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Next phase of the European Climate Change Programme: Analysis of Member States actions to implement the Effort Sharing Decision and options for further community-wide measures

A report for DG Climate Action

Buildings sector – Policy case studies report

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Executive Summary

This report has been prepared by **Ecofys** as the part of the study *Next phase of the European Climate Change Programme: Analysis of Member States actions to implement the Effort Sharing Decision and options for further community-wide measures.* The project has been funded by DG Climate Action of the European Commission (EC) with the aim of assisting the EC in the identification of policies and measures that enable the Member States to fulfil their national commitments under the Effort Sharing Decision (ESD). The Effort Sharing Decision only includes direct emissions e.g. natural gas combustion in heating systems. 'Indirect' emissions associated with electricity used within buildings, but emitted within the electricity generation sector, are assumed to be captured within the EU Emissions Trading System. These emissions are therefore outside the scope of the ESD and have not been considered further below.

Building upon the earlier work, this report provides a more detailed examination of the policy options that could be implemented on a national or EU wide level in order to deliver additional emissions reductions. This report is focused on policies targeting energy use in the building sector. A series of case studies have been prepared to illustrate examples of existing policies that could be replicated to deliver additional abatement. In each case an assessment has been provided of the relative strengths and weaknesses of the different policies, including the synergies and co-benefits.

There are a vast number of measures and options to reduce both the energy use and the environmental impacts from buildings. The measures fall into different categories, including financial measures, regulation, standardisation, information, capacity building and new-market based instruments. Most of these options are cost effective – however, a large share of the improvement potential remains untapped. In the absence of further policy intervention it is unlikely that the full abatement potential will be realised. This is because certain barriers and market failures are in place.

The Directive on Energy Performance in Buildings (EPBD) is the main legislative instrument affecting energy use and efficiency in the building sector in the EU. The Directive tackles both new build and the existing housing stock. Originally approved in 2002, this Directive was being replaced by a recast Directive that was approved 19 May 2010. Small buildings were included in the scope of the directive and the potential of 'low or zero energy' was addressed. The EPBD recast focuses mainly on energy efficiency measures when new buildings are constructed or when existing buildings undergo major renovations.

This report provides a detailed examination of four policy case studies that could deliver additional GHG abatement in the building sector, over and above existing EU wide policies An assessment is provided of the strengths and weaknesses of different options, including the synergies and co-benefits. Where possible, evidence has been gathered from ex-post studies of real-world examples, in order to suggest how Member States could maximise the benefits and mitigate unwanted side effects.

The case studies relate to

- White Certificate Schemes
- Capacity building programs
- Financial incentive schemes

White certificate schemes have been implemented in several member states including the UK, Italy, France, Denmark and Belgium (Flanders). The schemes can be quite complex, and different approaches to implement the schemes have been employed. Further details on the characteristics of the national schemes are described in the case study.

With rising requirements on building energy certification an expert capacity problem is expected. **Capacity building programs** may be able to help overcome these problems, for example, by building a large pool in a short time by training available experts from other fields, or experts who already do building visitations on a regular basis. This is considered to be an efficient approach with limited costs and it has already been applied in Germany and France. A problem might occur due to the different background experience of these experts which is in many cases not related to energy efficiency of buildings. In this case special attention is to be paid to the training procedures in order to ensure a certain level of knowledge.

Financial incentives tackle the most common financial obstacle: high up-front costs of energy efficiency projects. These combined with lack of financing very often hinder the purchase of efficient equipment, renovation measures, etc. or may lead to non-cost-effective allocation of capital. A number of countries offer financial support in the form of preferential loans, grants, subsidies, etc. in order to overcome this barrier but in many East-European countries the overall lack of financing still hinders the realisation of projects related to energy efficiency. A key advantage of grants, subsidies and loans is that they immediately fill a financial gap. The main issues to be considered are that a) there should be enough incentives to use the measure. Normally, this requires a financial scheme to be embedded in a well working regulation framework (as for example the Energy Saving Ordinance - EnEV in Germany) and to be accompanied with broad information campaigns creating awareness amongst building owners and that b) normally, financial schemes have the objective to push the market development and therefore aim at having impact in the longer term, for example even then, when the measure already will have been closed.

Thus, the case studies provide a review and analysis of policies that could be implemented by Member States to address buildings emissions. They provide a synthesis of existing information, with further analysis of policy relevant issues. The outputs provide a useful evidence base for national policy makers, which takes into consideration the strengths and weaknesses of each option.

Table of contents

1 Introduction

1.1 Background

This report has been prepared by Ecofys, in collaboration with AEA, as part of the study *Next phase of the European Climate Change Programme: Analysis of Member States actions to implement the Effort Sharing Decision and options for further community-wide measures.* The project has been funded by DG Climate Action of the European Commission (EC) with the aim of assisting the EC in the identification of policies and measures that enable the Member States to fulfil their national commitments under the Effort Sharing Decision (ESD).

In earlier phases of the project an assessment was made of the projected emissions of greenhouse gases to 2020 in each of the main ESD sectors, the potential gap between the projected emissions and the ESD target, and the abatement measures that could be implemented to reduce the emissions gap. In addition, a high level review was provided of the policies and measures in place at Member State level. Further information on the ESD, on Member State's targets under the ESD, and their analysis described above can be found in the *Greenhouse gas emissions projections, emissions limits and abatement potential in ESD sectors* report [AEA/Alterra/Ecofys/Fraunhofer ISI, 2012].

Building upon the earlier work, this report provides a more detailed examination of the policy options that could be implemented on a national or EU wide level in order to deliver additional emissions reductions. The focus of the analysis is on additional policies that could be implemented to support and complement existing EU-wide policies.

This report is focused on policies targeting energy use in the **building sector.** A series of case studies have been prepared to illustrate examples of existing policies that could be replicated to deliver additional abatement. In each case an assessment has been provided of the relative strengths and weaknesses of the different policies, including the synergies and co-benefits.

1.2 Characteristics of the building sector

The building sector includes both the non-residential (services) and residential sectors. The European building sector accounts for 40 % of the total energy use and for 36 % of Europe's CO_2 emissions [European Commission, 2009]. Together with an economic power of 9 % share of the total EU 27 GDP and 8 % of the total employment in Europe, the building sector represents a very important field of interest [European Commission, 2009]. Therefore it plays a major role in the European 20-20-20 energy policy.

The Effort Sharing Decision only includes direct emissions e.g. natural gas combustion in heating systems. 'Indirect' emissions associated with electricity used within buildings, but emitted within the electricity generation sector, are assumed to be captured within the EU Emissions Trading System. These emissions are therefore outside the scope of the ESD and have not been considered further below.

1.3 Emissions, policy gaps and abatement potential

1.3.1 Projected emissions

In the EU-27, the recent historical trend in buildings sector emissions has been a gradual decline that is partly masked by large annual fluctuations. From 1990 to 2008, emissions fell about 13 % from 720 to 635 MtCO2 eq. The decline can be largely explained by rehabilitation activities on existing buildings (and partly demolition) which more than compensates for the additional emissions from new (and more efficient) buildings. The fluctuations from year to year can be explained by annual ambient temperature fluctuations that lead to variations in heating demand [AEA/Alterra/Ecofys/Fraunhofer ISI, 2012]. In some Member States there was expansion of district heating (e.g. Sweden), therefore heating related emissions are reported in other sectors; also installation of heat pumps can have an effect.

From 2010 to 2020 the PRIMES 2010 baseline emissions projections [European Commission, 2010] show a decline in emissions, from 689 MtCO2 eq. to 626 MtCO2 eq., which is a decrease of about 9 %. Thus, current projections suggest that the building sectors will make an important contribution to the overall ESD targets within Member States [AEA/Alterra/Ecofys/Fraunhofer ISI, 2012].

Further details on *Greenhouse gas emissions projections, emissions limits and abatement potential in ESD sectors can be found in the project* report.

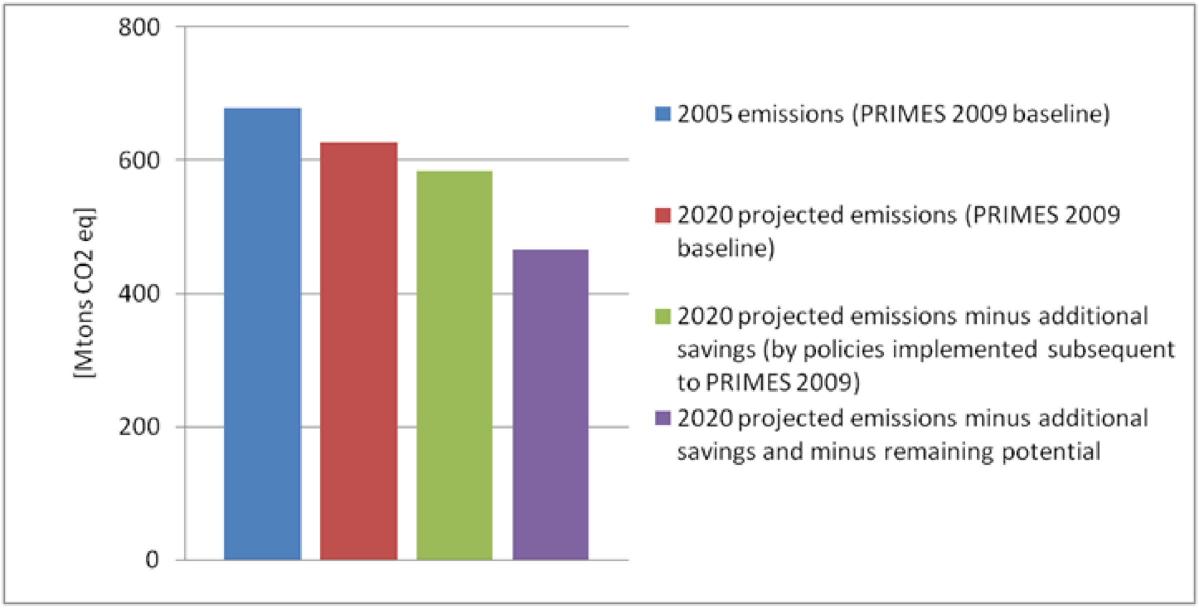
1.3.2 Abatement potential

Developments in the building sector are, in general, quite slow. This is caused by long renovation cycles of approximately 30-40 years. This means that a building that has been newly built or has been recently renovated will not undergo major changes or improvements during this timeframe. As a result, this can lead to significant lock-in effects, if energy efficiency measures are not applied at all or are realised at too low an ambition level.

The building sector has the potential for additional abatement by 2020. PRIMES 2010 [European Commission, 2010] projects the emissions in the sector to be 626 MtCO_2 eq in 2020. Our calculations for the abatement potential, which are based on an earlier study that investigated the Sectoral Emission Reduction Potentials and Economic Costs for Climate Change [Bettgenhäuser, Boermans et al., 2009; Ecofys, 2009] found that this amount can be reduced by 42 MtCO_2eq through additional policies implemented subsequent to PRIMES 2009 until June 2010). The results indicate that technical measures can further reduce the baseline emissions by 118 MtCO_2 eq and bring down the baseline to 466 MtCO_2 eq (further 20 % reduction) in 2020. 84 MtCO_2 eq of this abatement potential is cost-effective at a negative cost. Please note that emissions and possible savings related to the use of electricity are not part of the effort sharing decision (but part of the EU ETS) and are therefore not included in above mentioned numbers [AEA/Alterra/Ecofys/Fraunhofer ISI, 2012].

Figure 1 illustrates the baseline emissions and the CO_2 abatement potential for the built environment as identified in this study (residential and non-residential sector together).

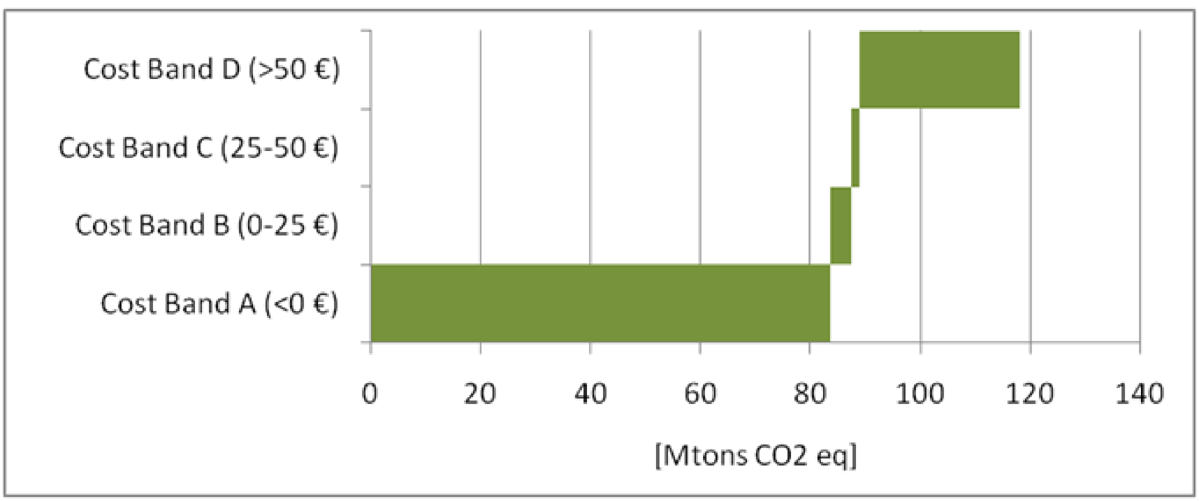
Figure 1: Emissions and abatement potential in the building sector



Source: Calculations by Ecofys on base of the SERPEC data

The overall cost curves for the built environment sector in 2020 in the EU 27 are shown in Figure 2. Note, that the cost-curve is sensitive to the energy price assumptions and the discount rate used. Investment costs are annualised over the technical lifetime of the measure using a discount rate of 4 % and energy savings are calculated against energy prices before taxation. Under these scenario conditions, a very large share of the abatement potential can be achieved at negative costs, i.e. with net economic savings.

Figure 2: Abatement potential and cost bands of the underlying options in the building sector in the EU 27 (residential and non-residential) in 2020.The abatement potential is relative to the baseline (PRIMES 2009 plus policies implemented subsequent to PRIMES until June 2010).



Source: Calculations by Ecofys based on SERPEC data

Data disaggregated at Member State level can be found in the *Greenhouse gas emissions projections, emissions limits and abatement potential in ESD sectors* report [AEA/Alterra/Ecofys/Fraunhofer ISI, 2012].

The countries with most abatement potential are France, Germany, Italy, UK, Poland and Spain (about 75 % of the remaining potential in the European Union). The remaining potential did not account for structural or behavioural changes that could lead to further savings. A key action to unlock the remaining cost effective abatement potentials of the building stock is deep renovation (i.e., a high retrofit rate combined with high ambition level of the measures applied). Rebound effects can reduce the abatement potential and therefore the abatement potential can in fact be lower [AEA/Alterra/Ecofys/Fraunhofer ISI, 2012].

Table 1 gives an overview of the measures in the 2020 abatement cost curve for the building sector. This shows which cost bands each of the measures fall within, based on the average EU values. Individual measures may fall within a different cost band at a country level, due to different national circumstances.

Table 1: List of measures in the 2020 abatement cost curve for the building sector (the table represents the EU average, the cost of the measures vary within the Member State)

Measure	Cost band			
	Retrofit		New building	
	Small building	Large building	Small building	Large building
Improving building shell: wall insulation	A	A	Not investigated	
Improving building shell: roof insulation	A	A		
Improving building shell: ground floor	A	A		
Improving building shell: windows	A	A		
Improved regulation & heat distribution	A	A		A
Heating: Condensing boilers	A	A		
Efficient tap water	A	A	A	A
Passive Houses/zero energy houses	Not investigated		B	C
Heating: Biomass (Pellets etc.)	C	A	D	B
Heat pumps	D	A	D	A
Solar water heater	D		D	
Micro CHP	D	D	D	D
Ventilation system with heat recovery			D	D

Source: [Bettgenhäuser, Boermans et al., 2009]

Combined measures may change in a different cost band. The costs depend on which measure is realised first. For that reason the *Sectoral Emission Reduction Potentials and Economic Costs for Climate Change* study also investigated packages of measures, as e.g. passive houses [Bettgenhäuser, Boermans et al., 2009; Ecofys, 2009].

1.4 The need for policy intervention

In the absence of further policy intervention it is unlikely that the full abatement potential will be realised. This is because certain barriers and market failures are in place.

Table 2 represents a classification of the barriers that may obstruct the energy efficiency options throughout the building construction and operation, as well as the purchase and use of appliances, suggested by [IPCC, 2007].

