Second is **technology standards**. The EU is also involved in setting technology standards:

- The Eco-Design Directive, adopted in 2009, introduced the life-cycle approach to the manufacturing and certification of energy consuming products, requiring the CE marking for energy consuming products for the EU market (EU, 2009c). Manufacturers and importers may however self-certify their products, if they received prior accreditation by national regulatory institutes, so that the efficiency of this scheme strongly depends on national practices.

- The Energy Performance of Buildings Directive (EU, 2010a) requires Member States to implement cost-effective minimum requirements regarding energy performance of the building envelope or the technical building system. Minimum requirements are already implemented in case of construction products, air conditioners, white goods, televisions, household and tertiary lighting, set-top boxes and home office appliances.

The rationale to do this at EU level is that purely national regulations for building materials and products could create barriers for the internal market, and it is important to continue this ongoing process so that the EU regulations apply to all materials and products used in the refurbishment of buildings. Otherwise, there could be a decision bias towards products and materials not yet subjected to these EU regulations.

3.5.4 Regulation of Outputs

The EU involvement in the regulation of outputs is currently limited. The Energy Performance of Buildings Directive (EU, 2010a) mandated Member States to define minimum performance requirements for new buildings and also for the existing building stock, but only when undergoing a major refurbishment or for public buildings.

The EU did already enable output regulation by requiring Member States to install an **energy performance certification scheme,** which could be used to introduce energy performance regulations for buildings at the national level. Moreover, there are regulations for other qualities of buildings that can have a positive effect on the energy performance of a building. For instance, minimum indoor air quality requirements (EU, 2010a) can positively influence the choice of air conditioning and ventilation systems during a refurbishment process (Bluyssen et al., 2003; Oliveira Fernandes, 1994 and 2000).

Regarding energy performance certificates, we already mentioned in Chapter 1 that it would be opportune to harmonize these schemes for buildings and develop national building refurbishment action plans based on the certificates. In this chapter, we found that there are problems with the national implementations of this scheme, while we need the scheme to be a reliable tool to ensure the compliance with existing (and future) output regulations, which is then an additional reason to harmonize the certificates. The proposed Energy Efficiency Directive is a first step towards a solution as it introduces stricter requirements. Moreover, it is an opportunity for the establishment of an EU scheme that Member States could voluntarily subscribe to, since they will anyway need to change their national schemes to cope with the new requirements.

4. Public support for building refurbishment

In this chapter, we discuss how to provide public support to building refurbishment. The chapter is structured in two sections: section 4.1 checks how EU funds are being used, and section 4.2 then discusses how better use could be made of these funds.

Table 4: Summarizing the current EU involvement

Pricing	Actors	Inputs	Outputs
EU-ETS Emissions trading scheme **Energy taxation** Min. taxation rate for different energy carriers	**EE proposal** Mandatory rate of refurbishment for public buildings Energy saving obligation for energy suppliers	**Labeling** Obligation to display energy consumption information Establishment of standard labeling for office equipment **Eco design** Minimum requirements in the product life-cycle for energy consumption, CO2 emissions, pollution, waste, … **EPBD** Minimum requirements for products, when refurbishing	**EPBD** Min. performance requirements when refurbishing Mandatory energy performance certificates when refurbishing, selling or renting the building Guidelines for development of energy performance certificates

Source: Own collection

4.1 How EU funds are being used

In this section, we illustrate that not all available EU funding is currently being used.

4.1.1 The available budget for building refurbishment

Altogether, up to €15 billion is available for building refurbishment investments and R&D of new technologies. This includes: (1) Cohesion Policy; (2) 7th Framework Program (FP7); (3) European Energy Efficiency Fund (EEEF); (4) and Intelligent Energy Europe (IEE) program.

First, the **Cohesion Policy** (EU, 2006c). The budget amounts to €347 billion in the 2007-2013 period, which is more than one third of the total budget of the European Union, and it is used to increase the social, economic and territorial cohesion among the different regions in Europe. The budget is divided in three funds: the European Regional Development Fund (ERDF) targeted at the less developed regions, and may be targeted at building refurbishment; the European Social Fund (ESF) can be received by all Member States, but does not cover building refurbishment; and the European Cohesion Fund (ECF) that finances the infrastructure and environmental projects of the EU12. Member States can access these funds by creating their own operational programs and/or by using dedicated EU financial instruments (e.g. JESSICA, JEREMIE and JASPERS). Recently, Member States have also been given the opportunity to use more of their total ERDF endowment for housing projects, so that now up to 6% of the total ERDF budget may be used for building refurbishment.[33]

Second, the **7th Framework Program** (FP7). This program has a budget of €50 billion to foster the research activity, cooperation and research capacities of Europe in the time period 2007-2013. Of this endowment, €2.35 billion may be committed for supporting

33 The economic recovery package in 2009 (EU, 2009b) includes a provision that allows all Member States to re-allocate 4% of their total ERDF endowment to energy related housing projects. A further amendment in 2010 gave the possibility for all Member States to utilize additional 2% of the ERDF funds for the rehabilitation of urban areas and renovation in order to help the social inclusion of marginalized communities (EU, 2010c).

energy-related research. About half of the budget for energy, €1 billion, is devoted to the Energy Efficient Buildings Public Private Partnership project that supports the development of innovative technologies for the construction sector.