Table 2: Taxonomy of barriers that hinder the penetration of energy efficient technologies/practices in the building sector

Barrier categories	Definition	Examples
Financial	Ratio of investment cost to	Energy subsidies

costs/benefits	value of energy savings	Higher up-front costs
		Lack of access to financing
		Lack of internalization of environmental, health and other external costs
Hidden costs/benefits	Cost or risks (real or perceived) that are not captured directly in financial flows	Costs and risks due to potential incompatibilities
		Performance risks
		Transaction costs
Market failures	Market structures and constraints that prevent the consistent trade-off between specific energy-efficient investment and the energy saving benefits	Limitations of the typical building design process
		Landlord/tenant split and misplaced incentives
		Administrative and regulatory barriers (e.g. in the incorporation of distributed generation technologies)
Behavioural barriers	Behavioural characteristics of individuals and organisational characteristics of companies that hinder energy efficiency technologies and practices	Tendency to ignore small opportunities for energy conservation
		Organisational failures (e.g. internal split incentives)
		Tradition, behaviour, lack of awareness and lifestyle
		Corruption
Information barriers	Lack of information provided on energy saving potentials	Lacking awareness of consumers, building managers, construction companies, politicians
Political and structural barriers*	Structural characteristics of political, economic, energy system which make efficiency investment difficult	Slow process of drafting local legislation
		Gaps between regions at different economic level
		Lack of detailed guidelines, tools and experts
		Lack of governance leadership/ interest
		Lack of equipment testing/ certification
		Inadequate energy service levels

Source: [IPCC, 2007; UNEP-SBCI, 2009]

The barriers presented in Table 2 can, on one hand, obstruct the implementation of energy efficiency measures in the building sector and, on the other hand, lead to investments in less cost-effective measures. Some of the barriers described above can be eliminated or reduced by intervention from the government. Therefore, various policy instruments which encourage energy efficiency in the building sector may be introduced. Such instruments may target households in fuel poverty, multi-residential buildings, renewable energies, etc.

In the following sections some of the barriers related to implementation of energy efficiency activities in the building sector are presented in more detail.

1.4.1 Financial costs/benefits

There are numerous barriers related to financing which can hinder the start-up of an energy efficiency project. In some Member States energy subsidies are offered in order to reduce prices for consumers or both for consumers and producers of energy. The subsidized energy prices do not reflect the long-term marginal costs of energy and obstruct the integration of energy efficiency measures [AEA/Alterra/Ecofys/Fraunhofer ISI, 2012; European Environment Agency, 2004].

The most common financial obstacle is the high up-front costs of energy efficiency projects. These combined with lack of financing very often hinder the purchase of efficient equipment, renovation measures, etc. or may lead to non-cost-effective allocation of capital. A number of countries offer financial support in the form of preferential loans, grants, subsidies, etc. in order to overcome this barrier but in many East-European countries the overall lack of financing still hinders the realisation of projects related to energy efficiency. Finally, when introducing a project the main factors considered are financing and energy savings. These do not internalize co-benefits, such as improved indoor environment, health, etc. [IPCC, 2007]. An additional barrier is that from the private perspective, energy efficiency measures can be less cost-efficient than from the social point of view.

A key advantage of grants, subsidies and loans is that they immediately fill a financial gap.

1.4.2 Hidden costs/benefits

Projects related to improvement of the energy efficiency in the building sector are usually small and do not draw the attention of investors and financial institutions. In addition, due to the small size of the projects, high transaction costs, such as verification of technical information, problems with building or reconstruction permits, preparation of viable projects and negotiation and execution of contracts, may add up, which obstructs some energy efficiency investments [IPCC, 2007]. Apart from this, deep renovation reconstruction affects the inhabitants in a substantial way.

1.4.3 Market barriers

The design and construction of a building is a complex process which involves multiple stakeholders. The most common market barrier is the “misplaced incentives” dilemma. This issue occurs in cases when the parties involved in the design and construction of the building are different from the “beneficiaries”. Misplaced incentives occur in cases when the parties involved in the process make decisions only based on the investment expenditures and do not take into account the life cycle and maintenance costs of the building in the future. Such an obstacle is often present in the “landlord-tenant split”. The landlord has no incentive to invest in more efficient heating equipment as the tenant is the one who profits from the energy savings later on. This dilemma has been addressed in a few countries as for example France, Germany, Netherlands and UK [CEPI,UIPI, 2010; IPCC, 2007].

1.4.4 Behavioural barriers

Energy consumption in Europe varies significantly depending on climate and wealth of the country. However, when comparing the energy use of Member States variations can also be found between countries with similar climate and wealth characteristics. This is caused by the difference between the behaviour of the consumers, their lifestyle and attitude towards the use of energy. Thus, countries where energy is less expensive and no discussion on energy conservation has been raised, the consumption is observed to be higher.

1.4.5 Information barriers

The most significant barrier for the implementation of energy efficiency measures in the building sector is the lack of information on costs, availability and payback periods of new technologies, as well as costs of own energy consumption and training for technicians on proper maintenance. This barrier may occur at any level of the chain – from the consumer through to the building managers, to construction companies to the politicians.

Obtaining information about energy efficiency options may also represent a barrier. This however varies in different countries, e.g. in Germany the German Energy Agency published reference cases and guidelines for interested users.

The lack of information on new technologies and the payback period of the investment along with risk reluctance to the adoption of innovative technologies can often cause investors (e.g. banks) to continue supporting older and well-established, but not so efficient technologies. To overcome the information barriers investors should be informed about the cost-effectiveness of the investment and about the short payback periods. It is possible to develop tools for assessment of the risk of a project, e.g. for estimation of the life cycle costs, etc. [AEA/Alterra/Ecofys/Fraunhofer ISI, 2012].

Awareness raising campaigns which provide information on energy efficiency in buildings can be organised in the Member State. Such information can be delivered on three levels:

- Information to consumers on possibilities to reduce energy consumption and on the available energy efficiency schemes offered by the government for new buildings and renovations
- Information to industrial customers
- Information to experts in energy efficiency and to service providers. This will ensure a well-functioning network of experts in the MS

[European Commission, 2005; IPCC, 2007]

1.4.6 Political and structural barriers

The structural characteristics of the political, economic and energy system can present a barrier to action. These make energy efficiency investments difficult. Such barriers can include the lack of standardization of energy-using equipment and components, which can lead to obstacles in the penetration of new technologies in the building market. This problem can be solved by improvement of the regulatory system in the EU and introduction of more transparency in the market structure [European Commission, 2005].

1.4.7 Conclusions on barriers

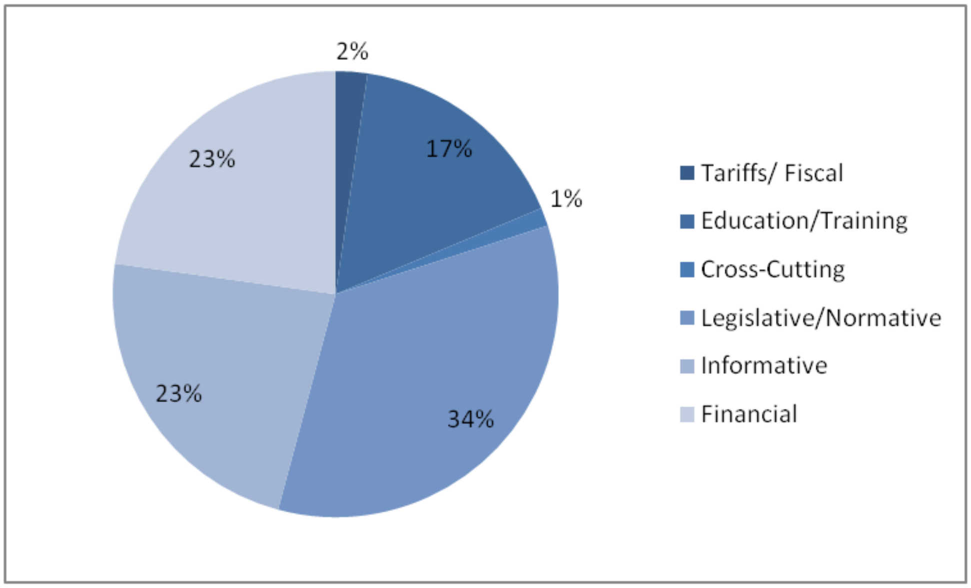
The combination of the barriers described above can lead to an inefficient allocation of resources and hinder the investment of cost-effective measures. For example, investments in the building envelope, such as wall and roof insulation, although very cost-effective compared to other options, may be obstructed by the high upfront costs, low competence and knowledge on the efficiency, vacating of the building during renovation, insufficient knowledge on the payback periods of the investment, etc. Therefore, the energy efficiency investors are prone to conduct multiple smaller renovation measures than to invest in a single more comprehensive activity. Moreover, in some countries there is a lack of information and general scepticism concerning new technologies, such as CHP and heat pumps [AEA/Alterra/Ecofys/Fraunhofer ISI, 2012].

1.5 Policy options

There are a vast number of measures and options to reduce both the energy use and the environmental impacts from buildings. Most of these options are cost effective – however, a large share of the improvement potential remains untapped [Nemry, Uihlein et al., 2008]. The unused potential for energy efficiency improvements is sometimes referred to as the energy efficiency gap [AEA/Alterra/Ecofys/Fraunhofer ISI, 2012; IEA, 2008; The Allen Consulting Group, 2004]; however the size of the gap is debatable [Jaffe,Stavins, 1994]. Consequently a large number of different policy measures have historically been or are currently in place throughout the EU to promote greater energy efficiency in all segments of the building sector [AEA/Alterra/Ecofys/Fraunhofer ISI, 2012].

The MURE II database[1] provides information on policies and measures taken or planned within EU Member States to improve energy efficiency and use of global renewable energy. The following figure illustrates the types of policies and measures (Figure 3). Most policies and measures are of economic, regulatory and informative type. The financial measures can be differentiated by soft loans and by grants/ subsidies. Only 13 % of the financing policies address soft loans, the remaining 87 % address grants and subsidies. Most of the regulatory instruments are related to the Energy Performance of Buildings Directive (EPBD) (directive 2010/31/EU) and its recast [European Parliament and the Council of the European Union, 2010], other policies and measures can be considered as national policies that are not directly related to EU policies, most of these policies and measures focus on education and outreach and incentives and subsidies.

Figure 3: Types of policies and measures for energy efficiency improvement and the use of global renewable energy



Source: [Institute of Studies for the Integration of Systems (ISIS), 2011]

1.6 EU Policy Landscape

The main building block of the EU regulatory framework is the recast of Energy Performance of Buildings Directive (EPBD) [Council of the European Union, 2009]. The Directive on Energy Performance in Buildings (EPBD) is the main legislative instrument affecting energy use and efficiency in the building sector in the EU. The Directive tackles both new build and the existing housing stock. Originally approved in 2002, this Directive was being replaced by a recast Directive that was approved 19 May 2010. Small buildings were included in the scope of the directive and the potential of 'low or zero energy' was addressed.

Overhauls have also been prepared for the eco-design and energy labelling directives within the framework of the EU policies on sustainable consumption and production (SCP) [European Commission, 2008]. Together these measures may achieve an important part of the potentially available cost-effective energy-savings in buildings [Uihlein,Eder, 2009b-b].

The EPBD recast focuses mainly on energy efficiency measures when new buildings are constructed or when existing buildings undergo major renovations. Consequently, this allows energy efficiency investments to be made at least cost, because they form part of the natural construction and renovation

[1] MURE is an information platform on energy efficiency policies in Europe and also a policy evaluation tool (see: http://www.isisrome.com/mure/index.htm).

cycles. However major renovations of buildings are not made very often (about every 40 years on average) and there might be energy efficiency measures that are cost-effective also outside the major renovation cycles [Uihlein,Eder, 2009b-a]. In particular, the retrofitting of windows and roof insulation to reduce energy losses may allow energy cost savings that outweigh the investment costs, without the need to carry these measures out at the same time as a general major renovation of the building [Nemry, Uihlein et al., 2008].

Currently, there is no European legislation that would address the retrofitting of building elements such as windows and roofs. Potentially, this was shown to be the most important area for additional policies in the EU to improve the environmental performance of buildings [Uihlein,Eder, 2009b-a].

1.7 National Policies

A large number of different policy measures have historically been or are currently in place throughout the EU to promote greater energy efficiency in all segments of the building sector. These are often country or area specific and take into account local needs or circumstances.

The following sections serve to introduce the measures which fall into different categories, including financial measures, regulation, standardisation, information, capacity building and new-market based instruments.

1.7.1 Financial measures

Zero or low interest loans

These are loans with preferential zero or low interest rates, which are offered for specific energy efficiency investments. They are often offered by way of public–private partnerships, although they may also be provided directly by public bodies [Uihlein,Eder, 2009a]. Preferential loans are an important measure to support energy efficiency in buildings in Germany [IEA, 2008]. According to EuroACE (2010) preferential loan support can be found in Austria, Czech Republic, Estonia, France, Hungary, Italy, Slovenia, Spain, UK (according to EuroACE 2004 also: Finland, Lithuania, the Netherlands and the Slovak Republic) [EuroACE, 2010a].

Grants and subsidies

Grants usually finance part of the investment for a given energy efficiency project. Normally they support projects aimed at improvements to the building envelope, such as insulation, draught-proofing, windows and doors. Assistance is provided for efficient appliances and heating systems, as for instance, biomass, heat pumps, thermal regulation and combined heat and power (CHP), as well. Examples of programs offering support through grants are: the Green Investment Scheme in the Czech Republic, the Grants for Renovation and Prefabricated-Panel Residences in Hungary and Programs for the Thermal Rehabilitation of Multi-level Residential Buildings in Romania. The key advantage of grants and subsidies is that they immediately fill a financial gap [IEA, 2008].

Subsidies are similar to grants and involve the subsidisation of part or all of the financial cost of energy efficiency improvements of buildings. Examples schemes include the UK the Carbon Emissions Reduction Target, in Slovenia – Financial Stimulation for Energy Efficiency Renovation and Sustainable Buildings of New Buildings, in Poland – Infrastructure and Environmental Operation Program, etc [IEA, 2008].

Fiscal measures

Fiscal measures include, for example, reductions in VAT rates for energy-efficient installations. However, fiscal measures often lack clarity and are not well known by the public. Another disadvantage is that they are often tied to large administrative bodies and tend to be inflexible [Uihlein,Eder, 2009a]. According to

OECD/IEA (2008) these measures did not appear to have had particularly large impacts in the cases where they were studied.

1.7.2 Regulatory framework and standardization

Regulatory instruments cover a wide range of instruments by which a government will oblige actors to undertake specific measures and/or report on specific information. Examples include energy performance standards for appliances, equipment, and buildings, standardized methodologies for calculation, measurement and verification of the energy performance of buildings, energy certification of buildings, including the obligation to display the certification, eco-design requirements for building components, obligations on companies to reduce energy consumption, produce or purchase a certain amount of renewable energy, mandatory energy audits of industrial facilities and requirements to report on greenhouse gas emissions or energy use [OECD/IEA, 2008].

For the residential building sector, energy efficiency standards are a regularly used instrument. They prescribe minimum technical requirements for energy conversion systems and energy end-use systems. Two main approaches are prescriptive standards, which impose requirements on specific components of equipment, and performance standards, which impose requirements on the overall level of (specific) energy use. Most industrialized countries have standards for the energy efficiency of new buildings, both prescriptive (e.g., insulation values of walls and roofs) and performance standards. Energy efficiency standards can be very effective in reducing or limiting energy use, but they are rigid and prescriptive standards in particular do not allow much flexibility. Furthermore, legislative processes can take time, and an adequate system of monitoring is necessary to enforce compliance [Blok, v. Breevort et al., 2008].

1.7.3 Information, capacity building and market transformation

Information measures help to overcome the lack of suitable information that is seen as the main barrier to energy efficiency measures. All different players need reliable and understandable information: house owners, the construction industry and service providers, financiers and regulatory authorities. Information that needs to be exchanged includes e.g. technological options, saving potentials, support schemes, regulations. Supporting the establishment of energy service companies (so called ESCOs) is a specific measure that is regarded useful for helping overcome the barriers of bounded rationality and lack of information. Energy services provide this to energy end users, and may include the supply and installation of energy-efficient equipment, the supply of energy, as well as building refurbishment, maintenance and operation [Uihlein,Eder, 2009a].

Environmental technology verification (ETV) programmes aim at increasing the acceptance of new technologies, by providing the costumer with credible and understandable performance information. These programs help tackle market barriers related to uncertainty regarding the performance of energy efficiency technologies, bounded rationality and inadequate information [Uihlein,Eder, 2009a].

1.7.4 Voluntary agreements

Voluntary agreements refer to measures that are undertaken voluntarily by government agencies or industry bodies, based on a formalized agreement. Agreements can refer to the actors' own energy use, or the energy use of the equipment they produce. There are incentives and benefits to undertaking the action, but generally few legal penalties in case of non-compliance. The scope of the action tends to be agreed upon in consultation with the relevant actors. These are often agreed to between a government and an industry body, with the latter agreeing to certain measures such as reporting information on energy use to the government, being subject to audits, and undertaking measures to reduce energy use. The European Union has made voluntary agreements with car manufacturers and with selected household appliance manufacturers. This type of measure is less relevant to incentivize renovations of residential buildings [European Commission, 2012].

1.7.5 Market based instruments

The economic rationale for using market-based instruments lies in their ability to correct market-failures in a cost-effective way. Tradable energy efficiency – or “white” – certificates are, as of a few years ago, only considered as a market-based tool to foster energy efficiency as opposed to standards and labelling, for example. White certificate schemes create certificates for a certain quantity of energy saved, for example one MWh. Regulated entities must submit enough certificates to show they have met energy saving obligations. If the parties obliged to submit certificates are short, this must be made-up through measures that reduce energy use, or through purchase of certificates [OECD/IEA, 2008].

1.8 Selection of case study policies

Based on previous results of this project (especially on the analysis of the abatement potential, the barriers and the existing policy landscape) we decided to focus the case studies in the building sector on the following policy options: White certificate (WC) schemes, capacity building measures and financial measures. In Table 3 we present the three instruments which were investigated in this report (marked with x). The four topics were considered to be interesting for this study as they encounter and in most cases eliminate many of the barriers described in the previous chapter.

Table 3: Overview of investigated instruments

	AU	BE	DE	DK	ES	FI	FR	IT	GR	NL	SL	SP	PT	UK
White Certificate Scheme		x		x			x	x						x
Capacity Building	x	x	x	x		x	x	x	x	x	x	x	x	x
Financial measures (we look at the German KfW programs as an example)			x											
Experiences with the national revolving fund in Estonia					x									

As can be observed from Table 3, only five countries so far were found to have implemented the WC scheme or, at least, only information on this from these MS was available. The White Certificate Scheme is an obligation to an energy producer/supplier to deliver energy savings (on the demand side) and thus contribute to the total CO_2 emissions of the country. This system diminishes some barriers, as for example high up-front costs, lack of financing, landlord/tenant split, lack of information and awareness of the end-users, etc.

The White Certificates scheme is a fairly new instrument and numerous issues arise with its implementation in new Member States. One concern is the additionality of the system to other political instruments provided to support energy efficiency activities. For example, under the WC scheme savings are achieved in the energy sector as a whole (including electricity) and due to the potential CO_2 savings there is possible interaction with the European Trading Scheme (ETS). Further, there is a concern about the additonality of the system with some financial tools, such as e.g. income tax rebates and VAT reduction in France and the Warm Front Scheme in the UK. Another concern is the *cherry picking* that in this context means that part of the target group would have implemented the energy efficiency measures also without the policy measure. This is often difficult to control and may be considered a disadvantage.

After implementing energy efficiency measures there arises another concern, regarding the quality of the Monitoring Reporting and Verification (MRV), which may be of low quality and not be able to control the compliance of the energy efficiency measure.

The second case study describes the structure of the capacity building programs in different EU countries. This topic was investigated as it covers other barriers related to energy efficiency compared to the WC scheme. In this case, barriers which are being eliminated are, for example, information obstacles and some political and structural barriers, such as lack of detailed guidelines, tools and experts and lack of equipment testing. Moreover, capacity building programs serve as a trigger to raise awareness regarding the overall energy efficiency in buildings.

Financial instruments are one of the most widely applied instruments in the EU to overcome barriers related to energy efficiency in the building sector. For the third case study it was decided that a best practice example on the basis of the KfW Programs implemented in Germany would be presented. The success of the programmes is due to various factors; however it is not possible to conclude that these programmes could be implemented in other countries with the same conditions. This has various reasons: The KfW lends money with low interest rates, which in some countries with generally higher interest rates would not be possible for these conditions because the cost for the country would be too high. Also the communication policy of the KfW programmes is strong. With brands, as for example the KfW 40 or KfW 60 house, the bank created broad awareness in Germany. On the other hand the KfW involves local banks in order to canalize the credits to the consumers. This requires strong communication and information policy, which is possible only with sufficient financial means. The budget has to be there, if this is not the case such programmes could not be successful.

The investigation of the KfW programmes illustrates the direct results of a well-functioning program on end energy use and CO_2 emissions reduction, but it also presents the co-benefits which arise with the implementation of such an instrument. The chosen study shows how financial tools can overcome barriers mainly related to financial costs/benefits, such as high up-front costs and lack of financing.

The fourth case study looks at revolving funds in Estonia.

In all four investigated cases it was observed that there are certain obstacles which are encountered and cannot be eliminated. Such barriers are, for example, administrative barriers and non-compliance, and these may create a bottleneck for the implementation of energy efficiency projects.

2 White Certificates Scheme

2.1 Objectives of the measure

The White Certificate (WC) system is an instrument which obliges an actor (e.g. an energy supplier or a grid company) to deliver a certain amount of energy efficiency savings which are defined either in absolute terms, as a percentage of yearly sales or as customer number in the case of the residential sector. Additionally, in some countries there is an alternative to certify the savings and trade these in the form of certificates – the so-called White Certificates [Bertoldi, Rezessy et al., 2010]. This new market-based instrument alongside other policy tools, such as building codes, tax exemption, etc aims to deliver energy efficiency improvements in a cost-effective way as it provides freedom to energy market operators to design their own measures and achieve the obligation target in the most efficient manner [Intelligent Energy Europe, 2007b; Togeby, Dyhr-Mikkelsen et al., 2007b].

The energy saving projects implemented by the obliged actors can be realised in the industrial, building or transportation sector depending on the regulations stated by the regulator/Government. The investment for the achievement of the energy savings is recouped in the energy bills of the end customers. Due to the incurred energy efficiency activities the energy demand and, respectively the energy bill, of the end-user are reduced. With the recoupment of the cost of the energy efficiency activities this reduction is balanced out and the energy bill of the end-consumer remains more or less constant before and after the performance of the energy saving measures.

The effort sharing decision only includes direct emissions, whereas the indirect emissions are captured as part of the EU emission trading system (ETS). It is important to note that WC schemes can potentially target various sectors, including transport, industry, etc. and target both direct energy use and electricity savings [Togeby, Dyhr-Mikkelsen et al., 2007b]. Due to the information available it is not possible to disaggregate the proportion of savings from existing schemes that fall within the scope of the ESD, thus results are presented at an aggregated level.

Efficiency measures that only address savings under the ESD scope include e.g. exchange of heating systems, insulation of envelope and exchange of windows. These measures address fuel savings that are clearly counted under the ESD scope. However this may raise issues regarding the shifting of emissions from one sector to another. From the perspective of the ESD target it would be optimal to replace all heating systems with heat pumps e.g., since all the emissions caused by heat pumps are counted in the power sector (electricity).

Emissions savings that are clearly not counted under the ESD scope are all the emissions that are due to electricity savings, such as e.g. the replacement of inefficient with efficient light bulbs result in emission saving under the ETS and have therefore no effect on the ESD target.

2.2 Application of the measure in EU Member States

White certificate schemes have been implemented in several member states including the UK, Italy, France, Denmark and Belgium (Flanders). However, the schemes can be quite complex, and different approaches to implement the schemes have been employed. Further details on the characteristics of the national schemes are described below.

2.2.1 United Kingdom

The UK[2] has had the Energy Efficiency Commitment (EEC) scheme since 1994 targeted at household consumption which has similar characteristics to the WC system. The energy efficiency savings were expressed in "fuel standardized TWh" in the first two phases (EEC1 and EEC2) until 2008 and later in CO_2 emissions savings in the third period (CERT). The WC system was implemented in 2002 and runs in 3-year cycles. The first cycle, named EEC1, was from 2002 to 2005 and it imposed obligations on all gas and electricity suppliers with more than 15,000 customers. In the second cycle (EEC2) which ran between 2005 and 2008, the obligation was increased to 50,000 domestic customers. In the supplier obligation phase in force between 2008 and 2012, eight retailers fall under the obligations whereas six of them attend to 99.5 % of all customers [Togeby, Dyhr-Mikkelsen et al., 2007a; Togeby, Dyhr-Mikkelsen et al., 2007b] [Department of Energy and Climate Change, 2011].

The costs for fulfilling the obligations were paid back through the electricity bills which created competitiveness between energy retailers to use the most cost-effective approach [Togeby, Dyhr-Mikkelsen et al., 2007a]. It was possible to transfer the energy savings maintained during EEC1 to EEC2, the second phase of the Energy Efficiency Commitment (EEC) of UK. Due to this ability to transfer savings, in 2005 more than one-fourth of the energy target of EEC2 was already achieved. The obligations for the second phase of the EEC were 130 fuel standardized TWh or 468 PJ total in households which represents 1 % average of the annual demand of the country [EuroWhiteCert, 2007; Intelligent Energy Europe, 2007b; Togeby, Dyhr-Mikkelsen et al., 2007a]. The last phase of EEC was initiated in April 2008 and will end in December 2012. It was renamed to Carbon Emission Reduction Target (CERT) and the obligations are expressed in CO_2 instead of final energy. The target energy savings for the third period are 185 $MtCO_2$ [Bertoldi, Rezessy et al., 2010]. The total costs for administration for the Office of Gas and Electricity Markets (OFGEM) accounted to € 592 million per year [Togeby, Dyhr-Mikkelsen et al., 2007a].

The energy efficiency savings can be achieved by implementing projects related to gas and electricity, coal, oil and liquefied petroleum gas. For evaluation of the achieved energy savings an ex-ante measurement is carried out. Moreover, the suppliers are obliged to show additionality of the schemes that are conducted- this can be done by financial means proving that a certain energy efficiency measure would not have been undertaken due to lack of capital of the household owners. [Bertoldi, Rezessy et al., 2010].

Measures that are eligible in the second phase of the EEC (EEC2) include wall and loft insulation, glazing, boilers, fuel switching, heating controls, appliances, tank insulation and draught proofing. The calculation period of the measures varies between 8 and 40 years. For example the calculation period of 8 years is granted to appliances, whereas credits for a calculation period of 40 years are given for insulation of walls. The longer evaluation terms allowed for some standard measures contribute to the implementation of certain activities, as these become more economically attractive for the obliged parties due to their cost-effectiveness. Togeby, Dyhr-Mikkelsen et al. state that depending on the promoted measures, the calculation period can be altered in order to support the measures that are considered important [Togeby, Dyhr-Mikkelsen et al., 2007a].

In the UK three different trading alternatives are available:

- Horizontal trading - between obliged parties
- Vertical trading – obliged parties acquires certified savings or projects from third parties
- Temporal trading – the obliged party may transfer a part of the savings to the next compliance period in case of overachievement

In the UK the energy obligation can only be fulfilled by residential end-user activities. In order to prevent this, the companies only target customers who can afford the savings. A priority group- customers who

[2] Strictly speaking to scheme only applies in England, Scotland and Wales; Northern Ireland has a similar but different scheme.

receive income-related support or tax credits- was created. Minimum 50 % of the obligation in the first and second phases (EEC1 and EEC2) was to be covered by the priority group (low income households). For non-compliance case-by-case assessment is required in the UK. If the energy efficiency obligation is not met the regulator OFGEM can decide whether a penalty is adequate. No guidance exists on how the penalty is to be carried out and assessed, but it is stated that its value can reach up to 10 % of the supplier's turnover. Moreover, the penalty should exceed the value of the compliance measures [Bertoldi, Rezessy et al., 2010].

2.2.2 Italy

Italy introduced the WC system in 2005 with an energy saving target expressed in primary energy in toe. Two periods can be distinguished- up to and after 2008. In the first phase the obligation was imposed on all electricity and gas distributors with more than 100,000 customers from 2005 to 2009. In 2008 all electricity and gas distributors with more than 50,000 customers were included which led to an increase of the number of obliged electricity distributors from 10 to 14 and of gas distributors from 20 to 61 [Bertoldi, Rezessy et al., 2010]. The obligations were increased on a yearly basis and the necessary new measures were doubled in 2007, 2008 and 2009, where the obligations on gas distributors were increased by only 50 % in 2008 [Togeby, Dyhr-Mikkelsen et al., 2007a].

The target savings for 2009 were 2.9 Mtoe. However 22 % of these were not distributed since 22 % of the energy supply is delivered by small suppliers. Extracting this percentage, an actual target value of 2.6 Mtoe for 2009, corresponding to 1.8 % of the primary energy consumption was estimated [Togeby, Dyhr-Mikkelsen et al., 2007a]. The overall primary energy savings were assessed to 6 Mtoe for the year 2012 and the cumulative energy savings to 22.4 Mtoe by 2012 [Bertoldi, Rezessy et al., 2010]. The targeted savings for the period 2005 – 2009 accounted to 230 PJ total which represents 0.5 % average of the annual energy demand of Italy [Intelligent Energy Europe, 2007b].

Projects related to all end-use sectors are accepted, including some supply options, as for example, combined heat and power (CHP), solar water heaters and photovoltaic (PV). Until 2008 minimum 50 % of the savings were to be accomplished by reduction of the supplied energy fuel. This was later removed in order to create market competition [Bertoldi, Rezessy et al., 2010].

Standard measures are split into 14 categories, including mainly households (CFLs, windows, wall insulation, electric water heaters, high efficiency home appliances, etc.), substitution (electric water heaters with electronic ignition gas heaters), mainly large end-users (high efficiency electric motors, power regulators, etc.), supply options (bag fired boilers, air conditioners, heat pumps, photovoltaic and solar water heaters) and analytical measures (CHP, district heating, energy recovery from natural gas decompression, etc.) [Togeby, Dyhr-Mikkelsen et al., 2007b].

The issue with policy additionality still exists in Italy – there is no tool to determine whether a project is rewarded twice by two different instruments. Three approaches are applied for evaluation of the Italian WC scheme – deemed savings approach, an engineering approach and the third approach is based on comparison of measured consumptions before and after the implementation of the project. Certificates can be traded by means of bilateral contracts and since 2006 there has been a possibility to trade on a spot market which is organised and administered by the electricity market operator [Bertoldi, Rezessy et al., 2010]. There are three types of certificates in Italy – Type I (electricity), Type II (gas) and Type III (other). Currently, only certificates of Type I and Type II are used. The distributors are obliged to deliver half of the obligation into their own fuel type but the possibility to purchase certificates from other types exists [Togeby, Dyhr-Mikkelsen et al., 2007a]. In case of non-compliance with the obligations there is a one-year grace period if at least 60 % of the annual target is achieved. If this is not the case there is a financial penalty which does not cancel the obligation [Bertoldi, Rezessy et al., 2010].

In Italy the implementation of a given activity is rewarded at the same pace as the progress of the savings. This means that an energy efficiency measure can generate certificates in five (or even eight) following years. This creates market uncertainty between the energy suppliers regarding the certificate value after 2010 [Togeby, Dyhr-Mikkelsen et al., 2007a].

2.2.3 France

The White Certificate scheme was introduced in France in 2006. The energy efficiency savings are presented in TWh cumac[3]. The WC system of France is aiming at 2 % annual reductions in the end-use energy intensity by 2015 and 2.5 % between 2015 and 2030 [Togeby, Dyhr-Mikkelsen et al., 2007a]. The first 3-year period lasted from 2006 to 2009 and imposed obligations on energy suppliers who deliver electricity, gas, domestic fuel (excluding transport), cooling and heating for stationary usages with annual sales of 0.4 TWh and suppliers of LPG with annual sales 0.1 TWh [Bertoldi, Rezessy et al., 2010]. The targeted savings, expressed in final energy, accounted to 54 TWh cumac cumulated over the life of the energy saving target for the first period. The target represented in PJ was 194 PJ total for the period 2006 – 2008 which accounted to 1 % average of the yearly demand of the country [EuroWhiteCert, 2007; Intelligent Energy Europe, 2007b]. The second phase is taking place from 1 January 2011 until the end of 2013 [Ministry of Ecology, 2010]. As stated by [Bertoldi, Rezessy et al., 2010] the energy savings per year should amount to 100 TWh cumac for the second period.

France does not impose any restriction on the scheme regarding projects, energies or end-use sectors with the exception of installations that are covered by the ETS sector. All parties can apply for energy efficiency savings in case the savings are greater than 1 GWh cumac over the lifetime of the project. There is a possibility to group smaller projects in order to apply for certification, as the certification is on application and not on project. Energy savings are only eligible if these are accomplished additionally to the standard activities of the obliged actor and they do not “generate direct income” in favour of the party [Bertoldi 2010]. This means that the energy saving measures are not undertaken for own profit. [Bertoldi, Rezessy et al., 2010].

The WC scheme can be implemented in combination with personal income tax deductions programs, as many of the projects are qualified for both the WC system and the tax rebates schemes [Bertoldi, Rezessy et al., 2010]. This provides the possibility to reduce the investment costs of the end-user. For example, in case of the replacement of a LPG boiler in a household, the obliged LPG actor will provide part of the initial investment costs and the household can further apply for 15% income tax reduction on the equipment expenditure. The evaluation of the French WC system is carried out by means of a “list of standardized actions with related energy saving deemed estimates” which has been issued in 2006 and updated several times thereafter [Togeby, Dyhr-Mikkelsen et al., 2007a]. The list includes 100 measures in the household and commercial sector, about 20 activities in the industrial sector and 5 in the transport sector [Bertoldi, Rezessy et al., 2010]. The standardized actions are split into several groups:

- Residential – building envelope (insulations of walls, windows and floors), thermal (heating system, solar water heating), equipment (lighting, appliances), services (training);
- Tertiary – building envelope (insulation activities), thermal (heating system, air conditioning, biomass, solar water heating), equipment (lighting), services (training);
- Transport – equipment (tyres)and services (training);
- Industrial – buildings (lighting) and production system (motors, heat recovery);
- Heating, cooling and public lighting [Togeby, Dyhr-Mikkelsen et al., 2007a]

France is the only country which has included the transport sector in the WC scheme [Bertoldi, Rezessy et al., 2010].