Third, the **Intelligent Energy Europe** (IEE) program (Deloitte, 2011; EU, 2006d; EC, 2011e). This program with a total budget €735 million for the period 2007-2013 was set up to ensure sustainable energy and enhance competitiveness. This includes projects on energy efficiency in all areas except transport (SAVE); use of renewable and alternative sources of energy (Altener); energy efficiency in transport (STEER); or the combination of them (Integrated Initiatives). Note that this program also financed five technical assistance facilities.

Fourth, **European Energy Efficiency Fund** (EEF) (EU, 2009d; EU, 2010b). The fund was launched in 2011, with a total budget of €286 million. Half of the budget came from the European Economic Recovery Program, and the other half from financial institutions in the private sector. The fund is for projects that achieve at least 20% energy savings or greenhouse gas emission reduction in urban areas. Note also that part of the money serves as technical assistance.

To sum up, the total amount of EU funding for building refurbishment is almost €15 billion. Most of this money is to support the implementation of projects (around 85% of the total budget), but there is also money for research, development and demonstration activities (around 15% of the total budget), and for the preparation of projects, and to help them apply for EU funding, i.e. technical assistance (around 1% of the total budget).

4.1.2 Utilization of funds

By the end of 2009, Member States allocated less than 1% of the ERDF funding for building renovation, while they can use up to 6% (Ward, 2011).[34] Absorption of the research has proven to be higher: around €2.2 billion has been executed so far of the €2.3 billion budget.

One of the reasons for the EU public funds being under-utilized may be the excessive "red tape". Participating in tenders for Cohesion Policy Funding has proven to be a substantial barrier, which is why technical assistance facilities aiding project preparation have been set up. They provide finances for creating documentation of project application, such as feasibility studies or formulating a business plan. Around €200 million is devoted to technical assistance for major (JASPERS, ELENA-EIB), medium (ELENA-KfW, ELENA-CEB, ELENA-EBRD) and minor (MLEI) projects. Since technical assistance tools have proven to be highly successful, their scope has been gradually extended to smaller projects and other targets.[35]

Finally, it is also noteworthy that there are also funds that can be used for building renovation but that are not dedicated to energy related renovation, but that aim at other issues instead. Box 5 presents some of these issues, by giving Member State examples of support to non-energy renovation.

34 In Estonia, following a successful CO_2-quota sale, the Government reprogrammed the budget, financing energy efficiency in buildings with the quota revenues. However, support from the ERDF to buildings was reduced from the previous 4% to 1% (Kalvet, 2011). In Poland, energy efficiency for housing amounts to only 1.2% of the ERDF and CF sums. State supports remains also negligible, leaving great potentials untapped (Kassenberg, 2011).

35 For instance, CEB-ELENA founded in 2011 provides support for social housing; EBRD-ELENA set up in 2012 targeted the Eastern European Member States.

Box 5: Member State support for non-energy related renovation

Rationale for the non-energy related renovation support include: (1) poverty; (2) rehabilitation policies; (3) other social issues; and (4) technology development.

First, some households spend a considerable amount of their income to ensure their basic energy needs, or fail to provide the sufficient indoor climate. For example, 60% of the people in new EU Member States spend more than 10% of their income for energy in their households (Eurostat, 2005). Therefore some Member States help the less affluent people to overcome the barrier of high upfront cost by giving grants for investment (such as the Warm Front scheme in the UK).

Second, deteriorating urban areas may require an overall rehabilitation to improve social cohesion, touristic or cultural appeal. For instance in Germany from 2002 to 2009, high-scale urban restructuring was undertaken within the framework of Stadtumbau program. Due to high emigration from former Eastern Germany urban areas, around 350 thousand flats needed to be demolished or restructured. With smaller multi-family houses, more livable and spacious urban areas were created (Couch et al., 2011).

Third, the elderly population of the European Union is on the rise. In 2010, 17% of the population in the EU27 was older than 65 years (Eurostat, 2011b). Over 90% of the elderly people choose to live in their own homes or with relatives, which need to be adjusted to fit the altered needs of the elderly occupants (Kasanen, 2004). In France for instance, senior owner-occupiers receive 70% subsidy for renovating – 20% higher, than young owner-occupiers. In Denmark, the entire cost of renovation may be recovered, when the refurbishment investment targets adjustments for elderly (Baek and Park, 2012).

Fourth, Member States may invest in the rapid installation of various promising technologies, such as heat pumps, PV panels or solar water heating. For instance, Denmark subsidizes boiler replacement (Danish Ministry of Climate, Energy and Building & Danish Energy Agency, 2011) while Germany provides grants for installation of solar thermal heating, heat pumps and innovative biomass solutions for heating (Amecke and Neuhoff, 2011). The first topic of THINK (Olmos et al., 2011b) addressed the reasons of public support for R&D activities in detail.