The certificates are valid for 3 compliance periods and banking for the next phase is allowed. It is possible to issue certificates from three different parties – obliged energy suppliers, public collectives such as state, region, department, etc. and non-obliged parties in case energy efficiency is not main business of the party. The exclusion of companies whose main activity is energy efficiency improvements aims at pushing market development. The obliged parties may exchange certificates amongst each other, but there is currently no centralized trading system in France and it is not planned for the future [Togeby, Dyhr-Mikkelsen et al., 2007a].

[3] cumulated over the conventional lifespan of the equipment and discounted from the second year at a 4 % rate

The certificate costs are recouped in the energy bills of the end-users. A pre-defined non-compliance penalty of 2 Eurocents/kWh cumac is applied in France [Bertoldi, Rezessy et al., 2010]. In case of penalty payment, the deficiency is withdrawn and thus not carried on to the next compliance period [Togeby, Dyhr-Mikkelsen et al., 2007a].

2.2.4 Denmark

The energy saving obligation, in force between 2006 and 2013, is mandatory for all electricity, gas and heat distributors, where only the first year savings, expressed in final energy, from projects are accounted for [Bertoldi, Rezessy et al., 2010]. The total savings targeted for the period are 7.5 PJ per year or 1.7 % of the annual demand in the end year [Intelligent Energy Europe, 2007b]. Currently, no formal certification or trading of savings exists in Denmark [Bertoldi, Rezessy et al., 2010].

All end-use sectors, excluding transport, are eligible for the scheme. Measures which are network-related or connected to the supply side are not approved and projects including change of fuel are recognised only in cases of consumption reduction. Transport is still not included in the scheme, except for internal transport consumption of the company [Bertoldi, Rezessy et al., 2010]. As mentioned above the savings from a certain energy efficiency activity are counted only for the first year. The Danish WC scheme does not distinguish between building activities (e.g. insulation with a long calculation period) and behavioural measures (with short calculation period) [Togeby, Dyhr-Mikkelsen et al., 2007a].

Moreover, differentiation between energy types is made only in case of fuel substitution. For example, when replacement of electric heating with district heating takes place, a multiplication factor of 2.5 is applied. In all other cases 1 kWh oil equals 1 kWh district heating [Togeby, Dyhr-Mikkelsen et al., 2007a].

The energy efficiency savings are assessed either through a specific engineering calculation or based on standard values. Most evaluations are carried out by means of the specific engineering method as the contribution of energy savings in the residential sector to the overall savings is very small [Bertoldi, Rezessy et al., 2010].

2.2.5 Belgium (Flanders)

In Flanders, Belgium, an energy saving obligation expressed in primary energy, without any savings trading or formal certification, has existed since the beginning of 2003 [Bertoldi, Rezessy et al., 2010];. Obliged actors are 16 electricity distributors. The targeted savings in 2008 amounted to 0.58 TWh annually and approved actions are all residential, non-energy intensive industry and services activities and can include fuel from any sources [Bertoldi, Rezessy et al., 2010]. A broad range of measures are eligible for the achievement of the obligation, but most typical in the residential sector are low flow shower heads, CFLs, thermal insulation of roofs and windows and condensing boilers. Various measures are approved in the non-residential sector as well. These include energy audits, retrofitting energy efficient lighting, variable speed drives, roof insulation, boilers with higher energy efficiency, etc.

Similar to the UK system, the energy companies in Flanders have an obligation to fulfil part of their savings in low income households [Lees, 2007].
The obliged actors implementing a project should submit their proposal including method for evaluation of the energy efficiency savings to the Flemish Energy Agency. The penalty for non-compliance is set at 1 Eurocent/kWh [Bertoldi, Rezessy et al., 2010].

2.3 Main features of the measures

The country examples described above have certain common features, but others differ between the schemes. These are described further below.

2.3.1 Obligations, obliged actors, compliance periods

Obligations can be expressed in primary energy (Italy and Belgium), final energy (Denmark and France) or CO_2 emissions reduction (UK- CERT). The compliance periods can be set to every few years, as in the case of France and UK, which have to show their accomplishments at the end of each period. Another possibility is the annual compliance period which is adopted by Denmark, Italy and Flanders. In the case of the multi-annual, which last on average 3 years, compliance targets are set every year in order to ensure stability of the policy and to allow energy suppliers to plan [Bertoldi, Rezessy et al., 2010].

The French approach regarding the exclusion of parties whose main business is energy efficiency services is, mainly to exclude savings that would have taken place without the presence of the WC scheme. Also they aim at boosting market development – it pushes energy suppliers to motivate the end-energy users to carry out energy efficiency improvements.

2.3.2 Eligible projects, energy types and sectors

In order to achieve their targets, the obliged actors can chose to implement energy efficiency projects or to purchase certificates from third parties. Small energy actors may be excluded from obligations as this might become a burden for them or restrict them from entering the market [Bertoldi, Rezessy et al., 2010]. Obligations can be imposed on electricity suppliers as is the case in Flanders, both electricity and gas suppliers as in the UK and Italy or as adopted by France, and in Denmark also other energy providers (heating, cooling, LPG) [Bertoldi, Rezessy et al., 2010].

In the UK there are no restrictions concerning cooperation and type of measures undertaken by the obliged actors. Moreover, there is free competition among the obliged parties, it is possible to transfer the costs on to the end-users and the consumers have the freedom to change the energy supplier on short notice. All these factors lead to innovative and cost-effective solutions to energy efficiency. Such a market can be considered to be at least as effective or even better compared to an open WC market [Togeby, Dyhr-Mikkelsen et al., 2007a].

The obligations division into fuel type and the obliged actors differs between the MSs as well. Whereas, some countries have appointed obligations on suppliers (retail companies), others have chosen to usher obligations on the distributors (grid owners)[Bertoldi, Rezessy et al., 2010].

A scheme can have a wide scope regarding end-use sectors (e.g. residential, tertiary and industry) which are covered to achieve the target, project types and/or technologies accepted. The scheme can be either completely open in terms of technologies and sectors or can be restricted. An open policy does not limit the obligation actor and he has the possibility to choose his own path to achieve the obligation goals. Limitations of the scheme might lead to higher compliance costs and may lead to utilization of a standard package of measures, thus not diversifying the market. A disadvantage of a fully open scheme is that including all project types and sectors might lead to higher costs for the system administrators who employ in monitoring, verification and validation of the energy efficiency measures [Bertoldi, Rezessy et al., 2010].

The UK is the only country where there is uplift provided to obliged parties for the development of new standard measures. In the French WC system there is no bonus for innovation measures, but a doubling of the value of the certificates takes place in cases when activities are undertaken in the regions not connected to the continental mainland electricity grid [Togeby, Dyhr-Mikkelsen et al., 2007a].

In Denmark half of the savings were conducted in the industry and trade where 2/3 of the electricity savings came from these sectors. 1/3 of the electricity and gas distributors' savings were accounted in other energy types and oil distributors reported only oil savings [Togeby, Dyhr-Mikkelsen et al., 2007a].

France has included training campaigns, use of renewable energies and energy efficiency in buildings in the list of standardized measures which creates diversity in the further development of the system [Togeby, Dyhr-Mikkelsen et al., 2007a].

2.3.3 Trading

In most MS which have implemented the WC scheme it is possible to trade certificates, eligible measures without formal certification or trade obligations [Bertoldi, Rezessy et al., 2010]. One exception is Flanders where no trading takes place but in case of over-achievement of the target the excess energy savings can be carried forward to the next compliance period. In France there is no official trading system (see chapter 2.2.3) and there are no plans to implement such, but over-the-counter trade between obliged parties, as well as between obliged parties and project implementers, is possible. In Italy there is an open market which has created business for the energy service companies – they can create and sell certificates on the open market or directly to an obliged party. In France and UK no white certificate stock exchange exists. In Denmark energy efficiency savings can be traded [Togeby, Dyhr-Mikkelsen et al., 2007a].

2.3.4 Summary of features

The results of the comparison between the schemes in the EU countries showed numerous variances which are presented in a summary table below (see Table 4).

Table 4: Main features of the White Certificate schemes

	UK	Italy	France	Denmark	Belgium (Flanders)
Obligation	lifetime delivered energy/CO2	cumulative primary energy	lifetime delivered energy	lifetime delivered energy	annual primary energy
Compliance period	multi-annual	annual	multi-annual	annual	annual
Obliged actors	electricity and gas providers with < 15,000 customers in EEC1 and <50,000 in EEC2	electricity and gas distributors with < 100,000 customers (2005-2009) & 50,000 customers (2008)	energy providers (incl. heating & cooling) with annual sales ≧0.4 TWh; LPG suppliers with annual sales ≧0.1 TWh	energy providers (incl. heating, cooling, LPG)	only electricity providers
Sector and project types	only residential sector; all projects related to gas & electricity, coal, oil and LPG	all end-use sectors, incl. CHP, solar water heaters and PV	ETS sectors excluded; the obliged party should undertake savings >1GWh cumac over the lifetime of the project; transportation included	all end-use sectors; no network-related or connected to the supply side projects; projects incl. Change of fuel are eligible only if they lead to consumption reduction; transportation is only included in case of internal transport consumption of the company	all residential, non-energy intensive industry and services
Eligible measures	all residential-related: wall & loft insulation, glazing, boilers, fuel switching, heating controls, tank insulation & draught proofing	14 categories including households (wall insulation, CFLs, windows, electric water heaters, etc.), substitution (e.g. electric water heaters with electronic ignition gas heaters), large end-users (e.g. high efficiency electric motors), supply options (AC, heat pumps,	100 eligible measures in the household and commercial sectors, 20 measures in the industry & 5 for the transport	n.a.	residential sector: low flow shower heads, CFLs, thermal insulation of roofs and windows & condensing boilers; non-residential sector: energy audits, retrofitting energy efficient lighting, variable speed drives, roof insulation, boilers with higher energy

		etc.) & analytical measures (CHP, district heating, etc.)			efficiency
Lifetime evaluation	long lifetime	lifetime of max. 8 years	long lifetime	standard lifetime 5 years	n.a.
Rewarding of an activity	in the first year	at the same pace as the reductions are realized	in the first year	in the first year	n.a.
Trading	no WC stock exchange; trading of savings and obligations	open market	no official trading system and market; trading of WC exists under the 2 €cent/kWh penalty price	trading of energy efficiency obligations	no formal certification; no trading
Savings sectors	building sector	building sector (lighting)	building sector (building envelope)	Trade and industry	n.a.

[Bertoldi, 2010; Mundaca, 2008]

2.4 Evaluation of the White Certificate Scheme

One of the most important factors to influence the development of given energy saving activities is the life time savings and the rewarding of the measures. Longer calculation periods, as in the UK and France, can make a certain measure more economically attractive because it increases the cost-effectiveness of the activity. Such an approach can be used as a regulatory tool to boost the development of particular energy efficiency measures which are considered more important than others. In Italy, on the other hand, there is a maximum 8 years calculation period which makes projects, such as building envelope improvements, an unattractive investment. For example, the largest obliged actor on the Italian market, ENEL (Ente Nazionale per l'Energia eLettrica), has generated a big share of its certificates by distributing CFLs (Compact Fluorescent Lights) for free. A similar approach can be observed in Denmark where there is no differentiation between technical and behavioural measures and a standard life time of 5 years is applied [Togeby, Dyhr-Mikkelsen et al., 2007a].

Moreover, the rewarding of a certain activity in Italy happens at the same pace as the savings are realised. Thus, a measure can yield certificates for up to 8 years. This and the fact that there are no long-term obligations create uncertainties among the obliged actors. In UK, France and Denmark all savings are rewarded in the first year with the implementation of the energy saving measure [Togeby, Dyhr-Mikkelsen et al., 2007a].

In several countries measures have been taken to overcome the issue of policy additionality, such as UK and France. In countries with high levels of decentralization of the energy efficiency policies, it is complicated to follow the policy additionality since the energy efficiency obligations are managed by the central administration, while energy efficiency schemes exist on local level, as well, which is the case in Italy [Bertoldi, Rezessy et al., 2010]. The WC system can be used in combination with other political tools for energy efficiency support, such as e.g. the personal income tax deductions in France and the Warm Front Scheme in the UK [Togeby, Dyhr-Mikkelsen et al., 2007a]. The Warm Front Scheme is a financial tool which targets the reduction of fuel poverty and provides grants for insulation and heating improvements of low-income households [EuroACE, 2010a]. The combination with other policy tools brings the risk of overlapping and therefore non-additionality.

The issue of interactions between the WC schemes and ETS is a major policy concern since the interactions between the two market-based environmental systems are still not clearly defined. It has been proposed to allow trading between the ETS and the WC schemes in Member States. One possible side effect is the double crediting of CO_2 savings which will be in place when “two separate carbon allowances are generated from a one-tonne decrease in physical emissions” [Harrison, Sorrell et al., 2005]. Thus, the carbon allowances produced in the WC scheme due to over-compliance could be sold in the ETS. It is expected that the WC scheme will not lead to lower CO_2 emissions in the EU as a whole except in the case that the reduction in emissions happens in sectors not covered by the ETS, as for example household fuel consumption. This however, refers explicitly to direct fuel use. Thus, reductions in the household electricity consumption through the WC system will not lead to a decrease in the overall CO_2 emissions [Forschung für nachhaltige Entwicklungen, 2009; Harrison, Sorrell et al., 2005].

Co-benefits of the WC scheme are:

- Enhancement of competitiveness and employment
- Reduction of fuel poverty
- Promotion of technological market transformation
- Abatement of atmospheric pollution
- Improvement of housing stock and comfort level
- Increase in the security of supply

[Mundaca, 2008]

There are a few comprehensive ex-post evaluations of the WC scheme and these do not distinguish between energy and electricity savings. Moreover; the additionality of the system with other political instruments is hard to assess and thus it cannot be estimated if the energy efficiency savings triggered by the WC scheme are additional or if these would have been carried out in the absence of the WC scheme as well.

Following Table 5 shows an overview of the outcomes in the different countries presented in the above sections

Table 5: Summary of the outcomes and impacts of White Certificate schemes

	UK	Italy	France	Denmark	Belgium (Flanders)
Main sectors	building sector	building sector (lighting)	building sector (building envelope)	Retail sector and industry	n.a.
Savings target	62 TWh (2002-2005); 130 TWh (2005-2008); 185 MtCO2 (2008-2012)	2.6 Mtoe (2009)	54 TWh cumac (2006-2009)	5.4 PJ/year (2006-2013)	0.58 TWh/year
Savings target [PJ]	468 PJ total (2005-2008)	230 PJ total (2005-2009)	194 PJ total (2006-2008)	7.5 PJ/yr (2006-2013)	n.a.
Target as % of annual demand	1 % (average)	0.5 % (average)	1 % (average)	1.7 % (end year)	n.a.
Savings achieved	86.8 TWh (2002-2005)	6 Mtoe (2012); 22,4 Mtoe (2009-2012)	n.a.	1834 TJ (2006)	n.a.
Policy additionality	utilization of the scheme in combination with other tools for energy efficiency support (Warm Front Scheme)	no monitoring possible due to high decentralization (energy efficiency obligations are managed by the central administration, while energy efficiency schemes exist on local level)	utilization of the scheme in combination with other tools for energy efficiency support (income tax rebates and VAT reduction)	n.a.	n.a.
Costs [€M/yr]	570	[90]	[200]	20	25,8

2.5 Wider impacts of the White Certificate Scheme

		Economic impacts
What was the cost to deliver the outcome, was it value for money?	(++)	Governmental expenditure was low in most cases, as the government is not an obliged party and only administration costs are present.
	(++)	Since the obligation was paid off by end users' energy bills, the scheme was cost-effective for the energy producers/suppliers as well.
	(++)	Estimations of the costs that the customers received were relatively low. As in the case of UK, it was assessed that the expenditures for energy efficiency measures delivered by the energy producer/supplier, accounted to ￡3.20 per fuel per household annually.
What wider economic impacts does the policy have?	(++)	The WC scheme creates competitiveness, enhances market diversification and increases the energy security
	(-)	Non-compliance is a possible risk where penalty has not been introduced

		Environmental impacts
Did the policy deliver the desired outcome?	(++)	The targets set so far have been over-achieved in the analysed countries. This lead to significant reductions in the energy consumption of households, CO_2 emissions, improved air quality and health
What other impacts has the policy had?	(++)	Long-term reduction of pollutants (including CO_2) and improved energy security are other co-benefits of the WC scheme
Are there impacts on emissions from other sectors?	(++)	As the WC scheme is not solely targeted at the building sector (with exception of UK), significant impacts have been achieved in other sectors, such as industry, services, etc. as well.

		Social impacts

Was the policy well received, were there issues in gaining acceptability, what did they relate to?	(++)	The obligation to energy producers/suppliers was over-achieved which leads to the conclusion that it was easy to accomplish the targets set by the government. In most cases the targets were easy to achieve because the scheme works well for all parties. Some countries plan to set the targets higher in the future in order to challenge the obliged actors.
	(++)	The end users' satisfaction was high, as their contribution was distributed over a longer period of time and was therefore relatively small. With the implementation of the scheme uncertainties and risks regarding technical and financial performance were eliminated.
What are the distributional impacts?	(++)	Some schemes had specific bias to certain sectors of society, thereby improving energy efficiency in some of the most disadvantaged households.
	(-)	Low quality of monitoring and verification after the completion of the energy efficiency activities lead to consumer dissatisfaction
	Cross-Cutting	
Are there interactions with policies in other sectors?	(++)	The WC scheme has high interaction with other sectors, as it is not targeted only to the building sector. In some countries the scheme can be applied with other instruments, such as financial and fiscal tools. The policy is highly related to information campaigns as it serves as a tool to raise awareness in the public.
Timeframe – is there anything to note about the timing of policy implementation and expected impacts?	(++)	Reductions in energy consumption and GHG emissions are measurable immediately and in the long-term after the realization of the energy efficiency activities

2.6 Maximising desired impacts/reducing unwanted impacts of the White Certificate Scheme

This section looks at how the positive impacts could be maximised to ensure the policy delivers its full potential. We have compiled the lessons learned from schemes that have already been introduced, as well as using evidence from the broader literature to suggest how implementation could be improved. Strategies to mitigate the negative impacts are also suggested.

Maximising the benefits

A wide and diversified list of eligible measures and projects is crucial for the scheme

To simplify the evaluation of eligible savings, some countries have implemented a list of measures. This list should remain "open" to ensure the introduction of new, innovative measures by obliged parties. A preset list of measures may incur higher compliance costs for the obliged actor. Nevertheless, it should be considered that a fully "open" list of measures might lead to higher administrative costs for the government for verification and monitoring.

Adjust lifetime evaluation so that it does not undermine important measures, but also ensure that no over-assessment will occur

Lifetime evaluation has been observed to be one of the most important issues in the WC scheme. If the calculation period is set too low and all measures receive the same lifetime evaluation (e.g. Italy), energy efficiency activities with low and high impact will be given the same value and thus the obliged parties will target smaller projects which will lead to non-cost-effectiveness of the scheme. On the other hand, it should be assured that the lifetime of certain measures is not evaluated too high as this might lead to "over-evaluation" of the accomplished saving (e.g. UK). Longer calculation periods can be used as an efficient approach to promote specific activities.

Mitigation measures

Design and "rules" of the system should be clear and transparent

It is crucial to simplify the scheme's concept in order to avoid high administrative costs, prevent confusion regarding the design of the scheme and to ensure compliance of the obliged parties.

Monitoring and verification are crucial for the evaluation of savings and compliance with the scheme

Establish a system for monitoring and evaluation of projects and measures. The system should be comprehensive enough to identify "free-riding" and "cherry picking", but it should also be kept simple enough to avoid high administrative costs.

Non-compliance should be avoided

Set a non-compliance fee before introducing the system to ensure parties will cover their obligations. It is important that the penalty is slightly higher than the costs for achievement of the obligation so that obliged actors will have motivation to fulfil the commitment.

Ensure all consumers have profit of the WC scheme

To ensure that all end users, including low-income households, profit from the scheme, it is advisable to include a minimum requirement for a specific priority group (as in the cases of Belgium and UK).

Calculation period of measures is crucial

The maximum credit period and the credit mode is a key design feature of the schemes. It has a significant impact on the amount of savings to be achieved. Existing systems in Denmark, Italy, France and UK assess the savings resulting from the same measure are completely different. To avoid low acceptance of energy saving activities with high potential or implementation only of measures with longer calculation periods, the calculation of the quotas received should be adjusted to the real value of the savings [Ecofys, Fraunhofer ISI et al., 2011].

Ensure industry will not move out of the country/Europe	Since the obligations are imposed on energy suppliers/distributors and no other industries, the risk of the industry moving out of Europe will be low.

2.7 Lessons learnt

The White Certificate scheme aims to promote energy efficiency in the most cost-effective way. It is observed that most of the achieved savings are in the residential sector. In the case of the UK only savings in the residential sector are eligible in the WC scheme. In France most of the certificates are related to the building envelope, whereas in Italy these are induced mostly by improvement measures for lighting in buildings. As mentioned above France is so far the only country which has included the transport sector in the scheme. In Denmark half of the savings were reported in the retail and industry sector [Lees, 2007].

- Monitoring and evaluation of the scheme is still underdeveloped. For example, the savings are not disaggregated by fuel and electricity savings and can therefore not clearly be allocated. [Mundaca, 2008].
- The scheme is observed to function well in both monopolistic and fully liberalized market conditions [Lees, 2007].
- The success of the scheme is highly dependent on the level of ambition and since the targeted savings have been achieved by all MS so far, more ambitious goals can be set [Mundaca, 2008].
- The “rules” of the scheme must be clear and transparent and should not be changed often in order to guarantee regulatory certainty for the energy companies [Lees, 2007]. The functioning of the “rules” of the scheme depends highly on the MS in which it is implemented. In certain countries the adoption of specific rules can act as a drawback, while their performance in other states has been evaluated as excellent. This should be considered before introducing the scheme.
- No independent assessment of the inclusion of transport sector exists. However; there are no technical or practical reasons against this practice [Togeby, Dyhr-Mikkelsen et al., 2007b]. It is also considered that including transportation in the scheme will be a good approach as it will increase the number of players and will therefore raise the liquidity of the market [Bertoldi, Rezessy et al., 2010].
- The monitoring and verification, as well as the administration costs can be significantly reduced by applying the ex-ante approach for calculation of the savings. For instance, in the UK the expenditure has been estimated to be less than 1 % of the total energy supplier cost. [Lees, 2007]. The disadvantage of this method is that the actual savings are not accounted.
- The evaluation of the lifetime savings should be carefully considered. In Italy the calculation period is set to 5 years which gives the same weight to different measures as insulation of walls and CFL lighting, whereas in the case of UK 40 year-calculation period is assigned to measures, such as insulation which might not be the real lifetime saving of the activity. Adjustment of the calculation periods should be considered depending on the importance of the energy efficiency measure and it should not be enhanced too much in order to avoid “boosting up” of certain activities [Lees, 2007].
- It is considered that long calculation periods are a good approach in cases when the target is to promote and create a market for specific energy efficiency measures, such as insulation activities.
- A list of eligible measures is an easy approach for evaluation of the energy efficiency activities, but it does not create market for new ideas.
- In order to ensure that consumers of the lower income class who cannot afford to contribute to the expenditure of energy efficiency activities are also included in the scheme, a target group should be established. An example is the system in UK, where 50 % of the obligation has to be achieved in households which receive income-related benefits or tax credits [Bertoldi, Rezessy et al., 2010]
- The scheme can be designed in a manner that it targets a specific sector, as in the case of UK – residential sector only, or in Denmark – retail and industrial sector.
- The WC scheme creates various benefits for the end users, as they raise awareness related to energy efficiency, eliminate uncertainties and risks concerning technical and financial performance, reduces transaction costs for obtaining reliable information, etc [Mundaca, 2008].

- Non-compliance rules and penalties should be established to ensure well-functioning of a scheme. The size of the penalty must exceed the cost of savings realisation.
- Currently the scheme seems to function well in general and it is attractive for all actors taking part. Governments are not obliged and the responsibility is passed on the energy producers/distributors. However, this could change depending on the outcome of the ongoing discussion on the proposed Energy Efficiency Directive. The obliged producers/distributors, despite investing in households, recover their costs from the energy bills of the end-users. And finally, the public is satisfied as they receive energy efficiency improvements at a low price or for free, as in the case of Italy, where CFLs were handed out for free [Lees, 2007].
- The WC scheme can be considered a good instrument not only for improving the energy efficiency of the current building stock and reduction of CO_2 emissions, but also for enhancement of the market development for energy related products and services. As mentioned above though, there are a few comprehensive ex-post evaluations of the scheme and the actual direct energy savings are difficult to estimate due to overlapping with other policy instruments.
- Due to the information available it is not possible to disaggregate the proportion of savings from existing schemes that fall within the scope of the ESD, so results are presented at an aggregated level. Measures, such as exchange of heating systems (efficient gas, oil or a pellet system) or energy efficiency measures, such as insulation would be measures which savings would count under the ESD scope.

3 Capacity building and training in the EU

3.1 Background

The Energy Performance Building Directive (EPBD) was implemented in the EU in 2002 and updated in 2010 (EPBD recast. It sets requirements for existing and new buildings. In order to regulate the correct implementation of the directive and to ensure compliance of the MS, a certification system was introduced. This leads to the inevitable issue of training, qualification of the experts and monitoring and verification of the certification efficiency of energy certification assessors (ECA). In this report a comparison between the ECA training programs, ECA qualification and monitoring methods is carried out. This analysis assesses the best practice examples, draws conclusions on the failures and successes in the different MS and thus searches for possibilities to improve the current training system.

It is important to differentiate between training of energy assessors and training of trainers. This chapter focuses mainly on the energy certification assessor training which takes place in the EU. It is observed that most countries in the EU have some sort of training system for energy auditors which can be voluntary or mandatory.

3.2 Application of the measure in EU Member States

There is a large amount of variability in the training programs that are offered in the different Member States. For example:

- *Austria:* Twice a year the Austrian Chamber of Commerce provides a 5-day informal course and the Austrian Energy Agency offered a 17-day specialized course which included e-learning. The cost of these courses varies and is estimated to be between € 400 and € 1,200.
- *Italy:* 7 day training courses are organised by ENEA and FIRE 6-7 times per year since 1992. The cost of such a course is € 1,000. On a regional level in the Lombardy region, Emilia Romagna, Liguria Region and Bolzano Province training courses for ECAs are provided. The costs of these courses vary between the regions. One example is Emilia Romagna Region where the expenses for a training program are between € 850 and € 1,200.
- *Greece:* Several unofficial seminars with short (20-40 hours) and medium (60-120) durations were organised. The professionals who want to obtain an ECA degree must pass an examination which is verified by the Technical Chamber of Greece.
- *Portugal:* The training courses consist of two main parts: technical and certification. In order to obtain a degree the candidates are required to pass both the technical and the certification examinations. The technical part of the program is taught by recognised organisations and costs amount to € 500 – € 1,000, while the certification part, organised by ADENE, costs € 800 – € 1,000. About 100 training programs are provided by ADENE
- *Spain:* There are significant variations between regions. Online courses are offered with durations ranging between 25 and 200 hours. In the regions Castilla and Leon the expenses of a training course are € 60, while in the Madrid Region the courses last 100 hours and the costs are assessed to € 180, whereas 80 % is covered by administration.

3.3 Main features of the scheme

3.3.1 Expert availability

With the rising requirements throughout the EU a certain number of energy auditors will be required in order to ensure a well-functioning certification of existing and new buildings. The estimated data collected for experts in this field is represented below in Table 6.

Table 6: Overview of expected numbers of ECAs needed and currently in the market

	Number of ECA needed	Number of ECA in the market
Austria	n.a.	1,300-1,500
Belgium	1,340	n.a.
Italy	110,000	42,090
Greece	3,500 (for the next 5 years)	n.a.
Portugal	2,000	1,300
Slovenia	n.a.	n.a.
Spain	3,700-3,900 [1]; 2245 [2]	n.a.
Denmark	1,200	1,000
France	6,000	Foreseen 6,000 lead-asbestos (2007)
Germany	5,500	n.a.
The Netherlands	1,000	200

Source: [Hoogelander, Dictus et al., 2006; Intelligent Energy Europe, 2010]

Data on the necessity and availability of ECAs in Member States is quite limited. However, a comparison of the available data leads to the conclusion that there is a shortage of experts in the field of energy auditing. Monitoring of the ECA capacity should be developed in order to identify the needs of each country and allowing mitigation measures to be developed for an shortages.

3.3.2 Minimum requirements for ECA

The minimum requirements for energy auditors vary widely in the MS, but it is observed that accreditation is given mostly to people with minimal education levels in the field of energy related to buildings. In most countries this level is represented by a degree in architecture, engineering or building physics and additional training is required in order to become an accredited energy expert [Hoogelander, Dictus et al., 2006]. A summary of the data obtained for the various minimum requirements in different EU countries is represented in the following Table 7:

Table 7: Overview of minimum requirements for energy auditors in various countries

	Minimum requirements for energy auditors
Austria	• chartered engineering consultants with relevant authorisation; • eng. agencies of expertise within their trading license, master builders and master carpenters; • general legally accredited ECA in the relevant area of expertise; • accredited inspection authorities and the technical departments of public enterprise bodies
Belgium	• minimum requirements are under development; the following are planned: • Flemish region- architect, engineering architect, civil engineer or industrial engineer with additional training; • Walloon region- building professionals with additional training

Italy	• professionals who are registered at the official association, demonstrating suitable design or energy auditing experience; • any person with a technical-scientific background (recognised by the regions and autonomous provinces) who attended a specific training course (organised or authorized by the regions and autonomous provinces) that required final examination
Greece	• engineers, graduates of technical universities- Class A (audits only of residential buildings with a total surface area >1,000 m^2 and Class B (audits of all buildings); • graduates of technological educational institutes (only Class A, eligible to classify for Class B after 5 years of experience); • already registered Energy Auditors in another EU country
Portugal	• full membership of the Architects Association, or Engineers Association or the National Association of Engineering, • min. 5 years of experience, • attendance of recognised courses & passing of the final examination
Slovenia	• engineers and architects (5 years of study &/or 3 years professional study & professional degree diploma in technical education), • minimum 5 years of experience in their own professional area [Lamberts, 1996; Langniß, Kohberg et al., 2011]
Spain	under development; expected are the following requirements: • higher technical education of university degree (engineering, architectural) • considerable additional training
Denmark	• trained engineer, architect, construction designer or similar level; • consultants are required to have a compulsory professional liability insurance & are obliged to participate in the admission course for the Energy Certification Scheme and must have passed the test; • 2 consultant classes are recognised: for small buildings and for all other buildings
France	• any expert can sign up for the examinations; • the accreditation consists of on-site exam, written exam and 2 certificates delivered each year; • no former training or education required
Germany	• final degree in architecture, structural/civil engineering, building services or building physics or mechanical electrical engineering for existing buildings; • for existing residential buildings - interior designers, master craftsmen in the field of main construction crafts, hearing, installation, chimney sweepers, accredited technicians in structural engineering, building services; • additionally - key courses in energy efficient building or 2 years of practical experience or additional training according to requirements in annex of EnEV or certificate for construction project applications; • for new buildings the qualifications are under the jurisdiction of the Federal States
The Netherlands	• higher vocational training in civil, mechanical or electrical engineering, or an intermediate vocational education; • additional training for experts (by recognised training centres); • several years of experience in the field of energy conservation techniques; • advice skills
Finland	• engineering background is required to take part in the training course; • authorisation requirements are fairly light [Venkat, 2006]

Sources: [Danner, 2008; Hoogelander, Dictus et al., 2006; Intelligent Energy Europe, 2007a; Intelligent Energy Europe, 2010; Lamberts, 1996; Langniß, Kohberg et al., 2011]

3.3.3 Administration of the training system

There are two types of administration systems – on national and on regional level. The administration is carried out by national authorities in Greece, Portugal, Slovenia, Denmark, France, The Netherlands and Finland.

In Austria, the informal training courses are provided by the regional governments in cooperation with the Chamber of Commerce and the Chamber of Civil Engineers or by regional energy agencies.

In Italy, the main framework is carried out by the central government and the regional authorities have the right to adapt it to their requirements. Due to delays in the drafting of the national framework, a few regions have already prepared legislation concerning minimum requirements and certification of buildings.

The training in Spain is organised by the regional government and regional energy agency.

The training courses in Portugal have to be recognised by a commission which includes the Directorate-General of Energy and Geology, the Portuguese Environmental Agency, the Counsel of the Public works and Transport, the Architects Association, the Engineers Association, the National Association of Engineering Technicians. The commission sets requirements on the training courses, as for example, the inclusion of at least two qualifies experts in the training team.

In Slovenia, the training programs and the common material are organised by the ministry, while in Greece the training courses are established by the Technical Chamber of Greece [Intelligent Energy Europe, 2010].

3.3.4 Training obligation

The training can be voluntary or mandatory. Currently, variations within the MS are observed. In *Austria and Spain* the training courses are voluntary, whereas in Spain the building energy certification can also be carried out from professionals who have not taken part in the training courses. In Austria the training is not mandatory for issuing certification with the exception of energy consultants working for the regional authorities who are obliged to take part in the courses[Intelligent Energy Europe, 2010].

Compulsory training is offered in most of the EU countries which were investigated. In *Greece*, it is planned to implement obligatory participation and a qualifying exam. Currently, only a few informal courses in energy auditing have taken place since 2008. The training system in *Portugal* is already in function and is mandatory for all persons who want to carry out building energy certification. The program includes recognised courses and is followed by a national examination. The accreditation in *Slovenia* is given to companies and it is planned to implement mandatory training courses and a qualifying exam[Intelligent Energy Europe, 2007a; Intelligent Energy Europe, 2010]. There have been several informal training courses on energy efficiency organised since 2001. In *Denmark and France* the expert should be nationally accredited and the experts are required to take part in the courses and pass a test. In *France*, there are no specific requirements on the participation in the programs, but as the persons who enter the courses also carry out lead-asbestos and termite inspections, it is assumed that the qualification level is high. Building energy certification can be issued for existing residential buildings in *Germany* from master craftsmen and technicians in the building field, in some cases these have attended a sufficient training course [Hoogelander, Dictus et al., 2006]. In *Finland*, the training program is divided into two parts – technical and electrical energy auditors - and it lasts two days. The participants are required to have an engineering background and the same training is offered to everyone irrespective of their background experience [Chapman, 2009; Kham, 2006].