4.2 Making better use of the existing EU funds

In what follows, we illustrate that making better use of EU funding could include: (1) requiring the development of a national building refurbishment plan; (2) avoiding paradoxes; (3) performance based allocation of funding; (4) avoiding excessive subsidization; and (5) leverage public funding.

First, **national building refurbishment plan**. As argued in Chapter 1, such a plan is about making an inventory of the national building stock, and would serve to identify policy priorities. Without such a plan, we risk to allocate public funding where it is actually not needed, or not to provide funding where it is crucial.

Second, **avoiding paradoxes**. It would indeed be paradoxical to support building refurbishment investments with EU funding in Member States where energy prices are kept artificially low, or where the carbon price has not been fully internalized into the building refurbishment decisions.

Third, **performance based allocation.** A performance based allocation of public funds can be done based on post-installation monitoring of a building refurbishment investment that has received support. This requires that Member States properly implement energy performance certificates for buildings so that performance improvements can be correctly measured, and funding can be allocated accordingly.

Fourth, **avoiding excessive subsidization**. Indeed, we should avoid that public funding goes to investments that would have been carried out anyway so that the money goes where it is most needed, for instance, to poor families that would otherwise not be able to refurbish.

Fifth, **leverage public funding** with financial mechanisms. For example, the successful KfW loans and grants in Germany require a leverage factor of ten for individual measures and two for complex retrofits, this encouraging recipients to aim for deeper renovation (Neuhoff et al, 2011). On average, public investment of €27 billion leveraged €54 billion in the period 2006-2009 (Sweatman, 2012).

The above has not yet been implemented to allocate EU funding, with some exceptions. For example, the European Energy Efficiency Fund only supports projects that achieve 20% primary energy savings, and also ELENA funding requires applicants to deliver 20% energy or greenhouse gas emission savings, which can be considered as a form of performance based allocation of EU funding.

5. Recommendations

The EU institutions should give Member States enough freedom to tailor their building refurbishment policies to their own context, but they nevertheless have an important role to play, which is mainly about assuring that there is commitment at the national level to address the building refurbishment problem, and in facilitating the implementation of solutions to the problem.

The prerequisite to refurbish all buildings by 2050 is to provide correct economic signals:

1) **Put an end to end-user regulated prices for electricity and gas.** Infringement procedures against these practices, not in line with the EU liberalization legislation, are already on-going; however, additional actions could be envisaged in order to speed-up their abolishment. For instance, the EU could avoid paradoxes such as providing subsidies for energy savings investments to Member States that are keeping energy prices artificially low.

2) **Internalize the carbon price into the building refurbishment decisions.** Currently, the carbon price is only partly internalized so that the decisions are biased towards fossil fuels, which is inconsistent with the EU climate and energy objectives. The recent EU Energy Tax Directive proposal was a first step in this direction, but more is needed.

The primary actions to refurbish all buildings by 2050 are about ensuring that the EU 2050 building sector target is reached:

3) **Establish national building refurbishment targets (or, at least, mandate the development of a national building refurbishment action plan)**. This is essential to assure that there is commitment to address the problem at national level. The establishment of targets has indeed already proven to provide commitment in other energy policy areas. However, if targets are politically infeasible, Member States should at least be required to submit a plan so that the European Commission can monitor progress. These plans will then also be instrumental for the development of national building refurbishment policies.

4) **Create an EU energy performance certificate scheme.** Regulation will be needed to get the expected investments in building refurbishment. What works best will be context specific, but it will typically include obliging actors to refurbish, and ensuring that this refurbishment also leads to improved energy performance. For the implementation of these regulations, energy performance certificates might be crucial as they can be used to administer and enforce the regulations. Therefore, the EU's main role as facilitator of national solutions to the building refurbishment problem is to make sure that there are adequate energy performance certificate schemes for buildings.

The proposed Energy Efficiency Directive already introduces stricter requirements, which is an opportunity for the establishment of an EU scheme that Member States could voluntarily subscribe to. Indeed, Member States will anyway need to change their national energy performance certificate schemes to cope with the new requirements.

Note finally that these certificates can then also provide the necessary information for the development of national building refurbishment action plans, especially if they apply to more buildings than today. More harmonized energy performance certificates would also make it easier to develop compare the resulting national plans.

Secondary actions to refurbish all buildings by 2050 are about minimizing the costs of achieving the EU 2050 building sector target:

5) **Facilitate the design of a building refurbishment market framework.** At this stage where Member States have just started to experiment with organized markets for building refurbishment, like the UK Green Deal, it will be difficult to agree on an EU design. Note however that any national market framework should include accreditation, standardized contracting, and measurement and verification protocols for building refurbishment. The EU institutions are already involved in these three issues, but more could be done, including the establishment of a quality label for energy services providers, and the development of contract templates and a standard measurement and verification protocol.