In Italy the obligations vary from region to region. In general it is observed that there are no requirements regarding attendance of training courses for qualified HVAC specialists and building energy auditors [Intelligent Energy Europe, 2010]

3.3.5 Quality control

In order to ensure that a certification system functions properly and is credible, certain quality of the information provided by the energy certificates, as well as performance of the experts in this field is required [Hoogelander, Dictus et al., 2006]. The quality control may include a complete check of the audit project including on-site inspection to random check of parts of the audit. The quality monitoring can be subdivided into four main groups:

- No quality control
- Random checks or control of selected audits
- Complete inspection of the audit reports
- Complete inspection of the audit reports and on-site control [Chapman, 2009].

Most countries investigated in this report have a central register with the main results of the certificate, but in only a few, a central database exists. In Spain and Greece, there is no monitoring and no official feedback system available so far. In Austria there is no standardized method established and several checks on regional level were discovered to exhibit inaccuracies in the energy performance certificates. The Ministry of Italy proposed to appoint a public organisation which will perform the report checks and/or possible on-site inspections. In Portugal there is an obligatory quality control system for the certification of new and existing residential and non-residential buildings. The level of control varies between the regions from simple checks of the EPC to complete data review of the calculations. Slovenia is still establishing quality assurance system and the main suggestion is to perform regular checks on the calculated or metered indicators. In Denmark, a complete structural validation system is applied for verification of the quality of the energy performance certificates [Hoogelander, Dictus et al., 2006].

3.4 Evaluation and wider impacts of the capacity building and training measures

	Economic impacts	
What was the cost to deliver the outcome, was it value for money?	(++)	The training usually pays off within a reasonable timeframe to the persons taking part in it. The training seminars are usually short and in most countries renewal of the licence is not demanded. For this reason the ECA is officially approved to issue certificates over a long period of time.
	(+)	To the end users certification gives the opportunity to increase the rent or sell price of the house in case an energy certificate states high quality (e.g. Germany).

	(++)	In Germany and France a different approach to the energy auditor deficit is accepted – experts from other fields receive additional training and can issue energy certificates. This keeps the administrative costs low and ensures rapid training of experts to fill the gap
What wider economic impacts does the policy have?	(++)	Capacity building of ECA develops and expands the employment market (energy auditors, trainers, organisation and administration)
	(-)	Energy auditing incurs additional costs after construction or major renovations.
	(--)	Big scale scheme for ECA training might lead to low expert quality.
	(--)	Low quality of monitoring and verification of the energy audits might lead to high costs.

Environmental impacts

Did the policy deliver the desired outcome?	(++)	The desired impact is only achieved when the system is designed and functions properly and there is assurance of experts' qualifications (pre-conditions for joining the courses and examinations).
	(--)	In cases of low quality of the experts and bad monitoring and verification of the building certification, desired environmental impacts are not accomplished
What other impacts has the policy had?	(++)	The certification process of existing and new buildings will ensure high quality of the building stock and will therefore guarantee lower GHG emissions, air and indoor quality, etc.
Are there impacts on emissions from other sectors?		N/A

Social impacts

Was the policy well received, were there issues in gaining acceptability, what did they relate to?	(++)	The programs are well-accepted by experts
	(n)	The acceptability of the end-users highly depends on their financial situation

What are the distributional impacts?	(++)	Energy auditing raises the awareness of the public regarding energy efficiency and the importance of energy certification and thus increases the overall building quality
	(--)	The system is still underdeveloped. The qualification of the experts to participate in the training is relatively low which leads to overall low ECA quality. Monitoring and verification processes are incomplete and need to be further developed to ensure proper building certification
	(-)	There is pressure to train experts due to the uprising deficit which leads to massive training courses and low ECA quality
	(-)	To this date only a few countries have implemented trainer training
	(-)	Low quality of the building certification may lead to consumer insecurity
	Cross-Cutting	
Are there interactions with policies in other sectors?	(++)	Capacity building is tightly linked to information and awareness raising campaigns. No further relations to other sectors
Timeframe – is there anything to note about the timing of policy implementation and expected impacts?	(+)	Impacts of the policy are long-term

3.5 Maximising desired impacts/reducing unwanted impacts of the capacity building and training measures

This section looks at how the positive impacts could be maximised to ensure the policy delivers its full potential. We have compiled the lessons learned from measures that have already been introduced, as well as using evidence from the broader literature to suggest how implementation could be improved. Strategies to mitigate the negative impacts are also suggested.

Maximising the benefits

Creation of a common/international European system	To achieve maximum benefit from the training a common system should be established on national level. In some countries there have been discrepancies regarding expert certification in different regions. This issue should be eliminated by creating a national training scheme which has the same "rules" regarding participation and examinations for everyone. A platform with collection of data concerning certified buildings and experts should be established.
Continuous education is crucial	Currently, most training courses take place once and no further training is offered. The system design should include training courses on a regular basis to ensure the existing experts are "up-to-date"

Mitigation measures

Ensure monitoring and verification of certified experts and buildings	Monitoring and verification of the experts' quality by means of examinations, as well as control of the certified buildings should be guaranteed. A good approach to increase compliance and motivation could be to introduce penalty or loss of licence for experts who presented low quality at certifying buildings.

3.6 Lessons learnt

In a number of countries data on expert availability, training programs, monitoring of expert's qualifications and quality control was limited and therefore a thorough comparison between the MS was difficult. Nevertheless, some conclusions on the well-functioning of the different systems can be drawn.

With rising requirements on building energy certification an expert capacity problem is expected. This issue can be overcome by, for example, building a large pool in a short time by training available experts from other fields of experts who already do building visitations on a regular basis. This is considered to be an efficient approach with limited costs and it has already been applied in Germany and France. A problem might occur due to the different background experience of these experts which is in many cases not related to energy efficiency of buildings. In this case special attention is to be paid to the training procedures in order to ensure a certain level of knowledge. Nevertheless the French experience appears to be successful so far in cases when the inspectors are provided with adequate tools and training [Hoogelander, Dictus et al., 2006].

Another method for ensuring a rapid fulfilment of the ECA capacity gap is the training of trainers. This approach has the advantage that it builds up a significant amount of experts in a short time. On the other hand, the quality of these experts can be questionable, as the trainers do not have much practical experience themselves. This method is currently applied in Spain, Portugal and partly in Belgium. In Slovenia, there is no training course for trainers. Any person who can demonstrate "adequate professional references in building design, measurements and energy auditing of buildings, knowledge about legislation/regulation on energetic and building construction and knowledge about EU regulations in the field of energy efficiency of buildings" can apply and become a trainer [Hoogelander, Dictus et al., 2006; Intelligent Energy Europe, 2010].
Various accreditation systems are observed in the EU. In Denmark and France a national accreditation is given, while in the Netherlands the accreditation is given to a company. In Germany, the accreditation regulations for existing buildings are stated in the national Ordinance, whereas for new buildings these are managed by the Federal States. The national accreditation of single persons has the advantage that

the quality is assured directly, but it is also observed to have the highest cost and there is a risk of losing investments in case of job switching. Accreditation of companies, on the other hand, is less dependent on personal career choices and the continuation of the work is guaranteed. This method is less expensive compared to the accreditation of a single person, but it does not ensure a high level of quality of the certification and it should be controlled closely. Finally, there is the option to have specific minimum requirements on the accreditation activities, but no national control. This system can show to be efficient in cases when it is connected to other already existing accreditation systems. Nevertheless, it has the disadvantage that there is no centralized control on the experts' quality [Hoogelander, Dictus et al., 2006]

As explained there are minimum requirements for ECAs which differ significantly in the various MS. The observations made in this report are that most countries have minimum requirements set on education, training, practical experience, etc. These requirements ensure a high level of knowledge in a direct manner, but it can lead to expert capacity shortage. Moreover, it does not ensure awareness of the experts on new development in the fields of energy certification and therefore it is recommended to organise training seminars on a yearly basis or provide access to up-to-date information [Hoogelander, Dictus et al., 2006].

With regard to administration, it is considered that administration by regional authorities might lead to difficulties related to a common training level of professionals. An effective tool to overcome this barrier would be the implementation of national quality standards and educational programs which can be applied in training courses organised by private bodies or organisations [Intelligent Energy Europe, 2010]. An important issue is the control and verification of the issued certificates. As proposed in [Hoogelander, Dictus et al., 2006] there can be two solutions: pro-active and repressive.

The pro-active solutions are:

- Clear guidelines and regulations on how the process is taking place and it provides standardized, constructive and usually simpler methods. According to Hoogelander, Dictus et al. the use of guidelines and standard tools will reduce the number of potential mistakes, saves time and costs and allows people with less experience to perform the calculations.
- An independent organisation is in charge of accreditation and control. This ensures that the quality control is independent, but it can also lead to some bottle-necks, such as bureaucracy, more time and costs
- Report checks of energy certification are organised in a centralized system which gives a direct insight into the experts' performance and it can prevent possible low performance at early stages.
- The input data should be collected centrally and the outcomes in a database. This provides a structural insight into the experts' work and the energy certification impact over longer time periods, which enables the tracking of improvements. This also allows adjustments in the policy structure at an early stage
- A feedback mechanism for improvements should be established in order to ensure a continuously enhanced and more effective system.

The repressive solution proposes a penalty, loss of accreditation or insurance in case of low-level performance from the expert's side. This will guarantee a prohibition of experts with bad performance from the market, but might be time-consuming and cause a raise in the experts' incomes and thus increase the certification costs [Hoogelander, Dictus et al., 2006].

In order to achieve a well-functioning building capacity system of energy auditors it is recommended that the following conditions are fulfilled [Intelligent Energy Europe, 2010]:

- There is an existing well-structured network of independent energy auditors
- Training is mandatory
- The validity of the professional category of the Energy Certification Assessors (ECA) is limited to a certain period and is subject to renewal (e.g. every 5 years)

- Monitoring and control of ECA activities is present
- A central database for certificates is available and it is managed on a national level
- Linkage of the capacity building programs with information campaigns and other soft tools

4 Financial measures for building construction and renovation

4.1 Overview of different financial measures

There are a vast number of policies aiming at improving energy efficiency in the building sector. In the previous chapters an overview of these strategies was presented. One of the most commonly applied instruments is the financial tool aiming to support activities related to energy efficiency in buildings. EuroACE identified eight different types of financial and fiscal instruments, each with distinct characteristics. Following table gives an overview of these instruments.

Table 8: Overview of different fiscal and financial instruments with different characteristics

	Characteristics	Examples	Typical products covered
Loans and Preferential loans	• Loans, with better terms and/or reduced interest rates, provided for building energy efficiency improvements • Typically finance all or most of an investment	• Estonia: The Credit and Export Guarantee Fund (KredEx) (2001 – ongoing) • France: Green Loan for Social Housing (2009-2020) • Germany: KfW Programme Energy-Efficient Construction (2005 – ongoing)	Windows, heating controls, central heating installations, insulation, ventilation systems, renewable energy technologies, housing access and other modernisation features.
Grants / subsidies	• Grants / subsidies for building energy efficiency improvements • Typically grants finance part of an investment	• Czech Republic: Green Investment Scheme (2009 – 2012) • Hungary: Grants for Renovation & Prefabricated-Panel Residences (2001 - ongoing) • Romania: Programs for the thermal rehabilitation of multi-level residential buildings (2002 – ongoing) • Poland: Infrastructure and Environmental Operation Programme (2007-2013) • Slovenia: Financial stimulation for energy efficiency renovation and sustainable buildings of new buildings (2008-2016). • UK: Carbon Emissions Reduction Target (2008-2012)	Renewable energy, insulation, draught-proofing, heating systems (including biomass, heat pumps, thermal regulation, Combined Heat & Power (CHP), solar), efficient appliances, windows and doors, district heating, lighting, fuel switching
Third Party financing (TPf)	• Investment is paid for by third party (e.g., bank, Energy Service Company (ESCO), installer of systems) • Building owner has to pay back investment over time • Different forms of 3 rd party financing, ranging from pay back as share of savings to financial lease	• Austria: Successfully establishing a regional Market for Third Party Finance (2001 – ongoing) • Netherlands: More with Less Programme (2008-2020) • Poland: Thermo-modernisation and Renovation Fund (1999-2016)	Heating and hot water systems
Tax rebates	• Various forms of personal tax	• Belgium: Tax Rebates for Home	Replacement of old boilers, solar

/ VAR reduction	reductions in response to building owners investing in energy efficiency • Low VAT rate for energy efficiency products and materials	Improvements (2003 – ongoing) • UK: Stamp Duty Relief for Zero Carbon Homes (2007 – 2012) • Belgium: Reduced VAT on home refurbishment (2000 – ongoing) • UK: Reduced Sales Tax for Energy Savings Materials (2000 – ongoing)	water heaters, roof installation, double glazing, central heating system, energy audit, boiler maintenance, efficient appliances, insulation, draught-proofing, passive houses and zero-carbon houses, draught stripping, heating and hot water controls, solar panels, wind and water turbines, heat pumps, micro CHP, biomass and other transformation/ restoration works
Tax deductions	• Deduction of personal income or corporate tax for amounts invested in energy efficiency	• Netherlands: Energy Investment Allowance (2004 – ongoing) • UK: Landlords' Energy Saving Allowance (2004 – 2015)	Insulation, draught-proofing and CHP. Lists of eligible technologies are frequently updated

Source: adapted from authors on basis of [EuroACE, 2010a]

The KfW Programme for the promotion of CO_2 emissions reduction from building renovation/ retrofitting can be evaluated as a successful financial instrument with incentive impact and positive macroeconomic effects [Clausnitzer, Fette et al., 2010; Clausnitzer, Gabriel et al., 2007; Clausnitzer, Gabriel et al., 2009; Clausnitzer, Gabriel et al., 2008; Matthes, Gores et al., 2009]. Therefore the first case study will have a closer look at the following three KfW programs in Germany:

- KfW program Energy-Efficient Construction
- KfW program Energy Efficient Rehabilitation
- KfW program Housing modernisation

4.2 Experiences with the German KfW programmes

The energy renovation of existing buildings is considered one of the most important levers for the climate protection in Germany [Auer, Heymann et al., 2008]. Also in terms of economic measures of the federal government in 2009, the building sector plays an important role because investments in energetic renovation (retrofitting) directly contribute to the German building sector and supply industry. The KfW Banking Group (*Kreditanstalt für Wiederaufbau*), a non-profit public banking group manages the government's funding programmes and has therefore a central role in these investments.

The objective of the KfW programs - energy efficient construction and energy efficient renovation - is to support building owners to finance energy saving construction measures in new and existing buildings [Clausnitzer, Gabriel et al., 2008].

The KfW banking group has provided preferential loans and grants for energy efficiency measures in the building sector since 1996. The KfW offers long-term low-interest financing with grace periods. It is assumed that the reduction of the interest rate leads to savings of about 7 % to 12 % of the loan. In general, the KfW bank raises funds from the financial market and passes the capital on to the programme applicants. As the KfW is AAA-rated, it faces low-interest rates on the market. Funding from the federal government is also used to reduce the interest rates [IEA, 2008; OECD/IEA, 2008]

The KfW raises funds from the financial market and transfers this capital, via commercial banks, to programme applicants in the form of lower interest loans. Financing for projects is channelled exclusively through regular banks; private households cannot apply directly to the KfW. The bank receives low interest rates in the financial markets because of its current AAA rate due to the guarantees in accordance with its public status. This does not exclude other private financial institutions in benefitting from clients that are willing to invest in energy efficiency measures. In general, the KfW finances only part of the efficiency measures. The lacking capital needs to be provided from private equity or other financing institutions, or from both. Therefore the private banks benefit from the KfW programmes. Often, the motivation to invest in energy efficiency measures may have been originally generated due to the publicity of the KfW and its positive image in the public. In that sense the KfW programmes with their loans and grants unleash more capital for energy efficiency measures and therefore work as leverage.

In addition, federal funding is also used to further decrease interest rates. Loan repayments are used to pay back the bank's liability on the financial market. KfW programmes include long-term low-interest financing of energy efficiency improvements and CO_2 emission reduction measures. Apart from a low interest rate, applicants may be exempted from credit repayment during the first years. Up to 100 % of the investment costs are financed. The maturity period of the long-term loans is up to 35 years. Fixed interest rate periods of up to 15 years are also offered [Clausnitzer, Gabriel et al., 2008].

The Energy-efficient rehabilitation program (*Energieeffizient Sanieren*) and the CO_2 -reduction program (*CO_2 Gebäudesanierungsprogramm*) with about 363 000 funded dwellings alone in 2009 takes a key position in the National Climate Change Programme. Since 2009 the program Energy efficient renovation continues the previous CO_2 building rehabilitation program under a new name and changed support conditions. Eligible criteria have been adjusted to current energy requirements for new buildings. Moreover, now many of the actions are eligible if they have a high energy quality. The current conditions can be looked up on the web (www.kfw.de) [Clausnitzer, Fette et al., 2010].