6) **Continue to widen and strengthen the technology standards and labeling of building refurbishment technologies, products and materials.** This is an ongoing process that needs to be finalized to avoid decision bias. Note that the rationale to do this at least partly at EU level is that national regulations for building materials and products can create barriers for the internal market.

7) **Develop a EU building refurbishment technology roadmap**. The development of a roadmap is needed to coordinate building refurbishment research, development, and demonstration activities, as well as to track progress of the technologies that are of strategic importance to achieve the building sector objectives. Several roadmaps have been developed in the context of the SET-Plan, but not yet for building refurbishment technologies.

8) **Use EU funding to support the implementation of the previous recommendations**. EU funding should indeed be allocated on the basis of a national building refurbishment action plan, which should therefore be a condition to receive funding. The allocation should also be performance based, which requires that energy performance certificate schemes for buildings are well-implemented in Member States. Another condition could be that energy price distortions need to be addressed, as it would indeed be paradoxical to provide EU funding for energy savings investments in Member States that keep energy prices artificially low.

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Annexes

Annex 1: Technical building refurbishment options

There are several options to reduce the GHG emissions from the existing building stock, and it is not possible to say which one is the best, since their costs and benefits are context specific and strongly related with the characteristics of the building in which they are implemented. In the following table, we present a short summary of the possible options to reduce GHG emissions within the building sector. Note that this annex is mostly based on the second THINK report (Meeus et al., 2011a) and CoM (2010).

Different options	Examples of actions
Replace existing buildings by new efficient ones	**Passive Houses** With current knowledge and materials, it is possible to achieve extremely high performance levels, such as the passive house standard (i.e. the building can maintain indoor comfort temperature with only very little energy needs). To achieve this performance level with existing building might be technically more demanding, since certain characteristics of the buildings (such as orientation and shape) cannot be drastically changed.
Thermally insulate existing buildings	**Walls, roof and ceiling insulation** The gains and losses of energy through walls, roof and ceiling can be reduced by applying additional insulation to existing buildings. The commonly used types of insulation used include: Fiberglass, Polyurethane foam, Polystyrene foam, Cellulose insulation and Rock wool. **Windows & Shading** Since gains and losses of energy are four to five times higher in glazing surfaces that in the rest of the surfaces, the replacement of windows can lead to great improvements. The choice shall consider both the daylight provision and gaining or protecting from solar radiation penetration. Moreover, shading devices can also be used to reduce cooling loads by reducing solar radiation penetration.
Replace energy consuming systems and components	**Lighting** Technology and design practices for the efficient use lighting have evolved dramatically over the last 20 years. Compact fluorescent lamps (CFL) and LED lighting technology must be considered. **Heating and cooling** Energy for heating and cooling corresponds to the largest energy end-use in the building sector in Europe, and so the energy performance of these systems is crucial. Currently, some of the most promising technologies are biomass and condensing boilers and heat pumps (for heating), and absorption chillers (for cooling). **Water heating** Domestic hot water is one of the main energy uses in buildings. Since there is no need for high temperatures, there are relatively simple and mature technologies that can provide this service, such as solar thermal, biomass boilers and air-water heat pumps. **Ventilation (HVAC)** Ventilation and air conditioning systems are important especially for commercial and services buildings. By adapting the size and the specificities of the system to the usage patterns of the building, it is possible to achieve considerable energy savings.
Change behavior of building users	**Redefine minimum and maximum indoor air temperature** By adapting the dressing code to the season (or outside air temperature), it is possible to decrease in winter and increase in summer the indoor air temperatures and keep the level of comfort of the building occupants. This type of measure can lead to significant savings in terms of energy used for heating and cooling purposes. **Efficient use of light** There are opportunities to decrease energy consumption for lighting purposes just by taking most advantage of the light of the sun, decreasing the need for artificial lighting during daytime. There are also automatically controlled systems, that adapt artificial lighting intensity according to the day light available.
Generate electricity from RES	**Net Zero Energy Buildings (NZEB)** When it is technically difficult to increase the energy savings of a building, there is the option of installing renewable generation technologies in order to compensate for the emissions caused by its energy consumption. These are the so-called Net Zero Energy Buildings, i.e. the balance between the emissions caused from the energy used and the emissions avoided by the electricity generated is zero. For each building, there is a different optimal balance between energy efficiency improvements and the installation of RES generation technologies.

Annex 2: Energy system analysis considering the building sector

Table 5: Summary of the existing energy system models that include the building sector

Model	Report	Time horizon	Geographic scope	Sectors included	Building end-uses	Refurbishment (Are different pathways considered?)
BUENAS	Global Potential of Energy Efficiency Standards and Labelling Programs (McNeil et al., 2008)	2030	World	Building	All	No
BPIE	Europe's Buildings Under the Microscope (BPIE, 2011)	2050	Europe	Building	Heating, Cooling, Ventilation	Yes
ECOFYS'04	Mitigation of CO2 Emissions from the Building Stock (ECOFYS GmbH, 2004)	2015	Europe	Building	Heating, Cooling, Ventilation	No
ECOFYS'05	Cost-Effective Climate Protection in the EU Building Stock (ECOFYS, 2005b)	2015	Europe	Building	Heating, Cooling, Ventilation	No
ETP'10	Energy Technologies Perspectives (IEA, 2010a)	2050	World	All (agriculture incl. in building sector)	All	No
3CSEP HEB	Best Practice Policies for Low Carbon & Energy Buildings (Ürge-Vorsatz et al., 2012)	2050	World	Building	Heating, Cooling, Ventilation, Hot water	Yes
Greenpeace	Energy [R]evolution – A Sustainable World Energy Outlook (Greenpeace, 2010)	2050	World	All	All	No
HARVEY	Energy and the New Reality (Harvey, 2010)	2050	World	All	All	No
IPCC AR4	Fourth Assessment Report (IPCC, 2007)	2030	World	Building	All	No
LAUSTSEN	Reducing Energy Use in Buildings with Factor 4 (Laustsen, 2012 cited by Ürge-Vorsatz et al., 2012)	2050	World	All	Heating, Cooling, Ventilation, Hot water	No
McKinsey	McKinsey Global GHG Abatement Cost Curve (McKinsey, 2012)	2030	World	Building	All	No
WBCSD EEB	Transforming the Market – Energy Efficiency in Buildings (WBCSD, 2009)	2050	USA, Europe, East Asia, India	Building	All	No
WEO'10	World Energy Outlook (IEA, 2010c)	2035	World	All (agriculture incl. in building sector)	All	No
Wuppertal	Target 2020: Policies and Measures to Reduce GHG Emissions in the EU (WWF EPO, 2005)	2020	Europe	All (agriculture incl. in building sector)	All	No
PRIMES	DG Energy Roadmap (2011)	2050	EU-27	All		Yes

Source: Ürge-Vorsatz et al., 2012)

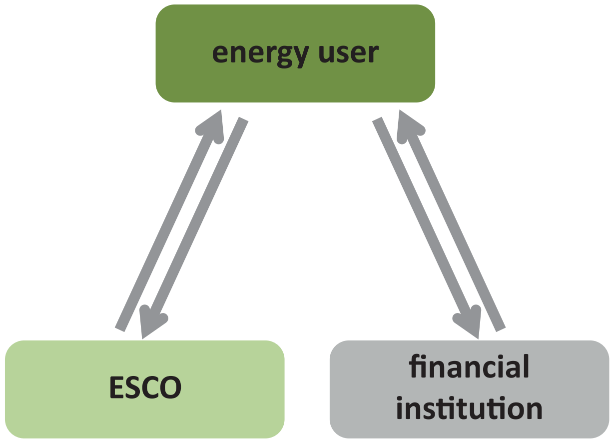
Annex 3: ESCO business models

Three basic business models can be distinguished: 1) guaranteed savings, 2) shared savings and 3) energy supply contracting (Table 6). In all the three agreements, the ESCO provides a wide range of services and generates energy and cost savings; the differences are in the manner in which the project is financed, payments are made by the host facility to the ESCO, and energy and cost savings are allocated between the ESCO and the customer (Bertoldi and Rezessy, 2005; Bertoldi et al., 2006; Dressen, 2003; Hansen, 2003; IEA, 2011; Poole and Stoner, 2003; Singh et al., 2010; Sorrel, 2007). In what follows, we present the main characteristics of the three business models.

Guaranteed savings

Under a guaranteed savings contract, the ESCO assumes the entire design, installation and savings performance risk, but it does not assume the credit risk. In this case, the project is financed by the customer, who can be supported by a financing entity (such as banks). Anyway, the customer takes the loan on its own balance sheet, assuming then the investment risk. Within this business model, the ESCO guarantees certain performance parameters, such as efficiency or energy savings and the cost of the service is based on the energy performance level achieved. The payments are made as soon as the performance criteria have been confirmed.

Figure 9: Schematic representation of the guaranteed savings business model



Source: own depiction

Shared savings

Similarly to the Guaranteed Savings business model, in the Shared Savings model the ESCO takes the technical design, implementation and performance savings risk. However, in this model, the ESCO also assumes the credit risk, i.e. the project is financed by the ESCO (or partly financed by the client and partly by the ESCO). Thus, when a loan agreement is done with a financial institution, the ESCO is responsible for repaying the debt and assuring the project secu-

Table 6: Summary of the main characteristics of the different Energy Performance Contracting business models

Characteristics	Guaranteed savings	Shared savings	Supply contracting
Performance guarantee	Related to the level of energy saved (throughout the contract life)	Related to the cost of energy saved (throughout the contract life)	Savings compared to current energy bill (throughout the contract life)
Payment	Directly related to the energy savings achieved	Value is linked to energy prices, because it is related to the cost savings	Fixed (or previously defined) rate; ESCO income depends on both performance and energy prices
Financing	Project is financed by the client (who can be supported by a third-party)	Project is financed (entirely or partly) by the ESCO	Project is financed by the ESCO