Since 1990, the KfW has been promoting the energy savings and CO_2 emissions reduction in buildings. Between 1990 and 2008 about 2.7 million buildings received subsidies in form of low interest loans and grants for actions to save energy and for CO_2 reduction. The preferential loan for refurbishment measures is provided via local commercial banks. An additional repayment grant is given if the KfW Efficiency House standard is achieved [Clausnitzer, Fette et al., 2010].

The following chapter shows an overview of the current KfW programs for construction, rehabilitation and modernization. The literature for the case study refers to already updated programs and standards. The energy efficient rehabilitation program e.g. continues the previous CO_2 -reduction program since April 2009 with changed funding conditions, it has been adapted to actual energetic requirements and now also funds many single measures that exhibit high energetic quality. The actual conditions can be looked up on the KfW website. The following tables give an overview of the standards for refurbishment and new construction.

Table 9: **Considered refurbishment standards until 31st August 2010, specific values in kWh/m²a**

Official term	Period in force	Useful energy	Final energy	Primary energy	Simplified term
EnEV 2007 refurbishment level	1.2.2002–30.12.2009	88	110	121	P120
KfW EH 100 (EnEV 2007)	1.4.2009–30.12.2009	63	79	87	P85
KfW EH 70 (EnEV 2007)	1.4.2009–30.12.2009	55	59	65	P65
EnEV 2007 new construction level -30%	2001–2009	51	55	61	P60
EnEV 2007 new construction level -50%	2007–2009	45	48	43	P45
EnEV 2009 refurbishment level	Since 1.10.2009	77	83	91	P90
KfW EH 130 (EnEV 2009)	1.10.2009–30.6.2010	63	79	87	P85
KfW EH 115 (EnEV 2009)	Since 1.10.2009	63	68	75	P75
KfW EH 100 (EnEV 2009)	Since 1.10.2009	55	59	65	P65
KfW EH 85 (EnEV 2009)	Since 1.10.2009	47	50	55	P55
KfW EH 70 (EnEV 2009)	Since 1.7.2010	47	51	46	P45
KfW EH 55 (EnEV 2009)	Since 1.7.2010	37	40	36	P35

Source: [Schimschar, Blok et al., 2011]

Table 10: Considered new construction standards until 31st August 2010, specific values in kWh/m²a

Official term	Period in force	Useful energy	Final energy	Primary energy	Simplified term
EnEV 2007 new construction level	1.2.2002–30.12.2009	63	79	87	P85
KfW EH 70 (EnEV 2007)	1.4.2009–30.12.2009	55	59	65	P65
KfW EH 55 (EnEV 2007)	1.4.2009–30.12.2009	40	43	48	P50
KfW energy saving building 60 (KfW 60[a] building)	2001–31.3.2009	49	55	60	P60
KfW energy saving building 40 (KfW 40 building)	2001–31.3.2009	34	36	40	P40
EnEV 2009 new construction level	Since 1.10.2009	55	59	65	P65
KfW EH 85 (EnEV 2009)	1.10.2009–30.6.2010	47	50	55	P55
KfW EH 70 (EnEV 2009)	Since 1.10.2009	47	51	46	P45
KfW EH 55 (EnEV 2009)	Since 1.7.2010	37	40	36	P35
KfW EH 40 (EnEV 2009)	Since 1.7.2010	28	31	26	P25
Passive house	Statistics since 1999	28	30	25	P25

[a] This is an older definition used by the KfW. The KfW40 building was replaced by the KfW EH 55 (EnEV 2007), respectively, KfW EH 70 (EnEV 2009) and the KfW60 building by the KfW EH 70 (EnEV 2007) and the later EnEV 2009 new construction level.
Source: [Schimschar, Blok et al., 2011]

4.2.1 KfW program: energy-efficient construction (formerly Ecological Construction)

4.2.1.1 Objective of the measure

Since 2005, this national policy has given preferential loans for the construction of new residential buildings. It is concerned with ecological construction and installation of new heating technologies based on renewable energies, combined heat and power and local and district heating in new buildings.

The program provides loans with preferential interest rates, limited to 50,000 €, for construction, production, and first acquisition of KfW efficiency houses.

4.2.1.2 Main features of the measure

This program (program 153) comes in the form of long-term, reduced-interest loans with a maturity of up to 30 years including up to a 5 year grace period, with a fixed interest period of up to 10 years, and up to 100 % of the building costs but not more than 50,000 € per housing unit [KfW, 2010]. If a building is constructed according to the KfW 40 or 55 standard, the KfW pays an extra grant, depending on the standard the grant amounts up to 10% of the loan.

The criteria to be met for loans are as follows:
KfW Efficiency House 40 (EnEV2009)

- The annual primary energy consumption Q_p must be maximum 40 % of the reference building value (as stated in Table 1, Annex 1 of the EnEV 2009). The specific transmission heat loss HT´ must not be more than 55 % of the reference building value (as stated in Table 1, Annex 1 of the EnEV 2009).
- Passive houses are financed under this variant if the annual primary energy consumption is not more than 30 kWh per m^2 of building floor area and the annual heating requirement Q_h is not more than 15 kWh per m^2 of living space

KfW Efficiency House 55 (EnEV2009) - Energy Conservation Ordinance of the year 2009:

- The annual primary energy consumption Q_p must be maximum 55 % of the reference building value (as stated in Table 1, Annex 1 of the EnEV 2009). The specific transmission heat loss HT´ must not be more than 70 % of the reference building value (as stated in Table 1, Annex 1 of the EnEV 2009).
- Passive houses are financed under this variant if the annual primary energy consumption is not more than 40 kWh per m^2 of building floor area and the annual heating requirement Q_h is not more than 15 kWh per m^2 of living space

KfW Efficiency House 70 (EnEV2009) - Energy Conservation Ordinance of the year 2009:

- The annual primary energy consumption Q_p must be maximum 70 % of the reference building value (as stated in Table 1, Annex 1 of the EnEV 2009). The specific transmission heat loss HT´ must not be more than 85 % of the reference building value (as stated in Table 1, Annex 1 of the EnEV 2009).

For all Energy Efficiency Houses it is valid that the transmission heat loss cannot be higher than the one stated in Table 2 (EnEV 2009). For the passive houses the energy technical planning and construction supervision are to be carried out by an expert [KfW, 2011a].

4.2.1.3 Evaluation of the measure

In the German National Energy Efficiency Action Plan (NEEAP) [Bundesministerium für Wirtschaft und Technologie, 2007], the final energy savings from the further development of the KfW program “Ecological Construction” are estimated at around 1.39 to 4.12 TWh per year in the final target year 2016 and about 0.28 to 0.83 TWh/a in the intermediate target year 2010. With regard to the present funding of the program, the impact level is assessed to be low, since it only refers to a relatively low number of new houses. In the medium term, however, if the further development of the program, which is announced in the NEEAP, will take place, a medium impact could be achieved.

4.2.2 KfW Program: Energy-Efficient Rehabilitation (formerly CO_2 reduction program)

4.2.2.1 Objective of the measure

The KfW CO_2 Reduction Program (*KfW-Programm zur CO_2-Minderung*) supports those responsible for investment measures in buildings, for example private individuals, housing companies, housing cooperatives, municipalities, districts, etc. The program started in January 1996. In the beginning, it was restricted to former West Germany. Since 2001 it has become valid all over Germany. Since 2005 it has been replaced by the new program Energy-efficient rehabilitation (*Energieeffizient Sanieren*) in the area of housing construction and modernization and energy conservation [KfW, 2010].

The current Energy-efficient rehabilitation program finances rehabilitation or refurbishment measures aiming at reducing energy consumption. Covered are windows, insulation of the roof as well of the walls and ground floor, heat pumps, ventilation.

4.2.2.2 Main features of the measure

The investors are given grants (programs 430 and 431) depending on the KfW standard reached. The grant amounts up to 15,000 Euro per living unit and up to 3,750 Euro per single measure per living unit. The maximum living units that can receive grants are two. The grant awarded under Program 430 and 431 can be obtained in cases of a renovation to the KfW Efficiency House or for individual actions or combinations of individual actions [KfW, 2011d].

Alternatively the KfW offers long-term low-interest loans (programs 151 and 152) with fixed interest rates for up to 10 years and a repayment-free starting-up time of up to 5 years. For a KfW Efficiency house the maximum loan is 75,000 € per housing unit, while for individual measures the loan maximum is 50,000 € per housing unit. The loan can be repaid at once any time without costs. Depending on the efficiency standard to which the building will be constructed, the KfW pays an extra grant that amounts up to 12.5% of the loan [KfW, 2011d]. In the programs 151 and 152, promotion is given for the energy rehabilitation of residential buildings, including nursing homes for which an application for construction permit was issued before 1995. Eligible investment costs are those which arise directly through the implementation of the energy saving measures including planning and auxiliary activities complementing the construction, as well as costs for ancillary works required for the proper completion and function of the building (e.g. renovation of window sills, testing the air tightness). Funding is provided for activities which contribute to achieving the energy level of a KfW Efficiency House.

The loan conditions depend on the different standards. The different standards are:

- KfW Efficiency House 55 (see Chapter 4.2.1.2)
- KfW Efficiency House 70 (see Chapter 4.2.1.2)
- KfW Efficiency House 85: The annual primary energy consumption Q_p must be maximum 85 % of the reference building value (as stated in Table 1, Annex 1 of the EnEV 2009). The specific transmission heat loss HT´ must not be more than 100 % of the reference building value (as stated in Table 1, Annex 1 of the EnEV 2009).
- KfW Efficiency House 100: The annual primary energy consumption Q_p must be maximum 100 % of the reference building value (as stated in Table 1, Annex 1 of the EnEV 2009). The specific transmission heat loss HT´ must not be more than 115 % of the reference building value (as stated in Table 1, Annex 1 of the EnEV 2009).
- KfW Efficiency House 115: The annual primary energy consumption Q_p must be maximum 115 % of the reference building value (as stated in Table 1, Annex 1 of the EnEV 2009). The specific transmission heat loss HT´ must not be more than 130 % of the reference building value (as stated in Table 1, Annex 1 of the EnEV 2009).

The following single measures in Program 152 apply for funding:

- Thermal insulation of walls
- Thermal insulation of roofs
- Insulation of floors / basement ceiling
- Replacement of windows and exterior doors
- Replacement / installation of a ventilation system
- Replacement of heating system

[KfW, 2011b; KfW, 2011c]

4.2.2.3 Evaluation of the measure

Between 1996 and 2004, the total volume of approved loans within the KfW CO_2 reduction program stood at 6 billion Euros. In total, 56.8 million m² living space in existing buildings in 685,000 dwellings were improved [IEA, 2008]. 66 % of the loans were used for heat insulation measures, about 20 % for the installation of energy-efficient boilers [Kleemann,Hansen, 2005]. The original KfW CO_2 reduction program was closed at the end of 2004.

The German government has reported that by the end of 2006, more than 2.5 million housing units had been renovated with KfW support since its inception. This resulted in around 1.5 TWh/yr energy savings in 2006, and 703 kt CO_2 annual reductions in CO_2 emissions. Through the implementation of the program, around 220,000 new jobs were created. It was further estimated that the various KfW programs for buildings had a combined impact of emission reductions of around 1 Mt CO_2 emission reduction per year [EuroACE, 2010a].

A first evaluation is available for the first phase of the program which was restricted to former West Germany. Assuming a total credit volume of 5,000 million DM (around 2,500 million €), the total savings of energy and CO_2 achieved by the program were estimated at about 6,028 TWh and 1.9 Mt respectively. For the period 2002-2004, an evaluation of the KfW CO_2 reduction program was carried out by the Forschungszentrum Jülich on behalf of the KfW [Kleemann,Hansen, 2005]. Between 2002 and 2004, the total volume of approved loans amounted to 2.4 thousand million Euro (205,000 living units) which is equivalent to a total investment volume of 5.4 thousand million Euro. The resulting cumulated CO_2 reductions for the period 2002-2004 were estimated at 790 kt (net impact) [EuroACE, 2010a].

Between 2001 and 2003, the majority of the loans of the programme were used for thermal insulation measures. 20 % were used to install energy-efficient boilers and about 14 % for renewable energies and district heating [IEA, 2008].

4.2.3 KfW Program Housing Modernization

4.2.3.1 Objective of the measure

The KfW Program Housing Modernization (*Wohnraum Modernisieren; Altersgerecht Umbauen*) offers loans and grants on a national level for modernization measures and CO_2 reduction measures in residential buildings in Germany, excluding nursing or other types of homes or hostels, holiday or weekend cottages. Moreover, credits are provided for the demolition of empty residential rental buildings for the purpose of urban renewal in the eastern federal states and eastern Berlin [EuroACE, 2010a].

The main targets for the fund are the modernization and rehabilitation of residential buildings (program 141-loan), examples are:

- Improvement of the utility value in general housing conditions (e.g. home floor plan, sanitary installations, balconies/loggias, lifts)
- Repair or replacement of defective building components (e.g. windows, floors)
- Construction measures after partial deconstruction
- Renewal of central heating installations or their components
- External areas of multi-family buildings (e.g. greens, external facilities, playgrounds)

This program will be closed at the end of 2011.

Improvement of accessibility in homes, residential buildings and living environment- Senior Housing Conversion (programs 155 for loans and 455 for grants), examples:

- Elimination of steps, thresholds, construction of wider doorways
- Handrails, intercom systems, door drives, lifts
- Modification of home floor plan, remodelling of bathrooms
- Technical installations (e.g. switches, connections, control devices)
- Construction of holding areas, weather protection

[EuroACE, 2010a]

Eligible measures include the thermal insulation of the exterior walls of buildings including directly related measures (e.g. improvement of the thermal insulation of the exterior walls, the roof, or the ceilings of top floors) or the renewal of the heating technology on the basis of renewable energies, combined heat and power and local and district heating (e.g. installation of heat pumps, solar thermal systems, biogas or biomass systems). The measures must comply with the minimum technical requirements specified in the annex to the program information sheet [EuroACE, 2010a].

4.2.3.2 Main features of the measure

All investors having investments in owner-occupied or rented residential buildings are eligible to apply: private individuals, housing companies, housing cooperatives, other investors who renovate residential housing, municipalities, districts, municipal associations, other bodies and institutions incorporated under public law. Investors receive a long-term, low-interest loan with a fixed interest rate and redemption-free grace years. As a private investor one can apply for the loan with any bank or savings bank, which will lend the funds. Municipalities and municipally-owned enterprises apply directly to KfW Development Bank:

- In the form of a long-term, reduced-interest loan with a maturity of up to 30 years including up to 5 repayment-free start-up years
- Fixed interest period of up to 10 years
- Up to 100 % of the financeable costs
- Standard - maximum of 100,000 € per housing unit
- Senior housing conversion - maximum of 50,000 € per housing unit [KfW, 2010]

[EuroACE, 2010a]

According to the [OECD/IEA, 2008], the interest rates were up to 2 % lower than market rates for the period 1990 to 2002.

4.2.3.3 Evaluation of the measure

A first evaluation of the new housing modernization program was carried out by [Kleemann,Hansen, 2005] based on the experience from the former CO_2 reduction program and the housing modernization programs. Assuming a total credit volume of €9 thousand million up to 2010 (or 1.5 thousand million € per year), of which assumed 25 % are used for energy saving "Öko-Plus" measures, the total cumulative CO_2 reduction in 2010 amounts to about 0.6 million tons or 0.1 million tons per year, which is a considerably lower estimate compared to the estimated impact of the former Housing Modernization Program 2003 and the KfW CO_2 Reduction Program [EuroACE, 2010a].

Another ex-ante evaluation of the new housing modernization program was carried out by a group of research institutes on behalf of the Umweltbundesamt in 2008. The impact calculation in this study is based on a space heating model including a representative sample of the building stock, which is characterized by specific building types. The total CO_2 reductions calculated with the model were extrapolated to the number of potential buildings improved with the funds of the new housing modernization program. For the period 2005 until 2030, a total credit volume of €1 billion is assumed for this program [EuroACE, 2010a].

With regard to the impact of the former programs and taking into account the improved conditions of the program valid since 1st February 2006, the impact level of the new program is characterized as medium [EuroACE, 2010a].

4.2.4 CO_2 emission and energy demand reduction through KfW programmes

In 2009, an immense effect on CO_2 emissions was observed from two of the programs described above. The total amount of CO_2 decrease from the program "Energy-efficient rehabilitation" was accounted to 744,000 tons for 2009 from which about 25 % was the reduction from grants. The emissions of the buildings were measured before the modernization, as well. The total amount of CO_2 emissions was estimated to be about 2,285,000 tons/year. The CO_2 reduction for 2009 was assessed to 33 % [Clausnitzer, Fette et al., 2010].

Table 11: CO_2 reduction from all modernization undertakings in the program "Energy-efficient rehabilitation"

	Building type	Estimated CO_{2e} reduction in tons per year
Grants	single-family house	190,243
Loans	single-family house	252,073
	multi-family house	301,767
Sum		744,000

Source: [Clausnitzer, Fette et al., 2010]

The total CO_2 decline in 2009 from the “CO_2 reduction program” was assessed to 211,000 tons. 21.8 % (46,000) tons were reduced from grants and the rest- 78.2 %, equivalent to 165,000 tons- from loans. It was estimated that in 2008 the grants lead to a CO_2 diminishment of 7,740 kg/year per dwelling, whereas the loans- 9,649 kg/a per dwelling [Clausnitzer, Fette et al., 2010].