Source: own depiction

Figure 10: Schematic representation of the shared savings business model

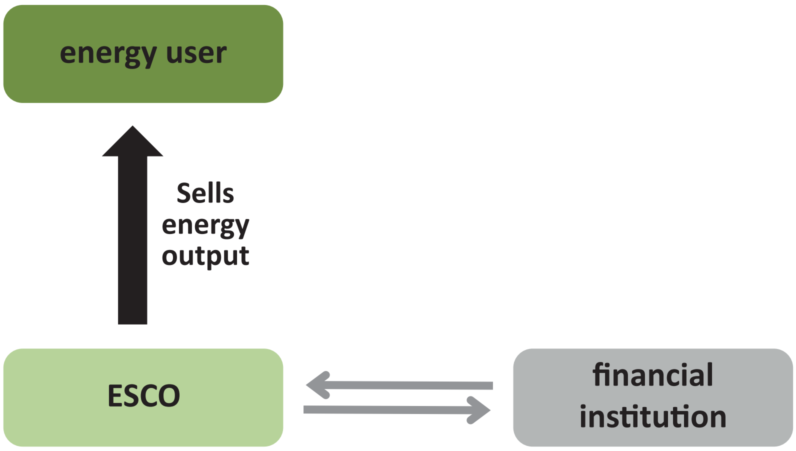
Source: own depiction

rity. In this business model, the contract specifies the sharing of the cost savings between the ESCO and the customer, throughout the lifetime of the contract. The payment is then based in the cost of energy saved, and it is spread over a certain period of time.

Supply contracting

The supply contracting business model, also known as "*chauffage*" or BOOT (Build-Own-Operate-Transfer), is very frequently used in Europe. This corresponds to an extreme type of energy management outsourcing, where the ESCO takes over operations and maintenance of the energy using equipment in the customer's facility and sells the energy output at an agreed price. In this business model, the contract specifies the energy services to be supplied and the price to be paid for those services throughout the lifetime of the contract. Thus, the fee paid by the customer is based on its current energy bill minus a percentage saving, i.e. the customer is guaranteed an immediate saving relative to its current bill.

Figure 11: Schematic representation of the energy supply contracting business model



Source: own depiction

Annex 4: EU Member State building refurbishment policies

Comparison of the energy prices was carried out based on the Excise Duty tables and the VAT rates published by the Commission (DG Tax, 2012a, 2012b).

Country examples were derived from the Second National Energy Efficiency Action Plans (NEEAP) submitted to the Commission in 2011 (BMWFJ, 2011; BMWI, 2011; Danish Ministry of Climate, Energy and Building & Danish Energy Agency, 2011; Ministry of Ecology, Sustainable Development, Transport and Housing; Ministry of the Economy, Finance and Industry, 2010; DECC, 2011), as well as energy policies and related regulations. For the comparison of the implementation of the Energy Performance Certification, the CA-EPBD study (2011) was used. Summaries prepared by WWF (2011) regarding the energy policy were also consulted for all the five countries. The following paragraphs list sources used other than these sources.

In case of Austria, the Climate Strategy, the Energy Strategy (BMLFUW, 2007; BMWFJ & BMLFUW, 2010) were included. In case of Germany, the Energiekonzept of September 2010 and the subsequent implementing regulations in June 2011 were surveyed. Further information was collected from the publications of the CPI regarding the German energy policy (Neuhoff, 2011; Amecke, 2011). In case of Denmark, the Energy Policy Agreement of 2008 and the energy strategy of 2011 was checked (Danish Government, 2008; 2011a; 2011b; Ministry of Climate and Energy, 2008). In case of France, the Grenelle laws were included (Grenelle, 2010a; 2010b). In case of the United Kingdom, the Climate Change Act of 2008, the Energy Act of 2011 were assessed (HMG 2008; 2011a; 2011b; DECC, 2011a; 2011b).

Table 7: Regulatory instruments and public support for building refurbishment at the Member State level

			AT	DE	DK	FR	UK
Regulation	Energy prices		High energy tax, high VAT, no reduced VAT on refurbishment	High energy tax, high VAT, no reduced VAT on refurbishment	High energy tax, high VAT, no reduced VAT on re-furbishment. Gov. plans to further increase taxes on energy	Low energy tax, normal VAT, reduced rate on refurbishment	No energy tax, low VAT, no reduced rate on refurbishment
	Regulation of actors	Owners	none	Retrofitting obliga-tion for attic, land-lord may increase rent annually by 11% for thermal efficiency upgrades until the costs are recovered	Connection obliga-tion to DH network	Majority decision of multiple own-ers is enough to renovate whole building, Landlord may increase the rent above the legal limit by 50% of the renovation costs	From 2016, landlord is obliged to accept energy saving investment if tenant asks and it incurs no extra cost for landlord
		Energy suppliers	none	none	Savings obligation of network com-panies, increase by 75% 2013-2014, 100% 2015 on (energy)	White Certificate scheme from 2006 (energy)	Carbon Emission Reduction Target (CO2)
	Regulation of inputs	Labeling and technology s tand-ards	Ecodesign directive implemented				
	Regulation of outputs	Energy Performance Certificates	EPC required in case of major renovation as well	Tightening build-ing requirements by 30%	Certificate valid for 5 years instead of the EPBD minimum 10	EPBD implemented	EPBD implemented
Unit of measurement for savings			Energy	Energy	Energy	Energy	CO2

Annex 5: Conclusions of Industrial Council Meeting (based on report version "V0", February 2012)

Serge Galant
Technofi
Submision date: April 19, 2012

Introduction

This Annex summarizes the first feed-back gathered during the expert group meeting.