Table 12: Calculation of the CO_2 reduction and the energy savings in the case of “CO_2-reduction program”

Subsidized cases 2009			Results for subsidized cases for 2008		Subsidized cases 2009	
		Number of subsidized apartments	CO_2 reduction	End-energy savings	Total CO_2 reduction	Total end-energy savings
			kg/a per apartment	kWh/a per apartment	tons/a	GWh/a
Grants	single-family house	7,259	5,144	14,721	37,000	107
	multi-family house	3,481	2,596	6,967	9,000	24
Loans	single-family house	8,874	6,413	18,561	57,000	165
	multi-family house	33,350	3,236	8,784	108,000	293
	Sum	52,964			211,000	589

Source: [Clausnitzer, Fette et al., 2010]

Another positive outcome from the programs “Energy-efficient rehabilitation” and “CO_2-reduction program” was the reduction of energy use in households. The total amount reduced in 2009 was 2,679 GWh. Thereof, 2,090 GWh were accounted to “Energy-efficient rehabilitation” and 589 GWh- to “CO_2-Gebäudesanierungsprogramm”. The total end-use energy saved in 2009 was estimated to be 589 GWh- 131 GWh from grants and 458 GWh from loans [Clausnitzer, Fette et al., 2010].

Table 13: CO_2 reduction and energy savings achieved by means of enhanced building modernizations (summary of “Energy-efficient rehabilitation“ and “CO_2-reduction program”)

2009	CO_{2e} reduction (all sectors, incl. upstream chain, all GHG)	CO_2 reduction in the residential sector	CO_2 reduction in the emissions-trading sector	End-energy savings
	t/a	t/a	t/a	GWh/a
Program "Energy-efficient rehabilitation"	744,000	567,000	90,000	2,090
"CO_2 building program"	211,000	153,000	33,000	589
Sum	955,000	720,000	123,000	2,679

Source: [Clausnitzer, Fette et al., 2010]

Table 14: End-use energy savings achieved by means of assisted building modernizations by energy resource (summary of “Energy-efficient rehabilitation“ and “CO_2-reduction program”)

	End energy savings in GWh/a		
	Program "Energy-efficient rehabilitation"	"CO_2 building program"	Total savings
Natural gas/Liquid gas	840	154	994
Oil	1,220	312	1,532
Coal	210	108	318
Biomass	-160	-35	-195*
Electricity	220	54	274
District heat	-240	-4	-244*
Sum	2,090	589	2,679

(*negative saving means expansion)
Source: [Clausnitzer, Fette et al., 2010]

4.2.5 Co-benefits of the measures

4.2.5.1 Employment effects

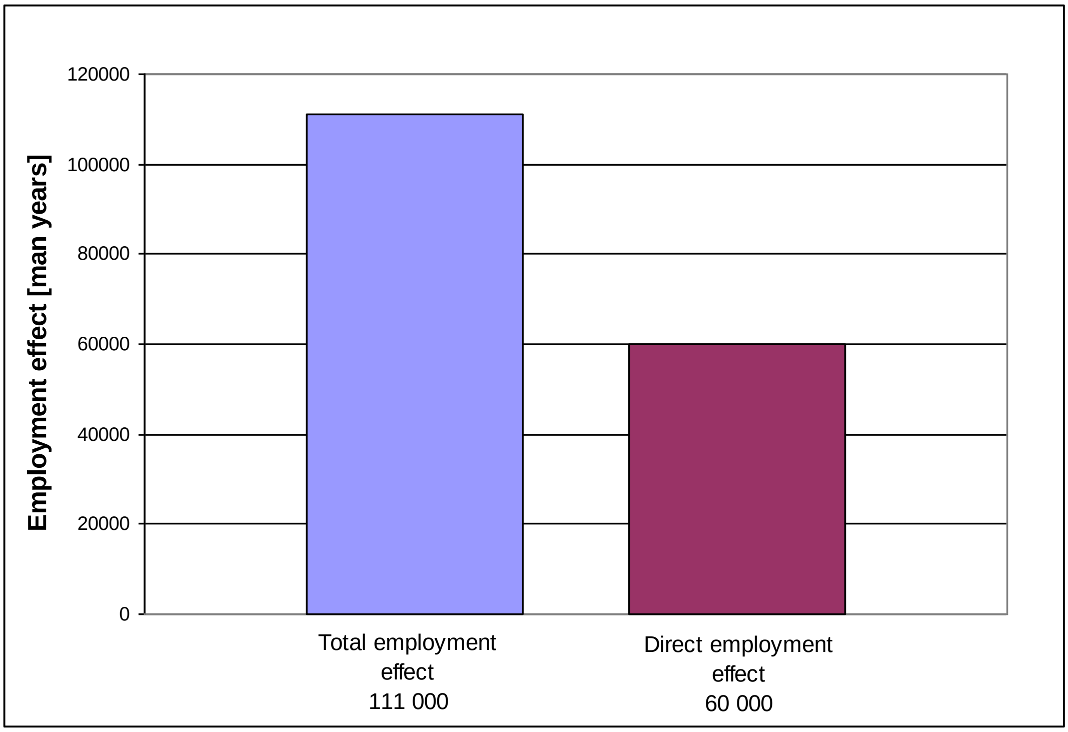
In 2009, the total effect of the programs “Energy-efficient rehabilitation” and “CO_2 reduction program” on the employment was accounted to 111,000 man-years. Thereof, about 80 % was contributed by loans and 20 % by grants. The indirect effect of these two programs on the employment was estimated to 60,000 man-years for the year 2009. The statistics above show that the employment increased with 16 man-years for each 1 million Euros that were invested. For the two programmes that provide information about the jobs impact, there is a ratio of one job created for every 25,000 – 30,000 € investment in programs [Clausnitzer, Fette et al., 2010].

Table 15: Subsidized cases 2009: Effects on employment

Credit amount	Million €	5,248
Grant amount	Million €	87
Investment amount	Million €	6,960
Direct employment effect	man-years	60,000
Indirect employment effect	man-years	51,000
Total employment effect	man-years	111,000
Thereof: from credits	man-years	89,000
from grants	man-years	22,000
Employment each 1 million investment	man-years	160

Source: [Clausnitzer, Fette et al., 2010]

Figure 4: Subsidized cases 2009: Effects on employment in man-years



Source: [Clausnitzer, Fette et al., 2010]

4.2.5.2 Heating cost savings

The subsidized cases of the CO_2 reduction program and the Energy-efficient rehabilitation program for the years 2005 to 2009 are expected to lead to heating cost savings of at least 561 million Euros for the building and apartment user. If the heating cost savings from the previous years are also taken into account, the subsidized cases of the years 2005-2009 will reach cumulative heating cost savings of almost 1,450 million Euros at the end of 2010 [Clausnitzer, Fette et al., 2010].

For the calculations Clausnitzer, Fette et al. assume that the impact on heating cost savings occurs in the next year. For the savings calculations for years 2006 to 2009 the actual (nominal) prices, as reported by the Federal Government, are used. The heating cost savings for 2010 are calculated by applying the prices from 2009, so these values and the sums for the period 2005-2010 are assessed only as preliminary data [Clausnitzer, Fette et al., 2010].

Table 16: **Heating cost savings for the period 2005-2010**

	Heating cost savings in million Euros						
Subsidized cases of the year …	**in year 2005**	**in year 2006**	**in year 2007**	**in year 2008**	**in year 2009**	**in year 2010**	**Sum for the years 2005-2010**
2005	-	54.2	57.8	69.8	57.1	57.4	296.2*
2006	-		122.9	148.8	121.9	122.9	516.5*
2007	-			76.8	65.9	66.6	209.4*
2008	-				112.5	113.5	225.9*
2009	-					201.1	201.1*
Sum	-	54.2	180.7	295.4	357.4	561.4	1,449.1*
Cumulative heating cost savings	-	54.2	234.9	530.2	887.7	1,449.1	

*preliminary value
Source: [Clausnitzer, Fette et al., 2010]

The resulted heating cost savings were estimated to about 5 billion Euros for the subsidized cases of the year 2009, assuming an average 30-year useful life of the subsidized facilities (2009 until end of 2038). This amount accounts for about 73 % of the capital expenditure of the subsidized investments in 2009. This means that even in case of conservative estimations of the energy price development from [Schulz, Bartels et al., 2005] and a narrow definition of the heating costs, a big share of the investments is profitable for the investors, if the heating cost savings of the tenant are considered [Clausnitzer, Fette et al., 2010].

4.3 Experiences with the national revolving fund in Estonia

In Estonia from 2003-2007 grants were provided for financing energy efficiency measures. In addition, grants have been available since 2003 to cover 50% of the costs of energy audits, development of the building design and consulting services. These grants are still available. To date (November 2011) the grants have supported 3,800 single and multifamily buildings with a total of €1.4 million. Grants were also available for buildings renovation, on average covering 10% of the costs. This measure supported 3,200 buildings with a total floor area of 17 million m^2 and a total amount of 11 million €.

However, there were some problems with these grants. There was not sufficient funding, that only single measures were carried out and that the grants were only available after payments [Adler, 2011].

In order to simplify the financing of reconstruction of apartment buildings, KredEx[4], together with the German Development Bank (KfW) and the Ministry of Economic Affairs and Communications, developed a long-term renovation loan with preferential interest, to be issued by banks [KredEx, 2011]. In doing so, EU Structural Funds are combined with the funds from Council of Europe development bank (CEB) to form a fund for housing refurbishment and to offer a long term low interest loan for apartment buildings to improve energy efficiency (see Figure 5) [Energy, 2009].

[4] KredEx was founded by the Ministry of Economic Affairs and Communications in year 2001 with a purpose to improve the financing possibilities of companies, to enable people to build or renovate a home and develop energy-efficient way of thinking.

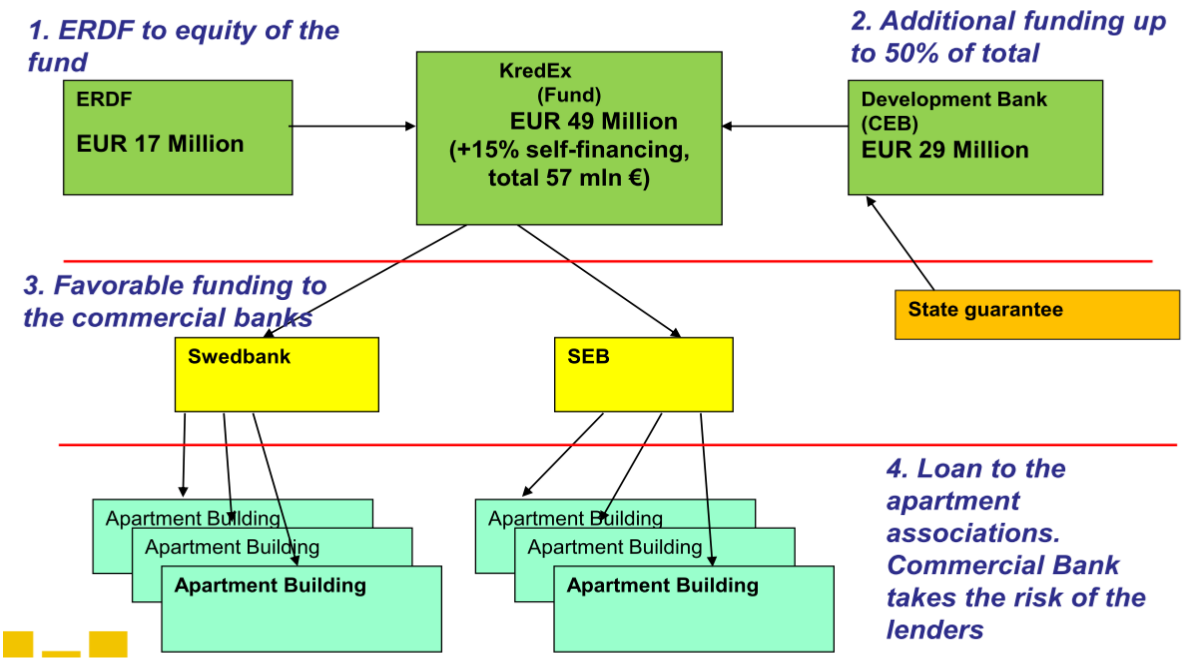


Figure 5: Low interest rate loan - revolving fund scheme

The differences in the conditions of the structural fund loan and the average commercial bank loan are summarized in the following table:

Table 17: Conditions of structural fund and a usual loan

	Structural fund loan	Commercial bank loan
Interest rate fixed for	Fixed for 10 years	Interest Fixed for 5 years or floating
Interest rate	Between 3.5 – 4.7%	Interest ~ 7-10%
Interest on 64 000 € loan (10 years)	4,5%: 15,573 €	7%: 25,137 €
Contract fee	0,5% - 0,75% from loan amount	Up to 1% from loan amount
Maturity	Up to 20 years	Average 2008: 11,8 years

Source: [Adler, 2011]

4.3.1 Objective of the measure

The aim of the renovation loan is to support the renovation of apartment buildings and to raise their energy efficiency by at least 20% in apartment buildings of up to 2000 m² and for at least 30% in apartment buildings of over 3000 m².

4.3.2 Main features of the measure

According to KredEx, the main terms and conditions for the loan are [KredEx, 2011]:

- **Target groups** are apartment associations or housing associations of apartments built before the year 1993, communities of apartment owners, out of which at least 80% of the owners have to be physical persons, or social and municipal premises in possession of the local municipalities.
- **Precondition** is that an energy audit is required in order to obtain a loan. The energy audits are used to estimate the energy savings that will be achieved by the building renovation measures.
- **Loan period** is up to 20 years.

- **Interest** is fixed interest for 10 years (not more than 4.4%).
- **Re-financing** of existing loans is not allowed.
- **Co-financing:** at least 15% which can be covered by parallel bank loans. Self-financing includes costs on energy audit and building project in the amount that is not covered by the grant from KredEx.
- **Minimum loan amount** is EUR 6400 per an apartment building.

According to [Adler, 2011] expenses connected to energy audits, thermal insulation, exchange of heating and ventilation systems and the installation of renewable energy devices are financed.

The key lessons learning from the fund are [Adler, 2011]:

- Preparation of the whole scheme takes a long time and there are many different partners to negotiate. For Estonia the preparation took two years. Negotiations included ministries in Estonia, European Commission, international banks, Estonian banks, state guarantee (Government-parliament-government), final conditions of the program and loan terms for end-beneficiaries.

- Economic situation in the country can change dramatically. As consequence the appetite for end-beneficiary for the loans was subject to variation. This could be mitigated by more awareness raising and flexibiliy on the size of the grant

- Legal framework is needed to support the measure. This relates to the decision making process within multi-apartment buildings. The process for making these decision can potentially present a challenge for implementing measures, where agreement is required from multiple occupants.

- Combine different measures as for example loan and grant, awareness raising, technical support or grants for technical documents.

- Information to market participants and end-beneficiaries are important.

Problems during implementation are [Adler, 2011]:

- End-beneficiaries are still cautious about taking up the loan. The measure has been used slower than expected.

- The incentive may not be sufficient to overcome a weak board (of the housing association) or strong opposition for renovation

- Many documents to prepare before loan application can be finalized (energy audit, building design documents, 3 offers, etc). This is a barrier for housing managers since they are mainly doing it as a side job.

- Loan conditions may provide a barrier for certain economic groups, as banks are sometimes reluctant to give the loan if the rise in loan payments is large even though payments for the heating will be less.

- The reporting from KredEx to ministries, international bank, EU is burdensome.

4.3.3 Evaluation of the measure

Some of the advantages of the revolving funds in comparison to the (earlier existing) renovation grants in Estonia are that a) there is the opportunity for re-usage of the funds, b) the loan is needed for reconstruction anyway, c) it is easier to administer and has lower administrative costs [Adler, 2011].

4.4 Lessons learnt

A number of lessons can be learned from the policy examples presented above:

- Financial incentives are an important tool for overcome barriers associated with the upfront costs of measures. However, they are not sufficient in themselves, and other barriers may have an important influence on the effectiveness of financial instruments.

- Accompanying financial incentives with awareness raising campaigns can improve the take up of the schemes, and also allow more efficient delivery. KfW is a good example of a strong communication policy that managed to raise awareness among the building owners to such extent that the KfW standards (such as e.g. KfW 40 house) are well known terms and are used by the banks or the construction companies to advertise their offers.
- For some grant schemes research has found that households eligible for funding are not always aware that they are able to apply. In contrast, other households that are not within the target group do apply for funding. These aspects can be improved with better communication.
- For loan schemes the affordability is a key factor. Interest rates and loan durations therefore need to be balanced to reflect the level of repayments which is compatible with the income of the target group. A study carried out by the Baltic Energy Efficiency Network (BEEN), including 26 different partners from Estonia, Latvia, Lithuania, Poland, Germany, Russia and Belarus, found that the affordability was a key factor influencing the success of loan schemes [Boermans,Grözinger, 2011].

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