The question

Massive building refurbishing in EU27 needs to be planned over 2012-2050 and coordinated in order to save energy while reducing GHG emissions in the most cost effective way.

This cost effective way goes beyond pure energy efficiency improvement since other values can enter the refurbishing decision like comfort (thermal, acoustic…), accessibility for an ageing population or needs for technology upgrade because of technology ageing.

Since buildings have local features (climate, cultural heritage, construction habits), keeping the refurbishing pace will require the fine tuning of European, national and regional policy design and implementation in a very regulated market. What is this fine tuning about?

What is still fuzzy in the first draft study?

Several issues need to be clarified in the next version of the report:

- What is the overall refurbishment goal and the constraints? There is indeed more than energy savings in the value of refurbishment (see above).
- If energy consumption remains the main driving force, be careful in comparing the performance of Member States (use overall energy consumption)
- Clearly state which needs to be regulated in order to reach the goal:
    - *should be refurbishment become mandatory (like in the car sector or for elevators in France, right now?)?*
    - *Should other price signals be used to trigger refurbishing at a higher rate?*
- Justify the guiding principles which will be used to reach the goal?
- The use of good lessons learnt from past experiences is to be addressed cautiously: there is a minimum time required to observe the change impacts in the building sector
- For the policy recommendations, it is required to provide a measurement process of the obtained results over quite a long period of time (for instance energy savings). These measurement processes (whether B to B or B to C) may have significant transaction costs.

Completeness: what are the issues to be addressed in the next report?

- The scale of the problem in terms of investment, turnover generated by refurbishment and funding schemes to cover the changes must be addressed using recent EC studies
- Include a state of the art section where the major policy tested options can be reviewed and the results explained:
  - *tax on energy consumption versus subsidies on energy savings,*
  - *direct versus indirect measures,*
  - *the use of differential savings to promote refurbishment,*
  - *the differentiation of policies per subsector (office buildings versus private house and collective housing)*
- explain why the rate of refurbishment observed today is so low, with a coverage of non-technical barriers (legal, human capital, renting versus ownership decision making, etc…)
- address the local scale of refurbishment (single building versus district) in order to optimise energy savings (investment costs versus money saved)
- detail the combination of the low technical refurbishment routes:
  - *tailored refurbishment where constructors use industrialised components but adapt the process to each ageing building,*
  - *industrialised refurbishment where manufacturers propose system wide standard solutions with probably less energy savings but at lower costs,*
  - *emphasize the need to monitor the implemented policies, in order to progressively validate the actual results (and to change if policy appears not in line with expectations)*

Coherence: what are the potential incoherencies in the next draft report?

Any public policy on refurbishment addresses a potential market failure: the refurbishment rate as observed in EU27 is too low when compared to the energy/climate change policies.

In the studied policy options:

- be exhaustive,
- underline the paradox: Think / Act globally and locally,
- dwell upon the cost/benefits (ex-ante) which allow ranking options and their European Added Value,
- in the final proposal, address the industrial policy consequences (technology leadership in a world market for current manufacturers, SME trainings to increase skills at local level),
- introduce the policy enforcement measures,

- detail the timing and the possible policy revision frequency since going over 2012-2050,
- show what is optimal between single building versus district renovation (including comfort, aesthetics, accessibility).

Based on the priority list of options, coherence must be addressed on the following items:

- incentives in front of policy objectives,
- financing in front of investments induced by policy objectives,
- role of the critical players including:
    - *utilities where energy savings may go against their core business,*
    - *network operators (electricity and gas) which could be incentivized at promoting energy savings (cost + and profit margins)*

Annex 6: Comments from project advisors

Nils-Henrik von der Fehr
Professor at Department of Economics, University of Oslo
Submission date: February 28, 2012

My comments are based on the first draft of the report dated February 2012, as presented at the meeting of the Scientific Council in Brussels on February 28-29, 2012.

Introduction

The aim of the report is to formulate policy recommendations for the European Commission (DG Energy) on building refurbishment in light of EU energy and environmental objectives. The analysis considers.... The main conclusion is that ...

Overall assessment

Overall, ...

The main problems with the report as it now stands is that the issue is not entirely well-defined, the analytical structure is unclear and one lacks a complete discussion of alternative policy measures and the rationale for EU involvement.

Other comments

What exactly is the problem? It is taken as given that emissions and energy consumption is to be reduced, but under which constraints: to minimise costs? to improve housing conditions? to improve standards of living?

What are the alternatives or options? There would appear to be many ways to achieve the goals, but which are they and what are their advantages and disadvantages: demolish existing buildings and build new one? insulate? replace energy-consuming equipment? lower/increase indoor temperature?

What are the potential of the various options? What needs to be done? What would it cost?

What are the available policy measures/instruments, and what are their pros and cons? Direct or indirect regulation? Taxing energy consumption or subsidising energy saving? Standards or recommendations? Mandatory restrictions or voluntary information provision? Timing of measures (now or when renovation is needed anyway)?

What is the market failure? Why would not consumers and providers of energy-saving/emission-reduction means find each other? Is there not a paradox in requiring energy providers to induce their customers to save energy?

What is the rationale for EU involvement? Why cannot the policy be decentralised; economies of scale (developing policy measures)? coordination (equipment standards)? public good (information, best practice)? commitment (difficulties in reaching national agreement)?

In addition:

- What is the typical life time of buildings? What is the churn rate? What is the scale of the problem?
- Is it necessary to define buildings and refurbishment?
- What is the "difficulty" of building refurbishment (cf. Section 1.2)?
- Are the questions referred to in Section 1.3 really related to the "market"?
- Are the so-called "guiding principles" really that? Are they not elements of policy, strategies, measures?
- It is unclear what the data on energy-savings potential really say (cf. 2.1).
- Would contracts be based on savings, given the difficulties of measurement (cf. Section 2.3)?
- What is the argument for wheter EU should be involved or not in planning, coordination and limiting costs? Why is EU involvement needed in the 6 recommendations?

Dr. Dörte Fouquet

Lawyer, Partner at Becker Büttner Held

Submission date: May 30, 2012

General comments

Building refurbishment is a very valid and important topic when it comes to achieving the EU's climate and energy targets. However, with building refurbishment and the related energy efficiency target, it appears that the EU is not on track. The report in this respect explains the problems behind the lagging behind of the EU Member States when it comes to reducing greenhouse gas emissions and increasing energy efficiency in their building sectors and discusses solutions – with a particular focus on the question where EU action is appropriate and where the question of which action to take should best be left to the Member States. It forms a very good basis for further debates in Brussels as in the Member States and may help laying the foundations for and shaping future EU and/or national policy in this area.

Conceptual comments

One thing that strikes a bit, is that the report seems a little biased towards greenhouse gas reductions, thus on DG Climate's target to reduce emissions in the building sector by 88-91% until 2050. It is always mentioned, in a way sounding quite negative, that existing measures only focus on "energy savings", rather than on greenhouse gas emissions. While indeed it is true that saving energy is often the focus, also because of the financial incentive in the form of savings on the energy bill, this should not be presented as though it was a negative thing. But this may be only a question of formulations.

Generally, the concept is very good, as it is very accessible: it is commendable that examples from the Member States are used to explain the problems and approaches for solutions. Sometimes, the examples could be more detailed, or a real (short) case study could be interesting. However, this could be done in Annexes or in some specific boxes as they are already being used for explanatory information in the report. Those boxes, providing additional information, contribute to a better understanding for a broad audience, and are thus a good feature of the report.

Comments on content

Based on the examples from Member States, as well as their discussion in EU context, the report concludes that not in all areas EU intervention is desirable, but that in others it is important to lay the basis for a market to develop. In particular, it rightly highlights, that there is no "one size fits all" when it comes t market design for building refurbishment, and although it is referred to the UK Green Deal approach quite a lot, it does not recommend an EU wide scheme but foresees only in a facilitation role for the EU institutions. Rather, it draws the intention to the most important problems: regulated energy prices – making energy cheaper than it is and thereby decreasing the incentives to actually save energy – and non-internalization of carbon emission costs. Indeed, EU action, such as the proposed energy taxation Directive, could help to create those prerequisites for a market in building refurbishment to develop at all.

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Péter Kaderják is the Director of the Regional Centre for Energy Policy Research at the Corvinus University of Budapest (www.rekk.eu). He received his MSc in Economics from the Budapest University of Economic Sciences in 1987. In 1998 he was appointed Chief of Cabinet of the Minister of Economic Affairs and started to work on the liberalisation of the electricity and gas sectors in Hungary. In January 2000 he became the President of the Hungarian Energy Office, the national energy regulator. Between 2000 and 2004 he also served as the Chairman of the Energy Regulators Regional Association (ERRA), an association of energy regulatory institutions of countries from Central and Eastern Europe, the CIS and South East Europe. Since 2004 he has been serving as Training Director for ERRA's in-house energy regulatory trainings. He has also been directing a postgraduate program in Energy Economics at Corvinus University since 2010. He is a research partner in the "European Energy Institute" at University of Leuven and a regular lecturer at the Florence School of Regulation. He has directed several recent research efforts with regional relevance. In 2011 he was appointed as alternate member of ACER's (Agency for the Cooperation of Energy Regulators) Board of Appeal.

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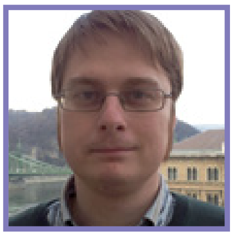

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